GM UNIVERSITY

CURRICULUM

Course Document

B.Tech.
in
Computer
Science- Information Security

GM UNIVERSITY
Innovating Minds

School of Computer Science & Technology
Faculty of Engineering & Technology

Course Document

Course Code	UE25CS1101
Course Title	Foundational Mathematics for Computer Science
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Veena C M, Kavya R, Raghu S, Dr. Madhukesh J K, Ganesh, Priya
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	1	2	2	5

Total Term/ Semester hours: 45

Note: 1 Lecture hour – 1 Credit
2 Practical hours – 1 Credit
2 Tutorial Hours – 1 Credit

2. Course Details

2.1 Course Aims and Summary

- The course 'Foundational Mathematics for Computer Science' aims To develop a strong foundation in mathematical concepts essential for computer science, it Covers the fundamentals of matrices, types of row transformations, and determining the rank using echelon forms. Students will learn methods to solve systems of linear equations. Also includes eigenvalues and eigenvectors, with the Rayleigh's power method for approximating dominant eigenvalues. Useful in image processing, cryptography, and computer graphics.
- The course introduces Differential Calculus Includes Taylor's and Maclaurin's series for function expansion and simplification. Introduces solving indeterminate forms using L'Hospital's Rule. Covers partial differentiation, Jacobian, and composite functions Widely used in optimization, machine learning gradients, and system modeling.
- The course Introduces modular systems critical in cryptography and coding. Covers congruences, solving linear congruences, Euclid's algorithm for GCD, and the remainder theorem. Discusses solving polynomials, linear Diophantine equations, and theorems

like Euler's, Wilson's and Fermat's. Used in Core to algorithms in cybersecurity, block chain, and hashing.

- The course introduces the Numerical methods is to develop algorithms and computational techniques for solving mathematical problems that may not have exact solutions. Numerical methods are crucial in computer science and engineering for simulations, data analysis, and solving real-world problems where analytical solutions are impractical or impossible to obtain.

2.2 Course Objectives

Course Learning Objectives: This course (UE24CS101) will enable students to Study:

- Understand and apply matrix operations. Identify types of matrices and perform basic operations ; apply elementary row transformations to reduce matrices to echelon form.
- Determine the rank of a matrix and solve linear systems. Evaluate the rank of a matrix using echelon form and apply it to analyze the consistency of linear systems.
- Use matrix methods to solve systems of equations. Solve systems of linear equations using Gauss elimination, Gauss-Jordan method, and approximate methods like Gauss-Seidel.
- Compute eigenvalues and eigenvectors. Understand the concept and computation of eigenvalues/eigenvectors; apply Rayleigh's power method for approximating dominant eigenvalues.
- Apply calculus for function approximation and differentiation. Use Taylor's and Maclaurin's series for approximating functions; evaluate indeterminate forms using L'Hospital's rule.
- Solve problems using partial differentiation. Apply rules of partial differentiation to composite functions, compute Jacobians, and solve related problems.
- Understand and apply modular arithmetic concepts. Apply concepts of congruence and linear congruences to solve problems; understand importance in cryptography and coding theory.
- Solve number theory problems using algorithms. Compute GCD using Euclid's algorithm, solve linear Diophantine equations, and apply Euler's, Wilson's, and Fermat's theorems in simple applications.
- Use numerical methods for solving equations and interpolation. Apply Regula-Falsi and Newton-Raphson methods for root-finding; use interpolation techniques such as Newton's forward/backward, divided difference, and Lagrange's formulae.
- Apply numerical methods to solve ODEs and integrate functions, Implement numerical techniques like Taylor series, Modified Euler, Runge-Kutta (4th order), and Milne's method for solving ODEs; use Simpson's rules for numerical integration.

2.3 Course Outcomes

Course Outcomes: At the end of the course students should be able to:

CO1	**Describe** the definitions, concepts, and basic methods in Linear Algebra, Differential Calculus, Modular Arithmetic, and Numerical Methods; recognize theorems and

	formulae in these areas.
CO2	**Explain** the key concepts, methods, and theorems in Linear Algebra, Differential Calculus, Modular Arithmetic, and Numerical Methods.
CO3	**Apply** the matrix operations, linear system solutions, eigenvalue methods, series expansions, indeterminate forms, differentiation techniques, modular arithmetic, GCD computation, theorem applications, numerical methods, interpolation techniques and ODE solution methods effectively.
CO4	**Analyze** the advanced mathematical techniques including Eigenvalues, Taylor's series, L'Hospital's rule, Jacobian, modular arithmetic, GCD computation, Diophantine equations, numerical methods, interpolation, numerical integration, and ODE solutions at a sophisticated level.
CO5	**Evaluate** methods from Linear Algebra, Differential Calculus, Modular Arithmetic, and Numerical Methods to determine the most effective solutions for diverse mathematical problems.
CO6	**Create** innovative solutions using concepts from Linear Algebra, Differential Calculus, Modular Arithmetic, and Numerical Methods; design and optimize algorithms for complex mathematical problems.

Outcome Map:

COs	**PO 01**	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	1	1	2	1	3				3		3	2	2	2
CO2	1	1	1	2	1	3						3	2	2	2
CO3	1	1	2	1	1	3				2	3	3	2	2	2
CO4	1	1	1	2	1	3			3	2	3	3	2	3	3
CO5	1	1	2	2	1	3	3		3	2	3	3	2	3	3
CO6	1	2	2	2	1	3			3	3		3	2	3	3

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Linear Algebra :** Basics of Matrices, Elementary row transformation, Rank of a matrix-echelon form. Solution of system of linear equations : Consistency, Gauss-elimination

method, Gauss- Jordan method and Approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors **:** Definition, Rayleigh's power method.

- **Differential Calculus :** Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems on Maclaurin's series. Indeterminate forms **:** L'Hospital's rule. Partial differentiation **:** Differentiation of composite functions, Jacobian and problems.
- **Modular Arithmetic :** Importance of modular arithmetic in the field of Computer science & engineering, Introduction to Congruences, Linear Congruences. Finding GCD **:** Finding GCD using Euclid's Algorithm, Remainder theorem (statement only), Solving Polynomials. **Linear Diophantine Equation**, System of Linear Congruence. Euler's Theorem(statement only), Wilson's Theorem(statement only) and Fermat's little theorem(statement only).
- **Numerical Methods :** Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). **Finite differences** : Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Numerical integration: Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules(without proof).
- **Numerical Solution of Ordinary Differential Equations (ODE's):** Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae).

2.5 Text Book and References

- **Text Book:**

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44^{th} Ed., 2021.
2. David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4^{th} Ed., 2018.

- **References:**

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11^{th} Ed., 2017.
2. N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10^{th} Ed., 2022.

3. **Other Resources**

http://nptel.ac.in/courses.php?disciplineID=111

http://www.class-central.com/subject/math(MOOCs)

http://academicearth.org/

3. **Teaching and Assessment**

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Introduction to Course document	https://docs.google.com/presentation/d/1DchD0mK2t4gMCI0r30hg5P4W5F0pDVo6DGXL5Yw9cf8/edit?usp=sharing	
1	Rank of a matrix-echelon form	https://l1nk.dev/2qQSF	https://www.youtube.com/watch?v=HOKCXJGgTYw&pp=ygUdUmFuayBvZiBhIG1hdHJpeC1lY2hlbG9uIGZvcm0%3D
2	Solution of system of linear equations-consistency		https://www.youtube.com/watch?v=VBFcG9ZnAys&list=PLNKD1qB9pptswuZcydBbqCKhiGFQTfs77&pp=0gcJCV8EOCosWNin
3	Solution of system of linear equations-consistency		https://www.youtube.com/watch?v=VBFcG9ZnAys&list=PLNKD1qB9pptswuZcydBbqCKhiGFQTfs77&pp=0gcJCV8EOCosWNin
4	Gauss-elimination method,		https://www.youtube.com/watch?v=dOqMFkFaf7I&pp=ygUYR2F1c3MtZWxpbWluYXRpb24gbWV0aG9k
5	Gauss- Jordan method		https://www.youtube.com/watch?v=2TVyfZfU2_s&pp=ygUUR

			2F1c3MtIEpvcmRhbiBtZXRob2Q%3D
6	Approximate solution by Gauss-Seidel method.		https://youtu.be/wtR6akToudg
Issue Assignment-1 and Assignment-2 Statements			
7	Rayleigh's power method.		https://youtu.be/9MDY0lINv8w
8	Solving the problems using MATLAb		
9	Taylor's and Maclaurin's series expansion for one variable	https://acesse.one/chK98	https://youtu.be/HvZZ9P8CyB4?list=PLM9RnGtTy9_8fitR4MwH10yUohIpeOA-L
10	Taylor's and Maclaurin's series expansion for one variable		https://youtu.be/C4QWLZEN2A8?list=PLM9RnGtTy9_8fitR4MwH10yUohIpeOA-L
11	L'Hospital's rule.		https://youtu.be/YEGCsPwWdXo
12	L'Hospital's rule.		https://youtu.be/UHDyKB0_R-E
13	Differentiation of composite functions,		https://youtu.be/bVoPB7fSl54
14	Jacobian and problems.		https://youtu.be/UwnSRSDrZJg
15	Solving the problems using MATLAB		
16	Introduction to Congruences, Linear Congruences	https://shorturl.at/HiHmI	https://youtu.be/OinIJmdvA-U
17	Finding GCD using Euclid's Algorithm		https://youtu.be/yHwneN6zJmU
Quiz -01 and Test-01			
18	Finding GCD using Euclid's Algorithm		https://youtu.be/yHwneN6zJmU

19	Remainder theorem (statement only), Solving Polynomials.	https://shorturl.at/hudin	https://youtu.be/e8DtzQkjOMQ
20	Remainder theorem (statement only), Solving Polynomials		https://youtu.be/-oOAYnaHQQY
21	Linear Diophantine Equation, System of Linear Congruence		https://youtu.be/xo29WjMM_dM
22	Euler's Theorem.		https://youtu.be/DyOv20d4c70
Assignment- 01 and Student Feedback – 1 Submission			
23	Euler's Theorem.		https://youtu.be/DyOv20d4c70
24	Wilson's Theorem		https://youtu.be/irRKpS7s5WI
25	Fermat's little theorem		https://youtu.be/3Cb0ys-jppU
26	Solving the problems using MATLAB		
27	Regula-Falsi method	https://acesse.one/7zspe	https://youtu.be/hqlQeWRPyvI
28	Newton-Raphson methods		https://youtu.be/HGCcx-5WWmA
29	Newton-Raphson methods		https://youtu.be/irAta3byzLs
30	Interpolation using Newton's forward difference		https://youtu.be/X8t6HRNaNVM?list=PLM9RnGtTy9__vgc4ufTsTmmHq3zDRRrjZ
31	Interpolation using Newton's backward difference		https://youtu.be/-9YaTDXREaE?list=PLM9RnGtTy9__vgc4ufTsTmmHq3zDRRrjZ
32	Newton's divided difference formula		https://youtu.be/FQJV-J5p-EA
33	Lagrange's interpolation		https://youtu.be/lXu

	problems.		N-L_N-L0
Quiz-02 and Test-02			
34	Lagrange's interpolation problems.		https://youtu.be/lXuN-L_N-L0
35	Simpson's (1/3)rd rules		https://youtu.be/ItRHhLGpKUA
36	Solving the problems using MATLAB		
37	Taylor's series method,	https://shorturl.at/3vEPb	https://youtu.be/3kEDT-YmfUQ?list=PLM9RnGtTy9__5X2XHe2r3dlw5rv-ojqCX
38	Taylor's series method,		https://youtu.be/9yGMf6-Cf7s?list=PLM9RnGtTy9__5X2XHe2r3dlw5rv-ojqCX
39	Modified Euler's method		https://youtu.be/TOnLoue7re4
40	Modified Euler's method		https://youtu.be/FqDg7LLd0Ww
41	Runge-Kutta method of fourth order prob.		https://youtu.be/Javfe8nFILI
Assignment- 02 and Student Feedback – 2 Submission			
42	Runge-Kutta method of fourth order prob.		https://youtu.be/IkLY52o9SKs
43	Milne's predictor-corrector formula	https://shorturl.at/3vEPb	https://youtu.be/LFl-ZQZ2qW4
44	Milne's predictor-corrector formula		https://youtu.be/LFl-ZQZ2qW4
45	Solving the problems using MATLAB		
Quiz-03 and Test-3			

3.2 Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/ Course Outcomes	15	25	20	40	100
CO1	10			5	15
CO2	5	5		10	20
CO3		10		10	20
CO4		5	5	5	15
CO5		5	5	5	15
CO6			10	5	15

AWD

	Quiz			**Test**			**Assignment**		**CIE**	**SEE**	**Total marks**
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
	Q1(5)	**Q2(5)**	**Q3(5)**	**T1(8)**	**T2(8)**	**T3(9)**	**A1(10)**	**A2(10)**			
CO1-15	3	3	4						**10**	**05**	**15**
CO2-20	2	2	1	2	2	1			**10**	**10**	**20**
CO3-20				3	3	4			**10**	**10**	**20**
CO4-15				1	2	2	3	2	**10**	**05**	**15**
CO5-15				2	1	2	2	3	**10**	**05**	**15**
CO6-15							5	5	**10**	**05**	**15**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

3.3 Schedule of Assessment

Assessment Type	Date	Marks	COs	Quiz	Test	Assignment/PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30min	60 min	6 weeks	3 hours
Quiz-1	**5th week**	15	**CO1, CO2**				
Quiz-2	**9th week**						
Quiz-3	**12th week**						
Test-1	**5th week**	**25**	**CO2, CO3, CO4,CO5**				
Test-2	**9th week**						
Test-3	**12th week**						
Assignment-1	**6th week**	**10**	**CO5**				
Assignment-2	**11th week**	**10**	**CO6**				
SEE	**18th week**	**40**	**CO1-CO6**				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.If marks scored is:
- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade Obtained
Total							**XXXXX**	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

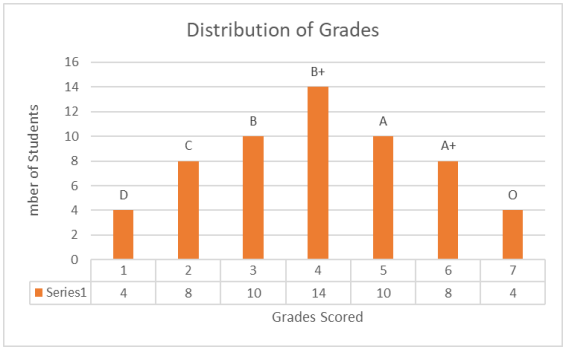
Attainment of Course Outcomes-Cos		
Outcomes- Targeted	Outcomes Level of Attainment	Observations and Remarks
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		
70% of Students will score A grade and above-1 70% of students will score B+ grade and Above-2 70% of students will score B grade and above-3		

Performance Recording

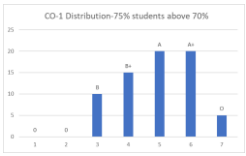
<table>
<tr><td rowspan="2">Academic Year
2024-25</td><td rowspan="2">Program:
B.Tech., in Computer Science and Engineering</td><td rowspan="2">Semester
I</td><td rowspan="2">Section</td><td rowspan="2" colspan="2">Course Code
UE24CS101</td><td colspan="5">Course Title
Discrete Structure for Computing</td></tr>
<tr><td colspan="5">Course Tutor/s:
Tutor’s ID/Department:</td></tr>
<tr><td>Total Number of students in the Class</td><td>Number of Students appeared for all the components of Assessment</td><td>Number of Students - Passed all the component of Examination</td><td>Class Average Marks</td><td>O-Graders
>= 91</td><td>A+ Graders
81<=M<= 90</td><td>A Grader
71<=M<= 80</td><td>B+ Graders
61<=M<= 70</td><td>B Graders
51<=M<= 60</td><td>C Graders
40<=M<= 50</td><td>D Graders
M<40</td></tr>
</table>

60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

4. Other Details

4.1 Assignment Details or Problem Based Learning

Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided**.**

4.2 Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

COURSE DOCUMENT

Course Code	UE24CS1102
Course Title	**Analog and Digital Fundamentals**
Program Code	IS
Program Title	B.Tech. Information Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	ISE
Department	Department of Information Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Information Science and Engineering
Faculty Member	Gagandeep B M
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18)-SEE Weeks (19-20)-Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- The course provides an overview of electronics by introducing the basic components used in Electronic devices and its applications.
- The course enhances the numerical computation by having knowledge of components such as binary representation, digital logic gates, and basic combinational and sequential circuits. Further, they could design a sequential circuits based on the real time application.
- The course introduces the need of operational amplifiers, which play a major role in deciding the design system of computing devices.
- The course provides a comprehensive knowledge on electronic component which can be used for implementation in various analog and digital systems for designing advanced systems.

2.2 Course Objectives

The objectives of the Course are:

- Explain the principles of P-N junction diodes and their applications in electronic circuits.
- Analyze the behavior of diodes using equivalent circuits and apply the min rectification techniques.
- Explore the characteristics and applications of Zener diodes as voltage regulators.
- Understand the structure and operation of Bipolar Junction Transistors (BJTs) as amplifiers and switches.
- Introduce feedback amplifiers and oscillators, including stability considerations and oscillator designs.
- Introduce the concept of Operational Amplifiers (Op-Amps) and their ideal behavior.
- Explore different input modes of Op-Amps: differential mode and common mode.
- Evaluate key parameters such as CMRR, maximum output voltage swing, input offset voltage, and bias current.
- Understand basic Op-Amp circuits including inverting and non-inverting amplifiers, voltage followers, summers, and subtractors.
- Design and simulate basic Op-Amp circuits for various functions like integrators, differentiators and comparators.
- Introduce different number systems including binary, hexadecimal, octal and their conversions.
- Explain the principles of combinational logic, Boolean algebra and the generation of switching equations from truth tables.
- Demonstrate the use of Karnaugh maps and Quine-McClusky minimization technique for simplifying Boolean expressions.
- Analyze and design combinational logic circuits including adders, subtractors, comparators, decoders, encoders and multiplexers.
- Understand the principles of bistable elements and their applications in digital circuits.
- Learn about various types of flip-flops including SR,JK, D and T flip-flops.
- Explore the characteristics and applications of latches and master-slave flip-flops

2.3 Course Outcomes

After undergoing these course students will be able to:

CO1	**Define** P-N junction, types of rectifiers their characteristics, functions. Zener diode, Bipolar Junction Transistor (BJT), Amplifiers Parameters, and need of Karnaugh map, Digital to Analog systems in types of Flip flops.
CO2	**Explain** the working principle of a P-N junction diode, process of rectification in Half-wave and Full-wave rectifiers, operating principles of a Bipolar Junction Transistor (BJT), Op-Amp Circuits, Karnaugh map types, quine-McCluskey in Analog to Digital systems. Further role of Flip-Flops in memory management in digital systems.
CO3	**Apply** the principles of P-N junction diodes to **construct** simple circuits that involve rectification, such as Half-wave and Full-wave rectifiers, voltage regulator. **Demonstrate** Bipolar Junction Transistors (BJT), combinational logic to be implemented in Flip flops
CO4	**Analyze** P-N junction diodes as rectifiers in Half-wave and Full-wave, their performance metrics such as ripple factor and efficiency. Also **compare** devices like Zener diodes, Bipolar Junction Transistors, Karnaugh map in Combinational circuits as feedback, and Flip flops in Registers, decoders and encoders.
CO5	**Evaluate** the role of Operational amplifiers efficiency, ripple factor, and practicality in different applications. Further, the need of Karnaugh map for design of combinational logic by using Flip flops.
CO6	**Construct** and **optimize** the circuit for rectification of signals and conversion of Analog system to digital system in combinational logic to be implemented by optimizing the various flip flop design in electronic circuit.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3		2							2	3	3	
CO2	1	2	3		2							2	3	3	
CO3	1	2	3		2							2	3	3	
CO4	1	2	3		2							2	3	3	
CO5	1	2	3		2							2	3	3	
CO6	1	2	3		2						3	2	3	3	

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Semiconductor Diodes and Applications:** P-N junction diode, Equivalent circuit of diode, Rectification-Half wave rectifier, Full wave rectifier (Ripple factor, Efficiency-only Definition) Zener Diode, Zener diode as a voltage regulator, Bipolar Junction Transistor (BJT) structure, The BJT as an amplifier, The BJT as a switch: Switching operation, A simple Application of a Transistor Switch, Feedback Amplifiers and Oscillators: Introduction, Types of feedback, Gain stability with feedback, Oscillators, Phase Shift oscillator, Wien Bridge oscillator.
- **The Operational Amplifiers:** Introduction to Op-Amp, Op-Amp Input Modes: Differential mode, Common mode, Op-Amp Parameters: CMRR, Maximum output Voltage Swing, Input Offset Voltage, Input Bias Current, Input and Output Impedance, Input offset current, Slew Rate, Basic Op-Amp Circuits: Inverting amplifier, Virtual ground, Non-Inverting amplifier, Linear applications of Op-amp: Summer, Subtractor, Voltage follower, Integrator, Differentiator and Comparator Numericals.
- **Digital Concepts and Number System:** Introduction to Number Systems, Number system Conversions: Binary to Hexadecimal, Hexadecimal Conversion, Hexadecimal and Octal to binary conversion, binary to decimal conversion Principal of combinational logic: Introduction, Definition of combinational logic, Canonical forms, generation of switching equation from truth tables, Karnaugh map (Three and Four variables k-maps), quine-McCluskey minimization technique: using don't care terms.
- **Analysis and design of combinational logic:** Introduction, General approach to combinational logic design Binary Adders and Sub-tractors, comparators, Decoders, Encoders: 8:3 line priority encoder, multiplexers.

- **Flip-Flops and its Applications:** Basic Bistable elements, Latches, The master-slave flip-flops(pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations, Registers, binary ripple counters (3 bits only) and Design of synchronous binary counters (3 bits only).

resources, textbooks

- D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.
- Thomas L Floyd, "Electronic Devices", Pearson Education 9th Edition, 2012.
- John M Yarbrough, "Digital Logic Applications and Design", Cengage Learning, 11th Indian Reprint, 2015.
- Donald D Givone, " Digital Principles and Design", Mc Graw Hill Education, 23rd Reprint 2013.

References:

- Robert.L.BoylestadandLouisNashelsky,"ElectronicDevicesandcircuittheory",PHI, 10th Edition, 2009.
- Charles H. Roth, Jr. and Larry L. Kinney, "Fundamentals of Logic Design", 7th Edition 2014.

Other Resources

- http://digimat.in/nptel/courses/video/117106114/L01.html
- http://acl.digimat.in/nptel/courses/video/117101106/117101106.html
- Introduction to Bipolar Junction Transistor(BJT) - YouTube
- Introduction to Digital Electronics -YouTube
- Flip-Flop-Introduction-YouTube

3.Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Introduction	Lecture-00	Video-00
1	Semiconductor Diodes and Applications: P-N junction diode	Lecture-01	Video-01
2	Equivalent circuit of diode	Lecture-02	Video-02
3	Numericals	Lecture-03	Video-03
4	Rectification—Half wave rectifier	Lecture-04	Video-04
5	Full wave rectifier	Lecture-05	Video-05
6	Zener Diode, Zener diode as a voltage regulator	Lecture-06	Video-06
7	Bipolar Junction Transistor structure, The BJT as an amplifier	Lecture-07	Video-07
8	BJT as a switch- Switching operation, A simple Application of a Transistor Switch	Lecture-08	Video-08
9	Feedback Amplifiers and Oscillators: Types of feedback, Gain stability with feedback	Lecture-09	Video-09
10	Oscillators, Phase Shift oscillator	Lecture-10	Video-10
11	Wien Bridge oscillator	Lecture-11	Video-11
12	The Operational Amplifiers Introduction to Op-Amp	Lecture-12	Video-12
13	Introduction to Op-Amp, Op-Amp Input Modes	Lecture-13	Video-13
14	Op-Amp Parameters	Lecture-14	Video-14
15	Basic Op-AmpCircuits: Virtual Ground Concept, Inverting amplifier	Lecture-15	Video-15
16	Non Inverting amplifier Linear applications of Op-amp: Summer, Subtractor,	Lecture-16	Video-16
17	Numericals	Lecture-17	Video-17
18	Voltage follower ,Integrator, Differentiator	Lecture-18	Video-18
19	Numericals	Lecture-19	Video-19

Internal Assessment-1, Quiz-01 and Assignment-01: Student Feedback			
20	Digital Concepts and Number System: Digital Concepts	Lecture-20	Video-20
21	Principal of combinational logic	Lecture-21	Video-21
22	Generation of switching equation from truth tables	Lecture-22	Video-22
23	Generation of switching equation from truth tables	Lecture-23	Video-23
24	Karnaugh map-3 Variables	Lecture-24	Video-24
25	Karnaugh map-4 Variables	Lecture-25	Video-25
26	Quine-McCluskey minimization technique	Lecture-26	Video-26
27	Quine-McCluskey minimization technique	Lecture-27	Video-27
28	Analysis and design of combinational logic	Lecture-28	Video-28
29	Binary adders and Subtractors	Lecture-29	Video-29
30	Comparators.	Lecture-30	Video-30
31	Decoders	Lecture-31	Video-31
32	Encoders, 8:3 line priority encoder	Lecture-32	Video-32
33	Multiplexers	Lecture-33	Video-33
34	Multiplexers	Lecture-34	Video-34
Internal Assessment-2, Quiz-02 and Assignment-02: Student Feedback			
35	Flip-Flops and its Applications: Basic Bistable elements, Latches, The master-slave flip-flops	Lecture-35	Video-35
36	Basic Bistable elements, Latches	Lecture-36	Video-36
37	The master-slave SR flip-flops	Lecture-37	Video-37
38	The master-slave JK flip-flops	Lecture-38	Video-38
39	Edge triggered flip-flops	Lecture-39	Video-39
40	Characteristic equations-JK,T, SR, D Flipflops	Lecture-40	Video-40
41	Registers-SISO, SIPO, PISO, PIPO	Lecture-41	Video-41

42	3 Bit Binary ripple counters using JK Flipflops	Lecture-42	Video-42
43	3 Bit Binary ripple counters using T Flipflops	Lecture-43	Video-43
44	Design of synchronous binary counters- D, SR Flipflops	Lecture-44	Video-44
45	Design of synchronous binary counters- JK, T Flipflops	Lecture-45	Video-45
Internal Assessment-3, Quiz-03 and Assignment-03			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/ Course Outcomes	15	25	20	40	100
CO1	8	2		6	16
CO2	7	7		8	22
CO3		11		10	21
CO4		3		12	15
CO5		2	10	4	16
CO6			10		10

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment /PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30min	60min	6weeks	3hrs
Quiz-1	5th week	6	CO1/CO2				
Quiz-2	10th week	5	CO1/CO2				
Quiz-3	15th week	4	CO1/CO2				
Test-1	5th week	8	CO1/CO2 /CO3				
Test-2	10th week	8	CO2/CO3				
Test-3	15th week	9	CO3/CO4 /CO5				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	All				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded. If marks scored is:
  - 91 and above O (outstanding);
    81-90:A+(Excellent);
    71-80:A(Very Good);
    61-70:B+(Good);
    51-60:B(Above Average);
    40-50:C(Average);
    below 40:D(Not satisfactory).
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience.

Course Document

Course Code	UE24CS1105
Course Title	**Problem Solving through C Programming**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Keerthi Prasad G
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- The course provides an insight for knowledge of fundamentals programming, terminologies and basic programming structure of C language.
- The course focuses on introducing the features of C programming by delving into the constraints of language. Further, develops problem-solving skills and encourages algorithmic thinking.
- The course illustrates the need of Automation by using hands-on experience by assigning specific projects to develop their knowledge in practical scenarios.
- The course enhances the programming skills by illustrating the real-time projects by introducing hands-on sessions with the role and need of programming concepts.

2.2 Course Objectives

The objectives of the Course are:

- To demonstrate a clear understanding of basic C programming syntax, data types, and control structures.
- To develop the ability to think algorithmically and design step-by-step solutions to various problems.
- To attain proficiency in using C language features, including functions, arrays, pointers, and structures.
- To learn the principles of modular programming and apply them to develop organized and maintainable code.
- To understand memory allocation and deallocation using pointers, dynamic memory allocation, and the associated best practices.
- To acquire knowledge and skills related to file input/output operations in C.
- To develop the ability to break down complex problems into manageable parts and solve them systematically using C programming.
- To gain proficiency in identifying and fixing common programming errors and debugging code effectively.
- To apply learned concepts to practical projects, demonstrating the ability to solve real-world problems through programming.
- To foster teamwork and collaborative coding practices by working on group projects or assignments.
- To learn and adhere to coding standards and best practices for writing clean, readable, and efficient C code.
- To lay the foundation for further studies in computer science and programming by building a strong understanding of fundamental concepts.
- To develop critical thinking skills in the context of programming, including analysing problems and evaluating potential solutions.
- To enhance communication skills related to programming, including writing clear and concise code comments and documentation.
- T0 introduce participants to relevant tools and environments used in the industry for C programming and problem-solving.

2.3 Course Outcomes

After undergoing this course student will be able to:

CO1	**Identify** and **recall** fundamental concepts of C programming, including data types, operators, control structures, functions, arrays, user defined types, pointers, and file handling.
CO2	**Understand** and **explain** the functionality and application of core C programming concepts such as control structures, functions, arrays, user defined types, pointers, and file handling
CO3	**Apply** core C programming concepts and techniques to develop and demonstrate structured programs.
CO4	**Analyse** the use and impact of various data structures and programming techniques in C.
CO5	**Evaluate** the efficiency and effectiveness of different file I/O methods, different dynamic memory allocation strategies and trade-offs between using global versus local variables in terms of memory usage and program maintainability.
CO6	**Create** complex C programs by utilizing advanced data types and structures, including structures, unions, pointers and enumeration.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3										1	3	3
CO2	1	1	2										1	3	3
CO3	1	1	1	3						2			1	2	2
CO4	1	1	1	2						2			1	3	3
CO5	1	1	1	1						2			1	3	3
CO6	1	1	1	2						2			1	3	3

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Introduction to Computer languages and C Programming:** Introduction to basic structure of a computer, evolution of computer languages. Introduction to C, Structure of C program, Steps

required to create and execute a C program, design tools – algorithm, flowchart and psuedocode, C tokens, variables, constants, Input/output statements in C.

- **Operators and expressions:** Types of operators in C, evaluation of expressions and type conversion.
- **Branching and looping statements:** Introduction to decision control, conditional branching statements, looping statements, nested loops and unconditional branching.
- **Functions:** Introduction to functions, function definition, function declaration, function call, return statement, passing parameters to functions, scope of variables, storage classes, recursive functions.
- **Arrays:** Declaration and initialization of single dimension and multi-dimensional arrays, accessing the elements of an array, passing arrays to functions, applications of arrays – searching and sorting.
- **Strings:** Introduction to strings, string taxonomy, operations on strings, miscellaneous string and character functions, arrays of strings.
- **Pointers:** Introduction to pointers, declaring pointer variables, types of pointers, passing arguments to functions using pointers, dynamic memory management using pointers.
- **Structure, Union, and Enumerated Data Type:** Structure declaration, typedef, array of structures, nested structures, pointer to structures, structures as parameter to functions, Introduction to union and enumerated data type.
- **Files:** Introduction to files in C, types of files, basic file operations, fseek and rewind.

2.5 Course Resources

Text Book:

- Yeshvant P Kanetkar, Let US C, 19th edition, BPB Publications.

References:

- E. Balaguruswamy, Programming in ANSI C, 7th edition, Tata McGraw-Hill.
- Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd edition, Pearson Publication.

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Introductory Presentation	Lecture-00	Video-00
1.	Basic structure of a computer	Lecture-01	Video-01
2.	Evolution of computer languages	Lecture-02	Video-02
3.	Introduction to C, structure of c program	Lecture-03	Video-03
4.	Steps required to create and execute a C program	Lecture-04	Video-04
5.	Design tools – algorithm, flowchart and psuedocode	Lecture-05	Video-05
6.	C tokens, Variables, constants	Lecture-06	Video-06
7.	Input/output statements in C	Lecture-07	Video-07
8.	Practical: Program 1	Lecture-08	Video-08
9.	Operators	Lecture-09	Video-09
10.	Operators	Lecture-10	Video-10
11.	Evaluation of expressions and type conversion	Lecture-11	Video-11
12.	Practical: Program 2	Lecture-12	Video-12
13.	Introduction to control statements	Lecture-13	Video-13
14.	Conditional branching statements	Lecture-14	Video-14
15.	Conditional branching statements	Lecture-15	Video-15
16.	Looping statements	Lecture-16	Video-16
17.	Looping statements	Lecture-17	Video-17
18.	Practical: Program 3	Lecture-18	Video-18
19.	Practical: Program 4	Lecture-19	Video-19
20.	Nested loops	Lecture-20	Video-20

21.	Break and continue statements, goto statement	Lecture-21	Video-21
22.	Practical: Program 5	Lecture-22	Video-22
23.	Functions: Introduction using functions	Lecture-23	Video-23
24.	Function definition, function declaration	Lecture-24	Video-24
25.	Practical: Program 6	Lecture-25	Video-25
26.	function call, return statement	Lecture-26	Video-26
27.	Passing parameters to functions, scope of variables, storage classes, recursive functions	Lecture-27	Video-27
28.	Arrays: Declaration and initialization of single dimension and multi-dimensional arrays	Lecture-28	Video-28
29.	Practical: Program 7	Lecture-29	Video-29
30.	Accessing the elements of an array, passing arrays to functions	Lecture-30	Video-30
31.	Applications of arrays – searching and sorting	Lecture-31	Video-31
32.	Strings and Pointers: Introduction	Lecture-32	Video-32
33.	Practical: Program 8	Lecture-33	Video-33
34.	String taxonomy, operations on strings	Lecture-34	Video-34
35.	Miscellaneous string functions, array of strings	Lecture-35	Video-35
36.	Pointers: Introduction to pointers, Declaring pointer variables	Lecture-36	Video-36
37.	Types of pointers, passing arguments to functions using pointers	Lecture-37	Video-37
38.	Dynamic memory management using pointers	Lecture-38	Video-38
39.	Practical: Program 9	Lecture-39	Video-39
40.	Structure declaration, typedef, array of structures	Lecture-40	Video-40

41.	Nested structures, pointer to structures, structures as parameter to functions Unions, Unions inside	Lecture-41	Video-41
42.	Practical: Program 10	Lecture-42	Video-42
43.	Introduction to union and enumerated data type	Lecture-43	Video-43
44.	Introduction to files in C, types of files, basic operations, fseek and rewind	Lecture-44	Video-44
45.	Practical: Program 11, 12	Lecture-45	Video-45

3.2 Assessment weight Distribution

COs	Q1	Q2	Q3	T1	T2	T3	A1	A2	CIE	SEE
CO1	2	1	2						5	5
CO2	1	2	2	3	3				11	14
CO3		2	3	4	4	4			17	13
CO4					3	4	2	2	11	4
CO5							4	4	8	2
CO6							4	4	8	2
Total	15			25			20		60	40

3.3. Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5thweek	3	CO1/CO2				
Quiz-2	10thweek	5	CO1/CO2/CO3				
Quiz-3	15thweek	7	CO1/CO2/CO3				
Test-1	5thweek	7	CO2/CO3				
Test-2	10thweek	10	CO2/CO3/CO4				
Test-3	15thweek	8	CO3/CO4				
Assignment-1	7thweek	10	CO5/CO6				
Assignment-2	14thweek	10	CO5/CO6				
SEE	18thWeek	40	CO1,2,3,4,5,6				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Course Document

Course Code	UE25CS1105
Course Title	**Web Designing & Programming**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CS-CY
Department	Department of Artificial Intelligence and Machine Learning
Faculty Code	EC25069
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Ms. Rakshitha G B
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**2**	**-**	**2**	**4**

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

This course

- This course enables understanding design principles needed in websites.
- This course presents design skills of web development by using relevant technologies.
- This course illustrates the knowledge to develop responsive tailor made web designs.
- This course enhances fundamentals secure coding practices used for potential threats.
- This course illustrates the tools used in web designs to integrate multimedia effectively.

2.2 Course Objectives

Course Learning Objectives: This course (UE24CS1106) will enable students to Study:

To use the syntax and semantics of HTML and XHTML

- To develop different parts of a web page
- To understand how CSS can enhance the design of a webpage.
- To create and apply CSS styling to a webpage
- To get familiarity with the JavaScript language and understand Document Object Model handling of Java Script

Course Outcomes

After undergoing this course, students will be able to:

CO1	**Recall** the basic syntax and rules of traditional HTML, XHTML, and HTML5.
CO2	**Explain** the differences between HTML, XHTML, and HTML5 and their impact on web development.
CO3	**Apply** HTML5 and CSS to design and implement web pages with various styling and layout features.
CO4	**Analyse** the structure and functionality of web pages created with HTML5 and CSS to ensure effective design and layout.
CO5	**Evaluate** the effectiveness of web pages in terms of design, usability, and accessibility.
CO6	**Create** interactive and dynamic web applications by integrating HTML5, CSS, and JavaScript.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3	3	1			2		2		1	3	1	1
CO2	1	2	3	3	1			2		2		1	3	1	1
CO3	1	1	2	3	1			2		2	1	1	3	1	1
CO4	1	1	2	2	1			2	1	2	1	1	2	1	1
CO5	1	1	1	2	1			1	2	1	2	1	2	1	1
CO6	1	1	1	2	1			1	2	1	2	1	2	1	1

Relevance: 1 high, 2 medium, 3 low

2.3 Course Content

- **Traditional HTML and XHTML:** First Look at HTML and XHTML, Hello HTML and XHTML World, HTML and XHTML: Version History, HTML and XHTML DTDs: The Specifications Up Close, (X) HTML Document Structure, Browsers and (X)HTML, The Rules of (X)HTML, Major Themes of (X)HTML, The Future of Markup—Two Paths?.
- **HTML5:** Hello HTML5, Loose Syntax Returns, XHTML5, HTML5: Embracing the Reality of Web Markup, Presentational Markup Removed and Redefined, HTML5 Document Structure Changes, Adding Semantics, HTML5's Open Media Effort, Client-Side Graphics with <canvas>, HTML5 Form Changes, Emerging Elements and Attributes to Support Web Applications
- **Cascading Style Sheets (CSS):** Introduction, CSS Overview , CSS Rules, Example with Type Selectors and the Universal Selector, CSS Syntax and Style, Class Selectors, ID Selectors, span and div Elements, Cascading, style Attribute, style Container, External CSS Files, CSS Properties, colour Properties, RGB Values for colour, Opacity Values for colour, HSL and HSLA Values for colour, Font Properties, line-height Property, Text Properties, Border Properties, Element Box, padding Property, margin Property , Case Study: Description of a Small City's Core Area.
- **Tables and CSS, Links and Images:** Table Elements, Formatting a Data Table: Borders, Alignment, and Padding, CSS Structural Pseudo Class Selectors, , Cell Spanning, Web Accessibility, CSS display Property with Table Values, a Element, Relative URLs, Navigation Within a Web Page, CSS for Links, Bitmap Image Formats: GIF, JPEG, PNG, IMG Element, Responsive Images, Positioning Images, Shortcut Icon, iframe Element.
- **Introduction to JavaScript:** Functions, DOM, Forms, and Event Handlers: History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Forms and How They're Processed: Client-Side Versus Server-Side, form Element, Controls, Text Control, accessing a Form's Control Values, reset and focus Methods.

2.4 Course Resources

Text book

- HTML & CSS: The Complete Reference Thomas A. Powell, Fifth Edition, Tata McGraw Hill, 2010.
- WEB PROGRAMMING with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, First Edition, 2018

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	First Look at HTML and XHTML, Hello	PPT	Video-00
1	HTML and XHTML: Version History, HTML	PPT	Video-01
2	DTDs: The Specifications Up Close,	PPT	Video-02
3	(X)HTML Document Structure,	PPT	Video-03
4	Browsers and (X)HTML,	PPT	Video-04
5	The Rules of (X)HTML	PPT	Video-05
6	The Rules of (X)HTML	PPT	Video-06
7	The Future of Markup—Two Paths?	PPT	Video-07
8	The Future of Markup—Two Paths?	PPT	Video-08
9	Hello HTML5, Loose Syntax Returns,	PPT	Video-09
10	XHTML5, HTML5	PPT	Video-10
11	Embracing the Reality of Web Markup,	PPT	Video-11
12	Presentational Markup Removed	PPT	Video-12
13	HTML5 Document Structure Changes,	PPT	Video-13
14	Adding Semantics, HTML5's Open Media Effort,	PPT	Video-14
15	Client-Side Graphics with <canvas>, HTML5	PPT	Video-15
16	Emerging Elements and Attributes to Support	PPT	Video-16
17	Introduction, CSS Overview , CSS Rules,	Lecture-17	
18	Example with Type Selectors and the Universal	Lecture-18	
19	CSS Syntax and Style, Class Selectors	Lecture-19	
20	ID Selectors, span and div Elements, Cascading	Lecture-20	
21	External CSS Files, CSS Properties	Lecture-21	
22	RGB Values for colour, Opacity Values	Lecture-22	
23	HSL and HSLA Values for colour	Lecture-23	

24	line-height Property, Text Properties,	Lecture-24	Video-24
25	Border Properties, Element Box,	Lecture-25	Video-25
26	padding Property, margin Property	Lecture-26	Video-26
27	Case Study: Description of a Small City's	Lecture-27	Video-27
28	Case Study: Description of a Small City's	Lecture-28	Video-28
29	Table Elements, Formatting a Data Table:	Lecture-29	Video-29
30	CSS Structural Pseudo Class Selectors	Lecture-30	Video-30
31	Cell Spanning, Web Accessibility	Lecture-31	Video-31
32	Element, Relative URLs, Navigation	Lecture-32	Video-32
33	Bitmap Image Formats: GIF, JPEG, PNG	Lecture-33	Video-33
34	Responsive Images, Positioning Images	Lecture-34	Video-34
35	History of JavaScript, Hello World Web Page,	Lecture-35	Video-35
36	Buttons, Functions, Variables,	Lecture-36	Video-36
37	Identifiers, Assignment Statements	Lecture-37	Video-37
38	Forms and How They're Processed	Lecture-38	Video-38
39	Forms and How They're Processed	Lecture-39	Video-39
40	form Element, Controls, Text Control,	Lecture-40	Video-40
41	Accessing a Form's Control Values,	Lecture-41	Video-41
42	reset and focus Methods	Lecture-42	Video-42

Assessment weight Distribution

COs	Q1	Q2	Q3	T1	T2	T3	A1	A2	CIE	SEE
CO1	2	2	2						6	5
CO2	1	2	2	3	3				11	14
CO3		2	2	3	4	4	2	2	19	13
CO4					4	4	2	2	12	4
CO5							3	3	6	2
CO6							3	3	6	2
Total	15			25			20		60	40

Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5thweek	3	CO1/CO2				
Quiz-2	10thweek	5	CO1/CO2/CO3				
Quiz-3	15thweek	7	CO1/CO2/CO3				
Test-1	5thweek	7	CO2/CO3				
Test-2	10thweek	10	CO2/CO3/CO4				
Test-3	15thweek	8	CO3/CO4				
Assignment-1	7thweek	10	CO4/CO5/CO6				
Assignment-2	14thweek	10	CO4/CO5/CO6				
SEE	18thWeek	40	CO1,2,3,4,5,6				

Grading Criterion

- Based on total marks scored grade is awarded.

  If marks scored is:

  91 and above O (outstanding); 81-90: A+ (Excellent);71-80: A (Very Good);61-70: B+(Good); 51-60:B (Above Average); 40 -50:C(Average); below 40:D (Not satisfactory).

- If one scores D grade, the candidate is required to re- register for the course ifhe/she wants to earn the credit at his/her own convenience.

Attainment Calculations:

Recording Marks and Awarding Grades

S.No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX) / Number of students (N)

Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes-Targeted	**Targeted Attainment Level**
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1

Course Document

Course Code	UE24CS1201
Course Title	Applied Mathematics for Computer Science
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Veena C M ,Raghu S, Kavya R, Dayana, Dr. Madhukesh J K, Ganesh .
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	2	2	0	4

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- The course 'Applied Mathematics for Computer Science' aims to summarize and describe the main features of a dataset. It involves measures such as mean, median, mode, range, variance, and standard deviation to provide insights into the data's central tendency and variability.
- The course introduce vector calculus and vector space is used in computer science engineering for various applications, such as computer graphics, machine learning, and simulations, where understanding and manipulating vectors are essential.
- The course covers Curve fitting involves finding a mathematical model that best fits a set of data points. In computer science engineering, this is used for tasks like regression analysis, where relationships between variables are modelled statistically to make predictions or understand patterns in the data.
- The course also covers probability distributions are used in various applications, such as machine learning algorithms, network analysis, and simulations.

2.2 Course Objectives

This course will enable students to Study:

- Define fundamental statistical measures such as mean, median, mode, range, variance, and standard deviation.
- Recall the basic concepts of vector spaces, vector calculus, and their significance in computer science.
- Explain how statistical measures summarize and describe datasets in computational applications.
- Describe the importance of vector spaces in computer graphics, machine learning, and simulations.
- Compute and interpret key statistical measures for a given dataset.
- Apply vector calculus principles to solve computational problems in computer science.
- Fit mathematical models to datasets using curve-fitting techniques in regression analysis.
- Utilize probability distributions to model real-world applications in machine learning and simulations.
- Analyze the role of different statistical methods in extracting insights from data.
- Differentiate between various curve-fitting techniques and evaluate their effectiveness in predictive modeling
- Assess the impact of probability distributions in decision-making processes within computational applications.
- Critically evaluate the efficiency of vector spaces in various computer science applications..

2.3 Course Outcomes

Course Outcomes: At the end of the course students should be able to:

CO1	**Describe** the concepts of data collection, central tendency measures, define vector space basics, and understand sampling theory principles.
CO2	**Explain** primary/secondary data collection, central tendency measures, vector calculus, linear transformations, correlation analysis, probability theory, and hypothesis testing with Student's t-distribution and Chi-square distribution techniques.
CO3	**Apply** advanced methods in data collection, central tendency measures, dispersion, vector

	spaces, transformations, curve fitting, probability theory, and joint distributions in complex problem-solving contexts..
CO4	**Analyze** and critically evaluate advanced data collection methods, integrate complex concepts, solve intricate problems in calculus and linear transformations, and apply advanced statistical analyses and hypothesis tests.
CO5	**Evaluate** and innovate methods for data collection, analyze complex statistics, apply advanced calculus and linear algebra, and utilize sophisticated techniques in curve fitting, correlation, regression, probability, sampling theory, and hypothesis testing.
CO6	**Create** sophisticated solutions through the application and synthesis of advanced mathematical and statistical techniques in data analysis, vector calculus, statistical modelling, hypothesis testing.

Outcome Map:

Cos	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	1	1	2	1	3				3		3	2	2	2
CO2	1	1	1	2	1	3						3	2	2	2
CO3	1	1	2	1	1	3				2	3	3	2	2	2
CO4	1	1	1	2	1	3			3	2	3	3	2	3	3
CO5	1	1	2	2	1	3	3		3	2	3	3	2	3	3
CO6	1	2	2	2	1	3			3	3		3	2	3	3

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Descriptive Statistics:** Concept of primary and secondary data, Methods of collection of primary data. Measures of central tendency : Arithmetic mean, median, mode, geometric mean and harmonic mean .Absolute and relative measures of dispersion : range, quartile deviation, mean deviation, standard deviation and variance with simple applications .
- **Vector Calculus :** Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems, Vector spaces : Definition and examples, subspace, linear span, Linearly

independent and dependent sets, Basis and dimension, Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation.

- **Curve fitting by the method of least squares:** Fitting the curves of the form $y = ax + b$, $y = ax^b$, $y = ax^2 + bx + c$, Correlation: Karl Pearson's coefficient of Correlation and rank correlation (without repetition) –problems, Regression analysis: lines of regression –problems, angle between the lines of regression.

- **Review of basic probability theory:** Random variables (discrete and continuous), probability mass and density functions, Mathematical expectation, mean and variance. Probability Distribution: Binomial, Poisson, normal distribution -problems (derivation for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.

- **Joint Probability distribution:** Joint Probability distribution for two discrete random variables, expectation and covariance. Sampling theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of Hypothesis: Test of Hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

2.5 Text Book and References

Text Book:

- **Khan and khanum**: "Fundamentals of Biostatistics " Ukaaz publications.
- **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021
- **H. K. Dass and Er. Rajnish Verma**: "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.

References:

- **E. Kreyszig:** "Advanced Engineering Mathematics" John Wiley & Sons, 10th Ed., 2018.

Other Resources

http://nptel.ac.in/courses.php?disciplineID=111

http://www.class-central.com/subject/math(MOOCs)

3. **Teaching and Assessment**

3.1 Teaching

Lecture Number	Lecture Topic	Lecture slides	Lecture videos
0	Introduction	https://drive.google.com/file/d/12SK4byRTzIa9bsehj112swHdTOLwXs4M/view?usp=sharing (m-1) https://docs.google.com/presentation/d/1D1667fN_pJYwjBvdmLGgKDW1Ggpv7rUc/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (m-2)	https://docs.google.com/presentation/d/1_K9HUV7qidSzDucmAjJb0jg1uxq2KGM3/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (mod-3) https://docs.google.com/presentation/d/1a4FyDODGF2Zw6is7nN0SR4nJrPRWGKQx/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (mod-4)
Issue-Assignment 1 and Assignment-2 Statements			
1	Concept of primary and secondary data, Methods of collection and editing of primary data.	https://docs.google.com/presentation/d/1GyXM4LCHBqnrd3IBAk2tUrjZVoz7tkrB/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (ppt) https://driv	https://youtu.be/YnWGBCe88DY?si=uMic5eYkL4nmVHeQ https://youtu.be/0_HpiRFrNAk?si=vf4-0z1VRZ4rN0Rq

		e.google.com/file/d/1jyjF6KebwjU8CwLn_TIvXVzQwcSgLBrW/view?usp=sharing (notes)	
2	Arithmetic mean, median, mode concepts.	https://drive.google.com/file/d/17EVKff73-1IsyZ_p1Mx-thvKs5cnR8Ax/view?usp=sharing (notes)	https://youtube.com/watch?v=B1HEzNTGeZ4&feature=shared
3	Geometric mean and harmonic mean.	https://drive.google.com/file/d/1DkPb48BbVk4aEj1ZdaffruyIHbAwTQaq/view?usp=sharing (notes)	
4	Range, quartile deviation, mean deviation, examples with problems	https://drive.google.com/file/d/1kWaHA-6XAgICF0Uj_0m94tngtqEGXZyM/view?usp=sharing (notes)	https://youtu.be/WnMXXWWlylo?si=ruZYoB_98I2tHLeJ
5	standard deviation and variance with simple applications		https://youtu.be/5wJUUgnMGWA?si=lNA7j6eT0H7uCWVS
6	standard deviation and variance with simple applications		https://youtu.be/x0rmUXWtSS8?si=djO0-w8nAZnFbv70
7	Scalar and vector fields.	https://docs.google.co	

		m/presentation/d/18FNk-n6GsRYORrmSEk6HPidD8hD2w0IA/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true(ppt) https://drive.google.com/file/d/1EfUahMxZALXTgzrzo4_a1we92YsXLz03/view?usp=sharing (notes)	
8	Gradient, directional derivative,	https://drive.google.com/file/d/1DwJRGDGFfjgwN4oDpAw_hmckv0DPkSaj/view?usp=sharing	https://youtu.be/FXTt6Sa79mI?si=VYAPeWMUC20rc_60
9	curl and divergence - physical interpretation.	https://drive.google.com/file/d/1h9UEr5LjZ4vEVlSz3gWC8V9XtXHEp0YM/view?usp=sharing	https://youtu.be/FRaf8EcUZRo?si=_HpnlkGDvOvJAqI3
10	solenoidal and irrotational vector fields. Problems.	https://drive.google.com/file/d/1067ZaVGgjaH-g1xDY59a5IT9g7aWnj9	https://youtu.be/Ec2hl6p1Jy4

		L/view?usp=sharing	
11	Definition and examples, subspace, linear span.		https://youtu.be/9uN7CwDqvZQ
Quiz -01 and Assignment-01: Student Feedback			
12	Definition and examples, Linearly independent and dependent sets.		https://youtu.be/mhvZKg7xTlA https://youtu.be/is1cg5yhdds
13	Basis and dimension.		https://shorturl.at/ev2mv
14	Definition and examples, Algebra of transformations, Matrix of a linear transformation.		https://youtu.be/CeqNHmkLn2w
15	fitting the curves of the form $y = ax + b$	https://docs.google.com/presentation/d/1kjG9FPVYHncv4v6yAWYS1qfg6Ir3RjwR/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (PPT)	https://shorturl.at/QA12n
16	fitting the curves of the form $y = ax^2 + bx + c$		https://youtu.be/cieQc7SWszM
17	fitting the curves of the form $y = ax^b$, and problems.		https://youtu.be/kAa5ReiZH6o
Quiz -01 and Test-1			
18	Karl Pearson's coefficient of correlation	https://drive.google.com/file/d/1zQdYk_p-7zC95EvPowDywApfHHkuqnj4/view?usp=sharing(Notes)	https://youtu.be/2CEGh1emkzM
19	Rank correlation (without repetition) –problems.		https://youtu.be/mmRknKAWMus
20	lines of regression –problems		https://youtu.be/QAEZOhE13Wg
Submission of Assignment-1 and Obtain Student Feedback-1			
21	angle between the lines of regression.		https://youtu.be/i67fmLKlbWo
Quiz -02 and Assignment-02: Student Feedback: Student Feedback			

22	angle between the lines of regression.	https://drive.google.com/file/d/14mcnPopHExIQE4uVzNW1WGpBdMJoUBn2/view?usp=sharing (Notes)	https://rb.gy/uamuhx
23	Random variables (discrete), probability mass and density functions, Mathematical expectation, mean and variance		https://youtu.be/3v9w79NhsfI?si=I5hV-jlW-N5orWh7RANDOM https://youtu.be/gUdeh-Z4dYA?si=OzlBVW5dSZQ65iUe
24	Random variables (continuous), probability mass and density functions, Mathematical expectation, mean and variance		https://youtu.be/UdJQVI9Sbok?si=Y9Yjt3_qTSqy6eCe
25	Binomial distribution		https://youtu.be/ZoUYKzgavnA?si=tpnZBQpEsfmkXoQf
26	Binomial distribution		
27	Poisson distribution		https://youtu.be/nvFXWa4tMI0?si=vw6bHSuQEqVZga3i
28	Poisson distribution		
29	normal distribution		https://youtu.be/tcmYVoNWy1A?si=mmEnw8OQaYugijhc
30	normal distribution		
31	Joint Probability distribution for two discrete random variables.		
Quiz -2 and Test-2			
32	expectation and covariance, Correlation.	https://docs.google.com/presentation/d/1_vo-BLg8j-s6GEk3X8ijDIJOhIpFuYRi/edit?usp=sharing&ouid=110661411284515728083&rtpof=true&sd=true (ppt)	https://youtu.be/slyRsDIX7tA
33	expectation and covariance, Correlation.		
34	Introduction to sampling distributions, standard error		https://shorturl.at/36uK1
35	Introduction to sampling distributions, standard error		
36	Type-I errors.		https://youtu.be/9yQm9F2_yIk
37	Type-I errors.		
38	Type-II errors.		
39	Type-II errors.		
40	Test of Hypothesis for means, student's t-distribution.		https://youtu.be/0zZYBALbZgg
41	Test of Hypothesis for means, student's t-distribution		https://youtu.be/N984XGLjQfs

Submission of Assignment-2 and Obtain Stuent Feedback-2			
42	Test of Hypothesis for means,		https://youtu.be/2QeDRsxSF9M
43	Test of Hypothesis for means,		
44	Problems on Chi-square distribution		
45	Problems on Chi-square distribution		
Quiz-03 and Assignment-03			
Examination Preparation Break			
Term/Semester End Examination			

1.2 Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
	Q1(5)	**Q2(5)**	**Q3(5)**	**T1(8)**	**T2(8)**	**T3(9)**	**A1(10)**	**A2(10)**			
CO1-15	3	3	4						**10**	**05**	**15**
CO2-20	2	2	1	2	2	1			**10**	**10**	**20**
CO3-20				3	3	4			**10**	**10**	**20**
CO4-15				1	2	2	3	2	**10**	**05**	**15**
CO5-15				2	1	2	2	3	**10**	**05**	**15**
CO6-15							5	5	**10**	**05**	**15**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

1.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment /PBL/PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	05	CO1 CO2	CO1=3 CO2=2			
Quiz-2	8th week	05	CO1 CO2	CO1=3 CO2=2			
Quiz-3	12th week	05	CO1 CO2	CO1=4 CO2=1			
Test-1	5th week	08	CO2 CO3 CO4		CO2=2 CO3=3 CO4=1 CO5=2		

Test-2	8th week	08	CO2 CO3 CO4		CO2=2 CO3=3 CO4=2 CO5=1		
Test-3	12th week	09	CO2 CO3 CO4		CO2=1 CO3=4 CO4=2 CO5=2		
Assignment-1	6th week	10	CO5 CO6			CO4=3 CO5=2 CO6=5	
Assignment-2	11th week	10	CO5 CO6			CO4=2 CO5=3 CO6=5	
SEE	18th week	40	CO1 CO2 CO3 CO4 CO5 CO6				CO1=5 CO2=10 CO3=10 CO4=5 CO5=5 CO6=5
Total Marks		100					

1.4 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

COs	Targets Sets	Target Achieved
CO1		
CO2		
CO3		

Course Attainment:

4. Other Details

4.1 Assignment Details or Problem Based Learning

Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24CS1202
Course Title	**Applied Physics for CSE**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department	Physics
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Department of Engineering Physics
Faculty Member	Dr. Swaroop K, Dr. Rakesh V, Dr. Anand B C, Dr. Vijaykumar J, Shubha S, Priyanka B R, Sahil R, Channabasavanagouda B, Kotresh K.
Semester Duration	Weeks (1-16)-Teaching, Learning and Continuous Assessment Weeks (17-18)-SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**1**	**2**	**2**	**5**

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- This course aims to provide a comprehensive understanding of various advanced topics in physics and their applications in modern technology and computing.
- It explores the fundamental concepts of laser physics, optical fibers, quantum mechanics, and quantum computation, offering students a broad perspective on the principles underlying these fields and their practical applications.
- The course covers the physics of animation, semiconductors, and superconductors, emphasizing their roles in contemporary computing technologies.
- The practical component includes laboratory experiments and simulations to reinforce theoretical knowledge through hands-on experience, preparing students for scientific research, engineering, or advanced technology careers.

2.2 Course Objectives

Upon completing this course, students will be able to:

1. Define the fundamental principles of quantum mechanics, quantum computing, physics of animation, LASERS, optical fibers, semiconductors, and superconductors.
2. Explain the key concepts and differences between quantum and classical computing, along with their computational advantages.
3. Illustrate the physics behind animation, including motion, forces, and optics, for realistic simulation in graphics.
4. Explore the working principles and applications of LASERS and optical fibers in modern communication and medical technologies.
5. Understand the electrical and optical properties of semiconductors and superconductors and their significance in electronic devices.
6. Develop problem-solving skills by applying quantum mechanics, matrix representation of quantum gates, and semiconductor physics to numerical problems.
7. Analyze real-world applications of quantum computing, LASERS, optical fibers, semiconductors, and superconductors in various industries.
8. Evaluate the impact of quantum mechanics and quantum computing in next-generation computing technologies.
9. Design and conduct experiments to investigate physical properties related to quantum mechanics, optics, and material science.
10. Develop simulations and models demonstrating fundamental physics concepts and their applications in technology and computing.

2.3 Course Outcomes

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

CO1	**Define** the fundamental principles and concepts of quantum mechanics, quantum computing, physics of animation, LASERS, optical fibers, semiconductors, and superconductors
CO2	**Explain** the concepts of quantum mechanics, quantum and classical computing, animation physics, LASERS, optical fibers, semiconductors, and superconductors
CO3	**Apply** the principles of quantum mechanics, matrix representation and operations of quantum gates, physics of animation, lasers, optical fibers, semiconductors, and superconductors to solve the numerical.
CO4	**Analyze** the applications of quantum mechanical concepts, various quantum gates, physics in animation, lasers, optical fibers, semiconductors, and superconductors
CO5	**Evaluate** the implications of quantum physics, quantum computing approaches, animated physics, different laser systems and optical fiber classifications, semiconductor and superconductor properties in computing applications
CO6	**Design** and conduct the experiments to determine properties learnt in theory and **Develop** simulations to demonstrate key principles of physics.

Outcome Map:

COs	**PO 01**	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	3										2			
CO2	1	3	3		3		3					2			
CO3	1	2	3		3		3					2		3	
CO4	1	1	2	3	3		3		2	2	3	2	3		
CO5	1	1	2	3	3		3	3	2	2	3	2	3	3	
CO6	1	1	1	2	2	3	3	3	2	2	3	2	3	3	3

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Communication and Networking: Laser and Optical Fibers**

  LASER: Characteristic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients and Expression for Energy Density, Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Semiconductor Diode Laser, Application: Laser Printer, Bar Code Scanner.

  Numerical Problems.

  Optical Fiber: Principle and Structure, Propagation of Light, Acceptance angle and Numerical Aperture (NA), Expression for NA, Classification of Optical Fibers, Attenuation and Fiber Losses, Application: Fiber Optic Communication.

  Numerical Problems.

- **Quantum Mechanics:** de Broglie Hypothesis and Matter Waves, de Broglie wavelength and expression by analogy, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle, Wave Function, Time independent Schrödinger wave equation, Physical Significance of a wave function and Born Interpretation, Expectation value, Eigenfunctions and Eigenvalues (Qualitative). Numerical problems.

- **Quantum Computation:** Introduction to Quantum Computing, Moore's law & its end, Differences between Classical & Quantum computing. Concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and Two qubits. Extension to N qubits.

  Matrix Magic: Dirac's Approach to Quantum Computing: Matrix representation of 0 and 1 States, Identity Operator I, Applying I to$|0\rangle$and $|1\rangle$ states, Pauli Matrices and its operations on $|0\rangle$and $|1\rangle$ states, Explanation of i) Conjugate of a matrix and ii) Transpose of a matrix. Unitary matrix U, Examples: Row and Column Matrices and their multiplication (Inner Product), Probability, Quantum Superposition, normalization rule. Orthogonality, Orthonormality.

  Numerical Problems.

  Quantum Gates: Single Qubit Gates**:** Quantum Not Gate, Pauli – X, Y and Z Gates, Hadamard Gate, Phase Gate (or S Gate), T Gate

  Multiple Qubit Gates**:** CNOT Gate, (Discussion for 4 different input states). Representation of Swap gate, Controlled -Z gate.

- **Physics of Animation**: Taxonomy of physics-based animation methods, Frames, Frames per Second, Size and Scale, Weight and Strength, Motion and Timing in Animations, Constant Force and Acceleration, The Odd rule, Odd-rule Scenarios, Motion Graphs, Examples of Character Animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing.

  Numerical Problems**.**

- **Semiconductors and Superconductors for Computing Applications:**

  Semiconductors: Fermi level in Intrinsic and extrinsic Semiconductor, Expression for the concentration of electrons in conduction band & holes concentration in valance band, Relation between Fermi energy and energy gap in intrinsic semiconductors (Derivation), Hall effect, Expression for Hall coefficient and its application.

  Numerical Problems.

  Superconductors: Introduction to Super Conductors, Temperature dependence of resistivity, Meissner's Effect, Critical Field, Temperature dependence of Critical field, Types of Super Conductors, BCS theory (Qualitative), Quantum Tunnelling, Josephson Junctions (Qualitative), DC and RF SQUIDs (Qualitative).

  Numerical Problems.

- **Practical Component**

Sl. No.	Experiments
1	Physics Lab 1: Optical Fiber
2	Physics Lab 2: Laser Diffraction
3	Physics Lab 3: Fermi Energy
4	Physics Lab 4: Photodiode Characteristics
5	Physics Lab 5: Simulation Experiment 1 Energy Gap of Semiconductor using Silicon Diode
6	Physics Lab 6: Simulation Experiment 2 Numerical Aperture of Optical Fiber
7	Physics Lab 7: Simulation Experiment 3 Determination of Planck's Constant
8	Physics Lab: Simulation Experiment 4 Hall effect experiment:- Determination of charge carrier density

2.5 Textbook and References

Text Book:

- Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
- A Textbook of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand. & Company Ltd, New Delhi, 2021.

References:

- Arthur Beiser, Concepts of Modern Physics, McGraw Hill, 7th edition 2017.
- V. Rajendran, Engineering Physics, Tata McGraw Hill Company Ltd., New Delhi -2012
- Solid State Physics, S O Pillai, New Age International Private Limited, 8th Edition, 2018.
- Lasers and Non-Linear Optics, B B Loud, New Age International, 2011 edition.
- Introduction to Superconductivity, Michael Tinkham, McGraw Hill, INC, II Edition, 1996
- Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge Universities Press, 2010 Edition.

Other Resources

- https://www.digimat.in/nptel/courses/video/115102023/L01.html
- https://www.digimat.in/nptel/courses/video/115101092/L01.html
- https://www.digimat.in/nptel/courses/video/115106121/L01.html
- https://www.digimat.in/nptel/courses/video/115102124/L01.html
- https://www.digimat.in/nptel/courses/video/115107095/L01.html
- https://www.digimat.in/nptel/courses/video/115102103/L01.html
- https://www.digimat.in/nptel/courses/video/115105099/L75.html
- https://www.digimat.in/nptel/courses/video/115103108/L01.html

3. Teaching and Assessment

3.1 Teaching Plan

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Introduction to Course Content & AWD	**Course Document**	
1	**LASER:** Basic properties of a LASER beam, Interaction of Radiation with Matter: Induced Absorption, Spontaneous Emission and Stimulated Emission.	**LASER** Slide No. 2-10	https://youtu.be/_JOchLyNO_w?si=qKrP_kLIE81HQlIZ
2	Einstein's A and B Coefficients: Rates of Absorption and emissions, Thermal Equilibrium, Boltzmann Relation, Derivation of Expression for Energy Density. Laser Action Explanation, Population Inversion explanation, Metastable State: Description using 3 level system,	**LASER** Slide No. 11-15	https://youtu.be/WgzynezPiyc?si=k_zH0w0tvrQuHqHb
3	Requisites of a laser system: Energy Source, Active Medium, Laser Cavity, Semiconductor Diode Laser: Principle, Construction, Working, Wavelength,	**LASER** Slide No. 16 -26	https://youtu.be/ejR5F_XetMg?si=yGlIjEmkIgZgpf4G
4	Application of LASER: Laser Printer, LASER barcode scanner. Numerical Problems: Ratio of Population, Number of photons/secs in a LASER beam of certain power output.	**LASER** Slide No. 27 -36	https://youtu.be/6A5dc7etdNo?si=wZDLhmF3aYE73PQP
5	**OPTICAL FIBER:** Principle: Total Internal Reflection, Structure: Core, Clad, Sheath and corresponding Refractive Index, Propagation of Light Through the Optical fibre (Ray Diagram), Acceptance angle and Numerical Aperture (NA) Explanation.	**OPTICAL FIBER** Slide No. 37 -43	https://youtu.be/zAVsTubdd_Q?si=GZRYkTEFxCAL1ZeR
6	Derivation of Expression for NA, Modes of Propagation Classification of Optical Fibers: Single Mode Step Index and Multi-Mode Step and Graded Index Fibers, Attenuation, Attenuation Coefficient,	**OPTICAL FIBER** Slide No. 38 -50	https://youtu.be/aylVgs2iDDw?si=bXUCgNHn2O5pht3x
7	Types of Fiber Losses: Absorption, Scattering and Geometrical Losses, Application: Fiber Communication. Numerical Problems: Numerical Aperture, Acceptance angle and Attenuation Co-efficient.	**OPTICAL FIBER** Slide No. 51 -64	https://youtu.be/C8tNsfnCC6M?si=kAeBkU7Os0a_PXcz
8	**Quantum Mechanics:** Statement of de-Broglie Hypothesis, Derivation of expression for de Broglie wavelength (λ) by analogy and different forms of expression for (λ).	**Quantum Mechanics** Slide No. 2 -12	https://youtu.be/jXZJpgIwE5s?si=rojfhjzRUzwoXHPu

9	Wave Packets, Wave Velocity and Group Velocity (Definitions and Mention of Expression) Heisenberg's Uncertainty Principle.	**Quantum Mechanics** Slide No. 13 -16	https://youtu.be/EIqKG5TiSYs?si=kCO-48By7KoqhluE
10	Wave Function, Explanation, General Mathematical Form (Exponential), Schrödinger Time Independent wave definition, Setting up of Time independent Schrodinger wave equation in 1D (derivation) and extension to 3D (mention).	**Quantum Mechanics** Slide No. 17 -18	https://youtu.be/AR23uxZruhE?si=z8Ubd3pBJHn1mWZ4
11	Physical Significance of a wave function (Probability Density) and Born Interpretation, Expectation value, Eigen functions and Eigen Values (Qualitative).	**Quantum Mechanics** Slide No. 19 -23	https://youtu.be/TQKELOE9eY4?si=dHUrtHhoqp8aebWt
12	Numerical Problems on de Broglie Hypothesis, Heisenberg's Uncertainty Principle.	**Quantum Mechanics** Slide No. 24 -29	https://youtu.be/TQKELOE9eY4?si=dHUrtHhoqp8aebWt
Quiz-1 and Test-1 Obtain Student Feedback			
13	**Quantum Computing:** Introduction to Quantum Computing, Moore's law & its end. Differences between classical & quantum computing.	**Quantum Computing** Slide No. 2 -12	https://youtu.be/aWLBmapcJRU?si=Wxido5rx7RoFqr8J
Issue-Assignment-1 Statements			
14	Concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and two qubits. Extension to N qubits.	**Quantum Computing** Slide No. 13 -19	https://youtu.be/90za6mazNps?si=ccwoq_oPXN9IRQQp
15	**Dirac representation and matrix operations:** Matrix representation of 0 and 1 States, Identity Operator I, Applying I to |0> and |1> states to show there is no change, Pauli Matrices and its operations on 0 and 1 states,	**Dirac Representation** Slide No. 20 -23	https://youtu.be/o5QQNWgx5fY?si=u6vzrs8QMi_kH_TW
16	Explanation of i) Conjugate of a matrix and ii) Transpose of a matrix. Unitary Matrix U. Examples: Row and Column Matrices and their multiplication (Inner Product).	**Matrix Operations** Slide No. 24 -36	https://youtu.be/DUuTx2nbizM?si=dXGFm59fgnEkgxBt
17	Probability, and Quantum Superposition, normalization rule. Orthogonality, Orthonormality.	**Matrix Operations** Slide No. 37 -40	https://youtu.be/fzNXHN8tI5I?si=jvWAXckQK-W6ZYJ2
18	**Quantum Gates:** Quantum Not Gate, Pauli – X, Y and Z Gates, Hadamard Gate, Phase Gate (or S Gate), T Gate.	**Quantum Gates** Slide No. 41 -49	https://youtu.be/rD_fH7O-D5Y?si=Ckdd

			_gXQpTIH2Rr2
19	CNOT Gate, Representation of Swap gate, Controlled -Z gate.	**Quantum Gates** Slide No. 50 -53	https://youtu.be/iMjpZwISIlA?si=JGU4cv83YpXpJzDQ
20	Numerical Problems.	**Quantum Gates** Slide No. 54 -58	https://youtu.be/emHhNFf5AVM?si=QkoOP75wpJKUQs4P
	Submission of Assignment-1		
21	**Physics of Animation:** Introduction, Taxonomy of physics based animation methods, Frames, Frames per Second.	**Physics of Animation** Slide No. 2 -5	https://youtu.be/D8uMVrplSFA?si=cL9ZwJGTzylVHx1M
22	Size and Scale, weight and strength, motion and timing in Animations: Motion Lines and Paths	**Physics of Animation** Slide No. 6 -9	https://youtu.be/-KCE3mPMVRY?si=5gMndIK0ay2kcsnT
23	Introduction to Motion, Timing Tools, Linear Motion Timing, Uniform Motion Timing, Slow in and Slow out, Constant Force and Acceleration, Forces Exerted by characters,	**Physics of Animation** Slide No. 10 - 17	https://youtu.be/qRR_1Gj6Kzw?si=jUtANizDxGmyHhFK
	Quiz-2 and Test-2		
24	The Odd rule: Odd rule multipliers, Odd rule scenarios (Four Different Scenarios), Motion Graphs,	**Physics of Animation** Slide No. 18 - 29	https://youtu.be/Y5cj9yCr-kc?si=CN88HrSoks-F3o3s
25	Examples of Character Animation: Jumping, Parts of Jump, Calculating Jump Actions, Jump Magnification (JM), Jump Acceleration, Landing, Stop time, Walking: Strides and Steps, Walk Timing.	**Physics of Animation** Slide No. 30 - 38	https://youtu.be/7Jt8K4hPtb4?si=Qr6vlf2RQx5gXoIL
26	Numerical Problems: Odd rule multipliers and Odd rule Scenarios, Jump magnification (JM), Stop time	**Physics of Animation** Slide No. 39 - 45	https://youtu.be/7Jt8K4hPtb4?si=Qr6vlf2RQx5gXoIL
	Issue of Assignment-2 Statements		
27	**SEMICONDUCTORS:** Explanation of Fermi level in Intrinsic & Extrinsic semiconductors and Explanation of Fermi level in n-type & p-type semiconductors, Carrier concentration (only expression), Relation between Fermi energy & Energy gap in intrinsic semiconductors (derivation).	**SEMICONDUCTORS** Slide No. 2 - 18	https://youtu.be/kCN-7wA8HUE?si=gA3ivXFvMtRdMjf0

28	Explanation of Hall Effect, Hall Voltage, Hall field, Derivation of Expression for Hall coefficient and Hall Voltage. Applications.	**SEMICONDUCTORS** Slide No. 19 - 32	https://youtu.be/iPU_pzrg4UE?si=bpcNFMInHTqDuP-X
29	**SUPERCONDUCTORS:** Introduction to Super Conductors, temperature dependence of resistivity mentioning the critical temperature. Meissner's Effect and Explanation. Critical Field, Temperature dependence of Critical field. Numerical problems.	**SUPERCONDUCTORS** Slide No. 3 – 8	https://youtu.be/Gk91YQDMTCw?si=RntlcxKh-NmxpM_7
30	Types of Super Conductors (Soft- Type1 and Hard-Type2), BCS theory (Qualitative), Quantum Tunnelling, Josephson Junctions (Qualitative), DC and RF SQUIDs (Qualitative), Numerical problems.	**SUPERCONDUCTORS** Slide No. 9 - 31	https://youtu.be/aQx5Xd6S1ys?si=lCmcHNSro2mAna_F
Quiz-3 and Test-3 Submission of Assignment-2 Obtain Student Feedback			
31	Physics Lab 1: Optical Fiber	**Optical Fiber**	https://www.youtube.com/watch?v=hpP3qLOUENg
32	Physics Lab 1: Optical Fiber	**Optical Fiber**	
33	Physics Lab 2: Laser Diffraction	**Laser Diffraction**	https://youtu.be/9SFqTlWJQO4
34	Physics Lab 2: Laser Diffraction	**Laser Diffraction**	
35	Physics Lab 3: Fermi Energy	**Fermi Energy**	https://www.youtube.com/watch?v=ZJi9JBqsVZI
36	Physics Lab 3: Fermi Energy	**Fermi Energy**	
37	Physics Lab 4: Photodiode Characteristics	**Photodiode Characteristics**	https://www.youtube.com/watch?v=0mSWVwJkBWI
38	Physics Lab 4: Photodiode Characteristics	**Photodiode Characteristics**	
Lab IA-1			
39	Physics Lab 5: Simulation Experiment 1 Energy Gap of Semiconductor using Silicon Diode	**Energy Gap**	https://www.youtube.com/watch?v=mymk_L3dVho
40	Physics Lab 5: Simulation Experiment 1 Energy Gap of Semiconductor using Silicon Diode	**Energy Gap**	
41	Physics Lab 6: Simulation Experiment 1 Numerical Aperture of Optical Fiber	**Numerical Aperture**	https://www.youtube.com/watch?v=b7dLcINlvwE
42	Physics Lab 6: Simulation Experiment 1 Numerical Aperture of Optical Fiber	**Numerical Aperture**	

43	Physics Lab 7: Simulation Experiment 2 Determination of Planck's Constant	**Planck's Constant**	https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=355&cnt=1
44	Physics Lab 7: Simulation Experiment 2 Determination of Planck's Constant	**Planck's Constant**	
45	Physics Lab 8: Simulation Experiment 3 Hall effect experiment:- Determination of charge carrier density	**Hall Effect**	https://vlab.amrita.edu/index.php?sub=1&brch=195&sim=547&cnt=2
46	Physics Lab 8: Simulation Experiment 3 Hall effect experiment:- Determination of charge carrier density	**Hall Effect**	
Lab IA-2			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment Weight Distribution:

	Quiz			**Test**			**Assignment**		**CIE**	**SEE**	**Total marks**
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
	Q1	**Q2**	**Q3**	**T1(8)**	**T2(8)**	**T3(9)**	**A1**	**A2**			
CO1(20%)	4	4	4						12	5	17
CO2(16%)	1	1	1	3	3	4			13	6	19
CO3(23%)				5	5	5			15	8	23
CO4(16%)							5		5	11	16
CO5(15%)							5		5	10	15
CO6(10%)								10	10	00	10
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment / PrBL	SEE
Weight				15	25	20	40
Duration				10 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1	**5**			
Quiz-2	9th week	5	CO1	**5**			
Quiz-3	14th week	5	CO1	**5**			
Test-1	5th week	25	CO2/CO3		**8**		
Test-2	9th week	25	CO2/CO3		**8**		
Test-3	14th week	25	CO2/CO3		**9**		
Assignment-1	7th week/ 12th week	10	CO4/CO5			**10**	
Assignment-2 (LAB)	12th week	10	CO6			**10**	
SEE	18th week	**40**	CO1-CO6				**40**
Total		**100**	All				

3.4 Grading Criterion:

Based on total marks scored grade is Awarded. If marks scored is:

- 91 and above O (outstanding); 81-90: A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory).
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

3.5 Attainment Calculations:

Sl. No.	USN	Student Name	Quiz 15%	Test 25%	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
						Total	XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N) Average Grade:

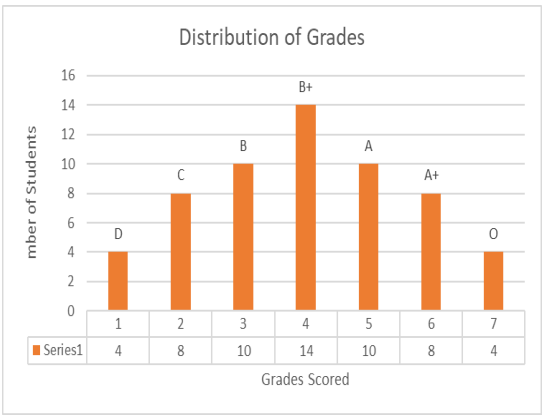
3.6 Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	Target
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1
70% of Students will score C grade and above-1 60% of students will score C grade and above-2 50% of students will score C grade and above-3	1

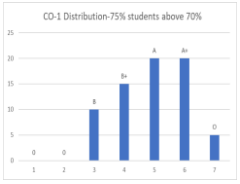
3.7 Performance Recording

Academic Year 2023-24	Program: M.Sc.	Semester 2	**Section** A	**Course Code** UE23CS1202		**Course Title** Applied Physics for CSE				
						Course Tutor/s: **Tutor's ID/Department:**				
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O- Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

3.8 Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

4 Other Details

4.1 Assignment Details or Problem Based Learning

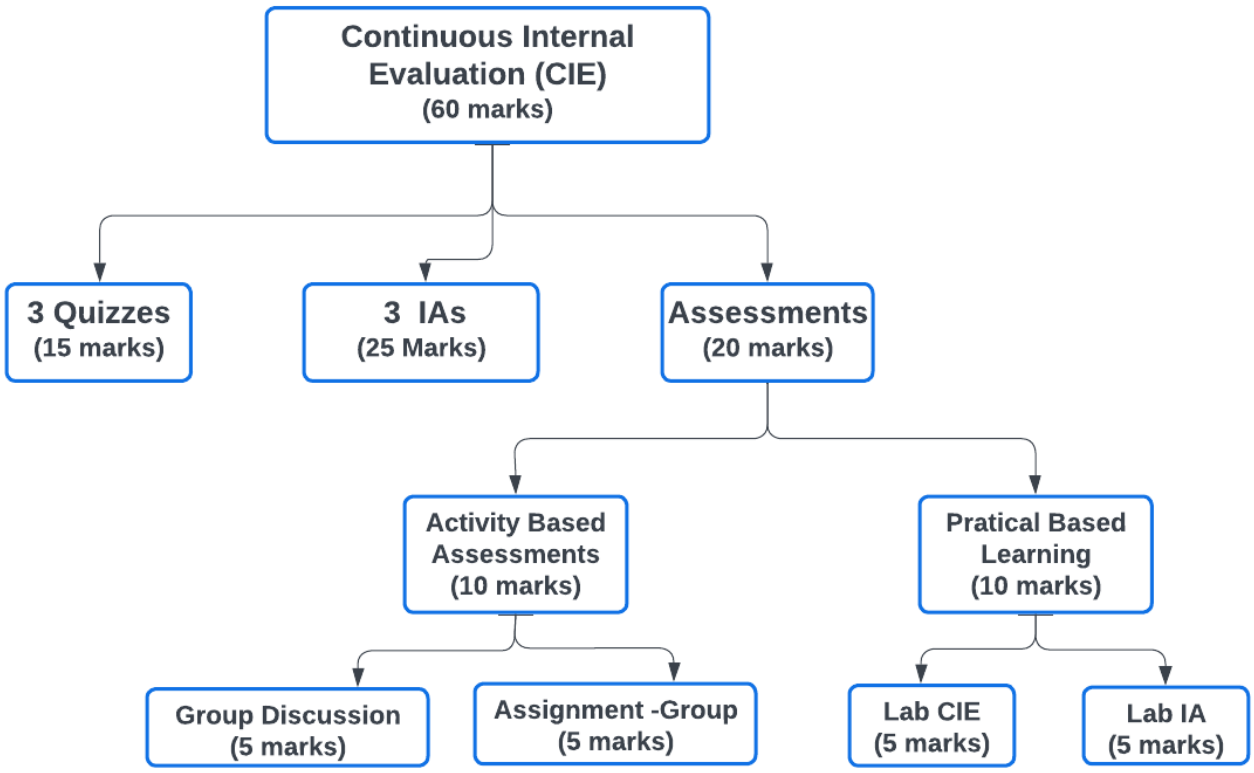
Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 60% and for Semester End Exam (SEE) is 40%. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE and SEE taken together.

Continuous Internal Evaluation (CIE):



- **Three quizzes** each of 5 Marks (10 mins) which comprises the CO1. Finally, the sum of 3 quizzes will be considered and marks will be finalized for **15 marks.**
- **Three IAs** each of 25 Marks (duration 01 hour) which comprises the CO2 and CO3 with the weightage of CO2- 10 marks and CO3- 15 marks in each IAs. Finally, by considering 3 IAs**,** test marks will be finalized for **25 marks.**

The blueprint of marks distribution for each IA is mentioned in below table;

<table>
<tr><th>Q No</th><th>Marks for each question</th><th>COs</th><th>Weightage</th></tr>
<tr><td>1</td><td rowspan="2">5</td><td rowspan="4">CO2</td><td rowspan="4">10</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td rowspan="2">5</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td rowspan="2">5</td><td rowspan="6">CO3</td><td rowspan="6">15</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="2">5</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td><td rowspan="2">5</td></tr>
<tr><td>10</td></tr>
<tr><td colspan="3">Total marks</td><td>25</td></tr>
</table>

Assignment Details and Practical- Based Learning

- **Assessments (total 20 marks);** comprise the CO4 and CO5. It includes two activities (each of 5 marks) and practical-based learning (for 10 marks). One activity, **Group discussion** is planned for 5 marks (Rubrics is attached in Annexure-I) and other one, **Assignment (Group)-report** is planned for 5 marks (Rubrics is attached in Annexure-II). Finally, the sum of 2 activities will be considered and marks will be finalized for **10 Marks.**
- **Practical-based learning** (PrBL) comprises the CO6 with a weightage of 10 marks. 5 marks for lab CIE and another 5 marks for Lab IA.

  i) **Practical CIE** includes evaluation of each experiment performed by a student by considering 5 marks for each experiment (Conduction=3 marks, Record = 2 marks). Evaluation will be done for 8 experiments that are for 40 marks (Annexure-II), then scaled down to **5 marks.**

  ii) **2 Practical IAs** (duration 02 hours) shall be conducted each for 20 marks (Annexure-III) and then scaled down to **5 marks**.

Semester End Examination (SEE):

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the subject (duration 03 hours).

- The question paper shall be set for 80 marks.
- The question paper will have 12 questions. There may be a sub-question in each question. The students must answer 6 full questions, selecting one full question. The student must answer for 80 marks and marks scored out of 80 shall be proportionally reduced to 40 marks.

The blue print of marks distribution for each question is mentioned in below table

Q No	Marks for each question	COs
1	10	CO1
2		
3	12	CO2
4		
5	16	CO3
6		
7	16	CO4
8		
9	16	CO5
10		
11	10	CO4/CO5
12		
Total marks = 80		

Annexure – I

Rubrics for Group Discussion

Criteria	Weightage (Marks)	Effective (5-4)	Minimal (3-2)	Unsatisfactory (1-0)
Level of Engagement	2	☐ Contributes to class activities by offering ideas and asking questions on a regular basis ☐ Often engages others in class discussions by inviting their comments ☐ Challenges the accuracy and relevance of statements made ☐ Identifies and summarizes main points	☐ Occasionally contributes to class activities by offering ideas and asking questions ☐ Sometimes engages others in class discussions ☐ Sometimes has an understanding of main points ☐ Identifies and summarizes some of the main points	☐ Fails to contribute to class activities ☐ Fails to invite comment/opinions from other students ☐ Demonstrates little understanding of main points ☐ Does not identify or summarize main points
Preparedness	2	☐ Usually prepared with assignments and required materials ☐ Expresses basic foundational knowledge pertaining to class discussions	☐ Seldom prepared with assignments and required materials ☐ Expresses limited foundational knowledge pertaining to class discussions	☐ Consistently unprepared for class ☐ Expresses no relevant foundational knowledge
Attitude	1	☐ Usually positive and cooperative with classroom projects and discussions ☐ Often supportive of other students' ideas	☐ Seldom actively participates in classroom projects and discussions ☐ Sometimes supportive of other students' ideas	☐ Rarely if ever participates in classroom projects and discussions ☐ Occasional disruptive behavior

Annexure –II

Rubrics for Assignment

Criteria/ Recommended Scores	Excellent 5	Very Good 4	Good 3	Satisfactory 2
Introduction of the given topic and significance	In-depth knowledge about the topic	Comprehension of the topic	Adequate knowledge of the topic	Inadequate Knowledge of the topic
Body of the content and flow of content	Main idea is focused and supported with detailed information	Main idea is clear and supported with general information	Main idea is fairly clear and supported with limited information	Main idea is not clear and a random collection of information
Relevance to the content	Relevant and comprehensive information to substantiate the topic is given with current updates and case studies	Relevant information supported with strong evidence	Relevant information with sufficient supporting evidence	Relevant information with insufficient supporting evidence
Conclusion	Strong conclusion exhibiting in-depth knowledge of the subject.	Recognizable conclusion	Inadequate conclusion	Absence of conclusion

Annexure –III

Rubrics for Practical CIE

Parameters	Allocated Marks	High	Medium	Low
Experiment conduction	3	Experiments conducted properly and the results obtained are correct	Experiments conducted and results obtained are not correct	Experiments are not conducted properly and the results obtained are not correct
		3	2	1
Record writing	2	Completed record submitted in the lab session	In-completed record submitted in the lab session	Record submitted in the lab session
		2	1	0

Annexure – IV

Rubrics for Practical IA

Sl. No.	Description	Max. Marks 20	IA	
			I	II
1	Write up: Formula, Tabular column and Circuit diagram / Ray Diagram	5	5 (1+2+2)	5 (1+2+2)
2	Conduction, Experimental setup / Circuit Connection	6	6 (3+3)	6 (3+3)
3	Calculations, Results and Accuracy	4	4 (2+2)	4 (2+2)
4	Viva- voce	5	5	5
Total Marks		**20**	**20**	**20**

Note: Average of two IAs is scaled down to 5 marks

Dr. Anand B C	**Dr. Swaroop K**	**Dr. Sanjay Pande M B**	**Dr. Prakash S V**
Course Coordinator	**Head of the Department**	**Director, SCST**	**Dean, FET**
		GM University	**GM University**

Course Document

Course Code	UE24CS1203
Course Title	Data Structures & Applications
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
Department	Department of Computer Science and Engineering
Faculty Code	01
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Dr. Shankarayya Shastri, Mrs.Akshata AMS, Mrs.Ashwini, Mrs. Kavya BM, Mr. Praveen R, Miss.Priyanka S.M, Miss.Shreyanka M.N, Miss.Yashodha MS.
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	1	2	2	5

Total Term/ Semester hours: 45

Note: 1 Lecture hour – 1 Credit; 2 Practical hours – 1 Credit ; 2 Tutorial Hours – 1 Credit

2. Course Details

2.1 Course Aims and Summary

Understand the fundamental concepts of data structures (e.g., arrays, linked lists, stacks, queues, trees, graphs) and their applications in solving computational problems. Enhance problem-solving skills by designing and implementing efficient algorithms using appropriate data structures for different real-world scenarios.

2.2 Course Objectives

Course Learning Objectives: This course will enable students:

- Define data structures and articulate their significance in computer science and software development.
- Explain the fundamental concepts and operations associated with data structures, including storage, retrieval, and manipulation.
- Identify and categorize different types of data structures available, such as arrays, structures, stacks, queues, linked lists, trees, graphs, stacks, and queues.
- Illustrate the representation of singly linked list and doubly linked list data structures including various operations.

- Develop proficiency in utilizing advanced data structures, such as trees and graphs, for solving complex computational challenges.
- Analyse the working methodologies of Depth First Search, Breadth First Search, Binary Search Tree, hashing techniques using various data structures.
- Evaluate the suitability of different data structures for specific application domains and problem contexts.
- Apply theoretical knowledge of various data structures to practical programming tasks, including algorithm design and development.
- Demonstrate the ability to design, develop, and evaluate software solutions that leverage appropriate data structures to meet specified requirements and constraints.

2.3 Course Outcomes

Course Outcomes: At the end of course, students will

Here is the tabular representation of all the Course Outcomes (COs):

CO No.	Course Outcome
CO1	***Define*** the fundamental concepts of pointers, structures, arrays, memory allocation, stacks, linked lists, queues, graphs, and trees, along with their limitations in data organization and management.
CO2	***Explain*** the importance of selecting appropriate data structures, including stacks, queues, linked lists, trees, and graphs, based on the requirements of an algorithm.
CO3	***Apply*** the concepts of dynamic memory allocation, linked lists, stacks, queues, trees, hashing and graphs to implement and evaluate algorithms for various applications.
CO4	***Analyse*** the different concepts in data structures like structures and union, static and dynamic memory allocation, queue and circular queue, singly and doubly linked lists, types of graphs, trees and hashing methods.
CO5	***Evaluate*** the advantages and limitations of various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, in terms of their usability, memory efficiency, and performance in solving computational problems.
CO6	***Create*** efficient and optimized solutions for complex computational problems by designing and implementing algorithms using appropriate data structures such as stacks, linked lists, queues, trees, graphs, and hash tables.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	3	3	3	2	3		2	2	1	2	2	1	2	
CO2	1	1	3	3	1	3		2	1	2	2	1	1	2	2
CO3	1	1	1	2	1	3		2	1	2	2	1	1	2	2
CO4	1	2	3	2	1	3		2	1	2	2	2	1	2	2
CO5	1	2	3	2	1	2	3	2	2	2	1	1	1	2	1
CO6	1	2	1	2	2	2	3	2	1	2	1	1	1	2	1

Relevance: 1 High, 2 Medium, 3 Low

2.1 Course Content

- **Revisit of Arrays, structures, pointers:** Organization of data as contiguous and non-continuous, recursion, Dynamic Memory Allocation functions, Dynamic arrays, Memory Layout of C Programs,
- **Introduction to Data Structures:** importance of selecting and designing data structures as per the need of an Algorithm. Basic data structures Stack and Queue implementation using static and dynamic arrays. Applications of stacks and Queues. Implementation, evaluation and conversion of Expressions.
- **Introduction to Linked lists:** Various operations on singly linked list and doubly linked list. Application and advantages of linked lists.
- **Introduction to Graphs:** Properties, types and applications. Representation of graph using adjacency matrix list and adjacency list. BFS using queue and DFS using stack.
- **Tree:** Tree as a graph, Types of trees, Application of trees, Implementation of Binary Search Trees. BST Traversals
- **Hashing:** Introduction to hashing, Static and dynamic hashing, Hashing techniques, Collision Resolution, and Application of Hash Tables.

2.5 Textbook and References

- **Text Book:**

1. N Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
https://drive.google.com/file/d/1Cq6v2Yj90FgQRzK4PG2EOkwt8wsQBZ0K/view?usp=drive_link

2. Aaron M. Tanenbaum , Data Structures Using C -, 2nd Ed, Universities Press, 2014.

- **References:**

1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning,2014.
2. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,2nd Ed, McGraw Hill, 2013

- **Other Resources**
  - https://nptel.ac.in/courses/106/105/106105171/
  - http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
  - https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
  - https://ds1-iiith.vlabs.ac.in/data-structures-1/List%20of%20experiments.html
  - https://nptel.ac.in/courses/106/102/106102064/
  - https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
  - https://nptel.ac.in/courses/106/102/106102064/
  - https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
  - https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
  - https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
  - https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html

Practice Questions:

- https://drive.google.com/file/d/1I9XC8HKo4Q0KMK0eEPiDPEgyoQzb1Dkr/view?usp=drive_link
- https://drive.google.com/file/d/1sUQNc3SVSFcGckXWdWGWo2GwY78bT8Mb/view?usp=drive_link
- https://drive.google.com/file/d/1Xr5MC3bOnaTmrdgri3rjrafMu0okz9o/view?usp=drive_link

3.Teaching and Assessment

3.1 Teaching

SL NO	Topics	Lecture Slides	Lecture Slides
1	Revisit of Arrays	https://docs.google.com/presentation/d/1gRBPAMjTL9u5d4EJGbfDWf0vPtf0it9p/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/08LWytp6PNI?si=Xjcxu5BS9I2-Uj2k
2	Revisit of Arrays	https://docs.google.com/presentation/d/1mjMhcxm-Zx36T3NtVadYChAzbZMwGnsi/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/08LWytp6PNI?si=xW8RkbTATYAWZeDS https://youtu.be/4Rll-_e9-0M?si=AWS2MVOVYXItHAx8
3	Revisit of structures	https://drive.google.com/file/d/1bUAa0Vc6pzrBTe55FDKtJi4Q2z_uczCu/view?usp=drive_link https://docs.google.com/presentation/d/1zaTWKx8T4UTBRbBq2dLqXoBvtbsYg7it/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/4Rll-_e9-0M?si=AWS2MVOVYXItHAx8
4	Demonstration of structure program	Lecture Slide-4	https://youtu.be/LpHnHRI6gLc?si=NaGimZ7nyqDl6hc9
5	Revisit of pointers.	Lecture Slide-5	https://youtu.be/4Rll-_e9-0M?si=o3_Ljbp73rIY1WYY
6	Organization of data as contiguous and non-continuous structures.	Lecture Slide-6	https://youtu.be/t_a6KDe7Aso?si=uPDDfepFL3O30z7P
7	Recursion	https://drive.google.com/file/d/1x1imXu1AVzabjqtZW-qW0E9XJL0PGqT2/view?usp=drive_link	https://youtu.be/kepBmgvWNDw?si=kSvLxtGyOtZGrxoN
8	Dynamic Memory Allocation functions	Lecture Slide-8	https://www.youtube.com/watch?v=7RNesIP9Ot0&pp=ygUtUmVjdXJzaW9uIER5bmFtaWMgTWVtb3J5IEFsb

			G9jYXRpb24gZnVuY3Rpb25z
9	Dynamic Memory Allocation functions	Lecture Slide-9	https://www.youtube.com/watch?v=7RNesIP9Ot0&pp=ygUtUmVjdXJzaW9uIER5bmFtaWMgTWVtb3J5IEFsbG9jYXRpb24gZnVuY3Rpb25z
10	Dynamic arrays demonstration	Lecture Slide-10	https://youtu.be/jzJlq35dQII?si=Dv5xtgIT7USfZbUu
11	Introduction to Data Structures, importance of selecting and designing data structures as per the need of an Algorithm.	https://docs.google.com/presentation/d/12iDxdY1zVXkXPAoJ7K5VDWPIK9ZZWWxa/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/-D5u5HJbISc?si=cc13liGWghyFQFjn
12	Basic data structure-Stack	https://docs.google.com/presentation/d/1EW1scmwcoFX5osSst2LIWNaeGKRNvVo_/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/I37kGX-nZEI?si=q9ZxsfvDD4nvzXRh
13	Basic data structure-Queue	https://docs.google.com/presentation/d/1LCFGCbc4WNh7FRnf47lt1hNhWaQ_QUz2/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/lno6Ft0tOZI?si=NL3pdmHdaXa3k_Xy
14	Stack and Queue implementation using static and dynamic arrays.	Lecture Slide-14	https://youtu.be/VmsTAVpz0xo?si=W9YI4ckaVz6yLL1a https://youtu.be/YqrFeU90Coo?si=VHWLzWRVFIRv98lR
15	Applications of stacks and Queues.	Lecture Slide-15	https://www.youtube.com/watch?v=bxRVz8zklWM&list=PLcFL7FQZfCUl-Qprn5QKv3YSsejh5NXT-
16	Implementation, evaluation and conversion of Expressions.	https://docs.google.com/presentation/d/1Rn8qnlllnoytYbfSI4qoBxztEoIE9tZq/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/RY4GkLahbCI?si=LttTyJQ7TxkeLdGP
17	Case Study: Undo Mechanism		https://youtu.be/uxdW-qES35s?si=MKLDWIEL0ozppadh
Quiz 1			
18	Introduction to Linked Lists	https://docs.google.com/presentation/d/1cmQSGgEycrOpNpQXhLhi4EsfpKKK1gdZ/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true https://docs.google.com/presentation/d/1jF793Yc9hNgc-cHzC_0cCsmUPPsEBud1/edit?usp=drive_link&ouid=113	https://youtu.be/R9PTBwOzceo?si=gArPoa1rBGNeW5yK

		187426498109970372&rtpof=true&sd=true	
19	Singly Linked Lists Implementation	Lecture Slide-18 DS SLL	https://youtu.be/nxtDe6Gq4t4?si=Yepo66_dbFGBHjYa
20	Singly Linked Lists Implementation	Lecture Slide-19 D:\GMU\DSA GMU 2024-25 Even Sem\DSA PPTs\Linked list data structure	https://www.youtube.com/watch?v=RCHGco2NvMk&pp=ygVFU2luZ2x5IExpbmtlZCBMaXN0cyBJbXBsZW1lbnRhdGlvbiBEb3VibHkgTGlua2VkIExpc3RzIEltcGxlbWVudGF0aW9u
21	Demonstration of SLL	Lecture Slide-20	https://youtu.be/nxtDe6Gq4t4?si=Yepo66_dbFGBHjYa
22	Doubly Linked Lists Implementation	Lecture Slide-21	https://youtu.be/H8-IuKKiQeo?si=ImeKPW2385udlYKZ
23	Doubly Linked Lists Implementation	Lecture Slide-22	https://youtu.be/H8-IuKKiQeo?si=ImeKPW2385udlYKZ
24	Searching and Sorting with Linked Lists	Lecture Slide-23	https://youtu.be/7I5eg7lyMYk?si=6JMsnOAbK8GjWDzA
Assignment 1: Announcement with Orientation			
25	**Introduction to Graphs and Applications**	Lecture Slide-24	https://youtube.com/playlist?list=PLFj4kIJmwGu3m30HfYDDufr3PZBfyngr0&si=faMtUfSV6Jno5cFV
26	Introduction to Graphs	Lecture Slide-25	https://www.youtube.com/watch?v=5hPfm_uqXmw&list=PLm77mruelczpPDzLgp4UefbQRT4-cyJsW
27	Properties of Graphs	Lecture Slide-26	https://www.youtube.com/watch?v=5hPfm_uqXmw&list=PLm77mruelczpPDzLgp4UefbQRT4-cyJsW
28	Types & Graph Representation using adjacency matrix	Lecture Slide-27	https://www.youtube.com/watch?v=5hPfm_uqXmw&list=PLm77mruelczpPDzLgp4UefbQRT4-cyJsW
29	Graph Representation using adjacency linked list.	Lecture Slide-28	https://youtu.be/3AtEzK4sowk?si=SOLwdtPPpwIohM-K
30	BFS using queue and DFS using stack.	Lecture Slide-29	https://www.youtube.com/watch?v=pcKY4hjDrxk&pp=ygUjQkZTIHVzaW5nIHF1ZXVlIGFuZCBERlMgdXNpbmcgc3RhY2s%3D
31	DFS BFS Program Demonstration	Lecture Slide-30	https://youtu.be/oO1857MQlcs?si=Gmveg7gLppK-akhM
32	Tree's introduction	https://docs.google.com/presentation/d/18A6M7v9lJlNYOkHLRPC1nRE4DbAVMQc-/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://youtu.be/9oTV7fDEaCY?si=2aGbT6nlLDQu_Odn
33	Types of trees	Lecture Slide-32	https://youtu.be/vvey2QCs98o?si=yDLT5B8CJj1UKF7S
34	Binary Search Tree Implementation	Lecture Slide-33	https://youtu.be/6vt3PFRC11E?si=-_rbvFhI3qFwkRr-

35	Binary Search tree traversals	Lecture Slide-34	https://youtu.be/-b2lciNd2L4?si=W6yNPXuS8BS6YZEg
Quiz 2, Assignment 1 Wrap up			
36	Hashing, Static and dynamic hashing	https://docs.google.com/presentation/d/1DuvWuC1QEATERCwq3sVsYA7PHZYSp-zt/edit?usp=drive_link&ouid=113187426498109970372&rtpof=true&sd=true	https://www.youtube.com/watch?v=d_4SL3BRPuQ&pp=ygUjSGFzaGluZywgU3RhdGljIGFuZCBkeW5hbWljIGhhc2hpbmc%3D
37	Hashing techniques	Lecture Slide-36	https://www.youtube.com/watch?v=W5q0xgxmRd8&list=PLxM5rzx4f4fwOPORqEZZhaaY5OG0WMZfF
38	Collision Resolving	Lecture Slide-37	https://www.youtube.com/watch?v=j612Fj-mgCY&pp=ygUUSGFzaGluZyB0ZWNobmlxdWVzICA%3D
39	Linear Probing technique in Hashing program	Lecture Slide-38	https://www.youtube.com/watch?v=ZEyPqqRTO00&pp=ygUkTGluZWFyIFByb2JpbmcgdGVjaG5pcXVlIGluIEhhc2hpbmcg
Assignment 2 announcement with Orientation			
40	Advanced Hash Table Applications	Lecture Slide-39	https://youtu.be/zeMa9sg-VJM?si=2i9fyLxB5meyyhCY
41	Advanced Hash Table Applications	Lecture Slide-40	https://youtu.be/zeMa9sg-VJM?si=2i9fyLxB5meyyhCY
42	PBL presentations		Class room discussion & Board Usage
43	Revision	Chalk & Talk	Class room discussion & Board Usage
44	Revision	Chalk & Talk	Class room discussion & Board Usage
45	Revision	Chalk & Talk	Class room discussion & Board Usage
Quiz 3, Assignment 2 Wrap up			

3.2 Assessment Weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	15			25			20		60	40	100
	Q1	Q2	Q3	T1	T2	T3	A1	A2			
CO1-17	5	5	5						15	2	17
CO2-23				3	3	3			9	14	23
CO3-24				3	3	4			10	14	24
CO4-16				2	2	2			6	10	16
CO5-10							10		10	0	10
CO6-10								10	10	0	10
TOTAL	15			25			20		60	40	100

3.3 Schedule of Assessment

Assessment Type	Date	Marks	COs	Quiz	Test	Assignment/PBL /PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1				
Quiz-2	10th week	5	CO1				
Quiz-3	15th week	5	CO1				
Test-1	5th week	3+3+2=8	CO2/CO3/CO4				
Test-2	10th week	3+3+2=8	CO2/CO3/CO4				
Test-3	15th week	3+4+2=9	CO2/CO3/CO4				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1 to CO4				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.

If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs		
Outcomes- Targeted	Outcomes Level of Attainment	Observations and Remarks
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		
70% of Students will score C grade and above-1 60% of students will score C grade and Above-2 50% of students will score C grade and above-3		

Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science and Engineering	Semester I	**Section** A	**Course Code** XXYYZZH11	**Course Title** Programming with C **Course Tutor/s:** **Tutor's ID/Department:**					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students-Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting

4. Other Details

4.1 Assignment Details or Problem Based Learning

Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**.

Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24CS1204
Course Title	**Python Programming**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Dr.Shivanagowda G M, Dr. Asha K, Maruthi S T, Gaurav P R, Snehal S Velankar, Deepa, Kavya K N ,Usha, Jayalakshmi
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**2**	**0**	**2**	**4**

Total Term/ Semester hours: 45

2. Course Details

2.1. Course Aims and Summary

- The Course enhances the knowledge of programmers involved in understanding Python programming language by illustrations.
- The Course provides an insight to understand dynamic semantics object-oriented concepts in python language.
- The Course illustrates modules and packages which enhances the knowledge of program modularity.
- The course enables fundamental core knowledge in writing Python scripts by providing design components.

2.2. Course Objectives

The objectives of the Course are:

- Work with Python variables, data types, and basic operations.
- Use Python to perform calculations and follow operator precedence rules.
- To Manipulate strings using slicing, formatting, and concatenation.
- To Write programs with conditional statements and loops for decision-making and repetition.
- To use lists, tuples, dictionaries, and sets to store and manage data.
- To understand the difference between arrays and lists and use arrays for efficient data handling.
- To perform calculations and data analysis with NumPy.
- To organize and process tabular data with Pandas.
- To create and customize charts and graphs with Matplotlib.
- To combine multiple visual elements in a single figure and export graphs.
- To build a strong foundation in Python programming for data analysis and visualization.

2.3. Course Outcomes

After undergoing this course students will be able to:

CO1	***Define*** fundamental Python programming concepts, including variables, data types, control structures, basic data structures (lists, tuples, dictionaries, sets) and foundational libraries like NumPy and Pandas, to address simple programming problems.
CO2	***Explain*** the functionality of key Python constructs such as control structures, data types, data structures, and their application in solving basic computational problems.
CO3	***Apply*** Python programming techniques to solve real-world problems by utilizing control structures, data structures, and data manipulation tools, ensuring proficiency in debugging and optimizing code.
CO4	***Analyze*** Python programming concepts such as variables, data types, control structures, data structures, and libraries like NumPy and Pandas to create solutions for data processing and visualization problems.
CO5	***Evaluate*** the implementation of Python programming concepts, including variables, data types, control structures, data structures, and libraries like NumPy and Pandas, to design efficient solutions for data processing and visualization tasks.
CO6	***Develop*** python programs by synthesizing concepts from variables, control structures, data structures, and libraries like NumPy and Pandas to solve complex computational and data visualization problems effectively.

Outcome Map:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2	3		3					3		3	1	2	3
CO2	1	1	2	3	3					3		3	1	2	3
CO3	1	1	2	2	2					3		1	2	1	3
CO4	1	1	2	1	1				3	3		1	1	1	1
CO5	1	1	1	2	1	3		2	2	2	3	1	1	1	1
CO6	1	1	1	1	1	3		2	2	2	3	1	1	1	1

Relevance: 1 high, 2 medium, 3 low

2.4. Course Content

Python Basics

Variables, data types (integers, floats, strings), numeric operations, operator precedence, string manipulation (indexing, slicing, concatenation), string formatting (.format(), f-strings).

Control Structures

Blocks, conditional statements (if-elif-else), Boolean expressions, truthy and falsy values, logical operators. Looping constructs (for, while), range-based iteration, loop control statements (break, continue).

Data Structures

Lists and tuples: mutability, indexing, slicing, common operations (appending, inserting, removing), list comprehension, tuple unpacking. Dictionaries and sets: key-value pairs, dictionary operations, set operations (union, intersection, difference).

Arrays and Data Processing

Arrays vs. lists, element-wise operations, slicing, filtering, searching, performance considerations. Introduction to NumPy: array creation, vectorized computations, basic aggregations. Pandas for tabular data: Series, Data Frames, indexing, filtering, reading/writing files.

Data Visualization

Introduction to Matplotlib: line plots, bar charts, histograms, scatter plots. Customizing plots (labels, legends, colors), multiple plots in a single figure, exporting visualizations.

2.5. Course Resources Text Book:

- Wesley J. Chun, Core Python Programming, Second Edition, Pearson, 2007.
- Allen Downey, Think Python, Green Tea Press,2nd Edition, 2015.
- Python for Everybody: Exploring Data in Python 3 Book by Charles Severance

References:

- Kenneth A. Lambert, Introduction to Python, Cengage,2011.
- Vamsi Kurama, Python Programming: A Modern Approach, Pearson,2018.

Other Resources

- https://www.w3schools.com/python/python_intro.asp
- https://www.geeksforgeeks.org/python-basics/
- https://www.udemy.com/course/python-the-complete-python-developer-course/?couponCode=IND21PM

3.Teaching and Assessment

3.1Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Discussion about Course objectives and Outcomes and Mapping of Program Outcomes and Course outcomes	Lecture-00	Video-00
Issue-Assignment 1 and Assignment-2 Statements			
1.	Overview of Python, differences from C (syntax, dynamic typing), setting up the environment.	Lecture-01	Video-01
2.	Dynamic typing vs. static typing,	Lecture-02	Video-02
3.	Python's data types (int, float, str), and type conversion.	Lecture-03	Video-03
4.	Arithmetic operators, precedence (similarities with C),	Lecture-04	Video-04
5.	Python-specific operations (e.g., **).	Lecture-05	Video-05
6.	Differences between strings in Python and C, string indexing	Lecture-06	Video-06
7.	string slicing, and common methods. String concatenation,	Lecture-07	Video-07
8.	if-else in python	Lecture-08	Video-08
9.	if-elif-else in python	Lecture-09	Video-09
10.	Boolean expressions and logical operators.	Lecture-10	Video-10
11.	Python's truthy/falsy rules, comparison with C (0 vs. non-zero)	Lecture-11	Video-11
12.	for loops over sequences	Lecture-12	Video-12
13.	While loops	Lecture-13	Video-13
14.	Loop control statements (break, continue).	Lecture-14	Video-14
15.	Using range() for loops, comparison with manual indexing	Lecture-15	Video-15
Quiz -01 and Test-1-Obtain Student Feedback			
16.	Lists: Basics and Operations List comprehension	Lecture-16	Video-16
17.	Dynamic size vs. fixed arrays	Lecture-17	Video-17
18.	list indexing, slicing,	Lecture-18	Video-18
19.	List operations like append/remove.	Lecture-19	Video-19
20.	List comprehensions.	Lecture-20	Video-20
21.	nested lists, and practical examples	Lecture-21	Video-21
22.	Tuples: Introduction to immutable sequences	Lecture-22	Video-22
23.	Tuple unpacking, and comparisons with lists.	Lecture-23	Video-23
24.	Dictionaries: Key-value pairs, hashing concepts	Lecture-24	Video-24

25.	Accessing, updating, and looping through dictionaries.	Lecture-25	Video-25
26.	Sets: Sets in Python	Lecture-26	Video-26
27.	Set operations: union, intersection, and difference.	Lecture-27	Video-27
28.	Python lists vs. arrays in C,.	Lecture-28	Video-28
29.	Element-wise operations, slicing, filtering	Lecture-29	Video-29
30.	searching, performance considerations.	Lecture-30	Video-30
Quiz-02 and Test-02 Submission of Assignment-1			
31.	Introduction to NumPy for efficient array operations, Creating arrays, indexing, slicing, and differences from Python lists.	Lecture-31	Video-31
32.	NumPy: Vectorized Computations Element-wise operations.	Lecture-32	Video-32
33.	NumPy: broadcasting, and aggregations (sum, mean, etc.).	Lecture-33	Video-33
34.	Pandas: Series, Introduction to tabular data, creating Series, and basic indexing and operations.	Lecture-34	Video-34
35.	Pandas: DataFrames Creating DataFrames, indexing rows/columns, and common operations like filtering.	Lecture-35	Video-35
36.	Data Processing with Pandas Reading and writing files (csv, excel).	Lecture-36	Video-36
37.	Data Processing with pandas filtering, and grouping operations.	Lecture-37	Video-37
38.	Data Visualization: Basics Introduction to Matplotlib,	Lecture-38	https://youtu.be/wIEt2CLfgEE?si=Q1558SWxMh3eJ3Kp
39.	line plots, bar charts, and histograms.	Lecture-39	https://youtu.be/iY7Sa_7ZVI4?si=ye5bvAwypyHYni4O https://youtu.be/-Z5CuBD3_YE?si=p98BOoy6E6xkYLLl
40.	Customizing Visualizations Adding labels, titles, legends, colors	Lecture-40	https://youtu.be/uSpBbX08SYY?si=7aKw5ilOcTeZ0Cy1
41.	Customizing plot styles.	Lecture-41	https://youtu.be/s6G

			BxE8GbNc?si=CPIXSMbNAPmgcIdJ
42.	Advanced Visualization Scatter plots, subplots.	Lecture-42	https://youtu.be/PcDKxsMCpx8?si=gk7fQg6HWkw7OTL2 https://youtu.be/z0wsrMKJbrQ?si=8WNS1ZGVWZR2uGJA
43.	Multiple plots in a single figure.	Lecture-43	https://youtu.be/z0wsrMKJbrQ?si=fYFS0W2l5LkdY3xz
44.	Exporting Visualizations Saving plots in different formats	Lecture-44	Video-44
45.	Creating publication-ready graphs.	Lecture-45	Video-45
Quiz-03 and Test-03 **Submission of Assignment-2 Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

2.6. Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
	Q1=5	**Q2=5**	**Q3=5**	**T1=8**	**T2=8**	**T3=9**	**A1=10**	**A2=10**			
CO1=19	5	3	5						**13**	**6**	**19**
CO2=21		2		3	3	3			**11**	**10**	**21**

CO3=21				3	3	3			**9**	**12**	**21**
CO4=19				2	2	3			**7**	**12**	**19**
CO5=10							10		**10**	**0**	**10**
CO6=10								10	**10**	**0**	**10**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

3.3 Schedule of Assessment

Assessment Type	**Dates**	**Marks**	**COs**	**Quiz**	**Test**	**Assignment/ PBL/ PrBL**	**SEE**
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1				
Quiz-2	10th week	5	CO1				
Quiz-3	15th week	5	CO1				
Test-1	5th week	8	CO2/CO3/CO 4				
Test-2	10th week	8	CO2/CO3/ CO4				
Test-3	15th week	9	CO2/CO3/ CO4				
Assignment-1	7th week	10	CO 5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1/CO2/CO 3/CO4				

3. Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
  - If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience.

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

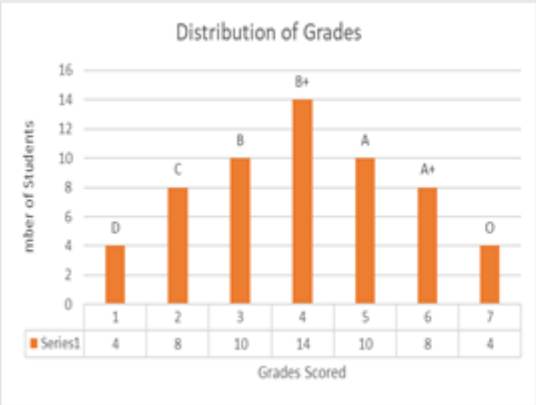
Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

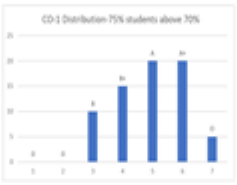
Performance Recording

Academic Year 2023-24	**Program:** B.Tech.,in Computer Science and Engineering	**Semester** 2	**Section** A	**Course Code** UE24CS1204	**Course Title** Python Programming					
					Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks		A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

4.1. Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2. Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24CS1205
Course Title	**Fundamentals of Computer Networks**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Dr. Arunakumar B T, Ranjitha D S,Nayana M R, Ravinandan R Jannu, Vinay H S, Ananya Patel G P, Veena C S, Sidramappa B
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**3**	**0**	**0**	**3**

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- The course provides an insight on transforming data to information by interactions between networked systems by considering the underlying principles of data transmission and communication protocols.
- The course introduces terminology and technologies associated with computer networks by imparting the fundamental laws on data transfer and their consequences. Further, the qualitative and quantitative aspects of data transmission such as bandwidth, latency, and reliability is discussed.

- The course covers concepts of Data, Protocols, and Efficiency by taking ideal network environments involving specific network protocols, network configurations, and relationships between different network elements.

2.2 Course Objectives: This course (UE24CS1205) will enable students to Study:

1. Define network hardware and software components.
2. Explain the concept of reference models in networking.
3. Differentiate between guided and wireless transmission media in the physical layer.
4. Describe the sliding window protocols.
5. Identify and analyze the channel allocation problem.
6. Describe routing algorithms and their role in network communication.
7. Explore the role of the Network Layer in the internet.
8. Understand the services provided by the Transport Layer.
9. Describe the elements of transport protocols.
10. Explain congestion control mechanisms in the Transport Layer.

2.3 Course Outcomes

Course Outcomes: At the end of the course students should be able to:

CO1	**Define** various types of networks, network protocols and the transmission media,TCP,UDP that are necessary for effective communication between networks.
CO2	**Explain** different protocol models-OSI,TCP/IP, the Data Link Layer in networking, framing, routing algorithms , IPv4 and IPv6 in the network layer, connection setup, error control, and flow control offered by transport protocols.
CO3	**Apply** Shortest Path, Flooding, and Distance Vector routing to network scenarios to identify the best data path , transport services in ensuring reliable data transfer, and congestion control in a network, Connection establishment in TCP and UDP based networks.
CO4	**Analyze** the differences between OSI and TCP/IP models, Sliding window protocols, channel allocation problem, routing algorithm, TCP and UDP Services for reliable data transmission and appropriate protocol based requirements.
CO5	**Evaluate** different types of computer networks used for data transfer can be assessed by examining aspects like congestion control and the rate of data transfer.
CO6	**Create** various networks to transfer the data using network simulators.

Outcome Map:

Cos	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	1	2	3	3			3	2	1	2	1	1	2	3	
CO2	1	2	3	3			3	2	1	2	1	1	2	3	
CO3	1	2	3	3	2		3	2	1	2	1	1	2	3	
CO4	1	2	3	3	2	2	3	2	1	2	1	1	2	3	2
CO5	1	2	3	3	2	2	3	2	1	2	1	1	2	3	2
CO6	1	2	3	3	2	2	3	2	1	2	1	1	2	3	2

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Introduction to networks**: Network hardware- Personal Area Networks, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Network software- Protocol Hierarchies, Connection-Oriented Versus Connectionless Service, Service Primitives, Reference models- The OSI Reference Model, The TCP/IP Reference Model. **Physical Layer:** Guided transmission media -Twisted pair, Co-axial Cable, Fiber Optics.
- **The Data link layer:** Design issues of DLL- Services Provided to the Network Layer, Framing, Error Control, Flow Control, Sliding window protocols-A One-Bit Sliding Window Protocol, A Protocol Using Go-Back-N. **The medium access control sublayer:** The channel allocation problem- Static Channel Allocation, Assumptions for Dynamic Channel Allocation.
- **The Network Layer:** Network Layer Design Issues- Store-and-Forward Packet Switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection-Oriented Service, Comparison of Virtual-Circuit and Datagram Networks, Routing Algorithms- The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, The Network Layer on the internet-The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols.
- **The Transport Layer-Ⅰ:** The Transport Service- Services Provided to the Upper Layers, Transport Service Primitives, Elements of transport protocols- Addressing, Connection Establishment, Connection Release, Error Control and Flow Control, Multiplexing, Crash Recovery, Congestion control- Desirable Bandwidth Allocation, Regulating the Sending Rate.

- **The Transport Layer-Ⅱ:** The internet transport protocols- Introduction to UDP, Remote Procedure Call, Real-Time Transport Protocols, The internet transport protocols- Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

2.5 Course Resources

- **Text Book:**
  - Computer-Networks- Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, 5th-Edition. (www.pearsonhighered.com/tanenbaum)
  - Computer Networking A Top-Down Approach -James F. Kurose and Keith W. Ross Pearson Education 7th Edition, 2020.
- **References:**
  - Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill,Indian Edition
  - Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
  - Mayank Dave, Computer Networks, Second edition, Cengage Learning
- **Other Resources**
  - https://www.digimat.in/nptel/courses/video/106105183/L01.html
  - http://www.digimat.in/nptel/courses/video/106105081/L25.html
  - https://nptel.ac.in/courses/106105081
  - https://www.youtube.com/watch?v=gIjUTIYSa8M
  - https://www.youtube.com/watch?v=GmbWm0P_9cw
  - https://www.youtube.com/watch?v=1cn-Km6t6qU
  - https://www.youtube.com/watch?v=JJbD_OgfsbY

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Overview of Course Content	Lecture-00	
1	Introduction to networks	Lecture-01	https://youtu.be/wXsgJPnr1nQ?si=Ie8tlmd_A9bPmF3C
2	Network hardware-PAN, LAN	Lecture-02	https://youtu.be/v3cB9TF0HSA?si=nVYFf-pbDG1UguLf
3	Network hardware-MAN, WAN	Lecture-03	https://youtu.be/v3cB9TF0HSA?si=nVYFf-pbDG1UguLf
4	Network software- Protocol Hierarchies,	Lecture-04	https://youtu.be/aY6m7oh9Ee4?si=LxCEtyYqo3z66cy6
5	Connection-Oriented Versus Connectionless Service, Service Primitives	Lecture-05	https://youtu.be/x-Y0-lGongQ?si=fqLEUKKOvvveMmLE
6	Reference models- The OSI Reference Model	Lecture-06	https://youtu.be/2NlSHvCgdPY?si=tcrxB3AQniWdW_o7
7	Reference models- The OSI Reference Model	Lecture-07	https://youtu.be/2NlSHvCgdPY?si=tcrxB3AQniWdW_o7
8	The TCP/IP Reference Model.	Lecture-08	https://youtu.be/VJxJCSEtY_0?si=V_FLFZ2s9x0Yc8NE
9	Guided transmission media:-Twisted pair	Lecture-09	https://youtu.be/pFLWhllr5BY?si=zsDwh1uMALE92-p3
10	Guided transmission media:- Co-axial Cable, Fiber Optics	Lecture-10	https://youtu.be/pFLWhllr5BY?si=zsDwh1uMALE92-p3
11	The Data link layer: Design issues of DLL	Lecture-11	https://youtu.be/nwcvcOUGTRA?si=DvOXkKS2i4S2gvto
12	Services Provided to the Network Layer	Lecture-12	https://youtu.be/nwcvcOUGTRA?si=DvOXkKS2i4S2gvto
13	Framing-character oriented	Lecture-13	https://youtu.be/VzydkaO27V0?si=2idbC4MJfi5HR7-Y
14	Framing-bit stuffing	Lecture-14	https://youtu.be/VzydkaO27V0?si=2idbC4MJfi5HR7-Y
15	Framing-byte stuffing	Lecture-15	https://youtu.be/VzydkaO27V0?si=2idbC4MJfi5HR7-Y
Submission of Assignment-1 Quiz-01 and Test-1			

16	Error Control, Flow Control	Lecture-16	https://www.youtube.com/watch?v=6BwF2XtY7e0
17	Sliding window protocols-A One-Bit Sliding Window Protocol	Lecture-17	https://www.youtube.com/watch?v=WgSuj2TEmwU
18	A Protocol Using Go-Back-N	Lecture-18	https://www.youtube.com/watch?v=SmsJyMye43E
19	The medium access control sublayer: The channel allocation problem	Lecture-19	https://www.youtube.com/watch?v=0QIPFdLdCwE
20	Static Channel Allocation, Assumptions for Dynamic Channel Allocation.	Lecture-20	https://www.youtube.com/watch?v=0QIPFdLdCwE
21	Network Layer Design Issues- Store-and-Forward Packet Switching,	Lecture-21	https://www.youtube.com/watch?v=zHhyOyfq0mo
22	Services Provided to the Transport Layer	Lecture-22	https://www.youtube.com/watch?v=RHkf0MrCS8s
23	Implementation of Connectionless Service, Implementation of Connection-Oriented Service	Lecture-23	https://youtu.be/b5RqEuD0BoQ?si=uXSZefuuAuYkt0JS
24	Comparison of Virtual-Circuit and Datagram Networks	Lecture-24	https://youtu.be/b5RqEuD0BoQ?si=uXSZefuuAuYkt0JS
25	Routing Algorithms- The Optimality Principle	Lecture-25	https://youtu.be/2TXWvNY5bfc?si=JmrA-bi4MJM3bqce
26	Routing Algorithms- Shortest Path Algorithm	Lecture-26	https://youtu.be/vAAtBzpAgAc?si=NA4Q49xVHfr4pnOj
27	Routing Algorithms-, Flooding, Distance Vector Routing	Lecture-27	https://youtu.be/zuwdzCj8ims?si=FAQvZT0AsTMTJmPI
28	The IP Version 4 Protocol	Lecture-28	https://youtu.be/ZbvhJiTtiSI?si=n6NunfeT6Ldz3NHq
29	The IP Version 6 Protocol	Lecture-29	https://youtu.be/jOAA8If0xo0?si=c4S0k_Vi4JqM4hBs
30	Internet Control Protocols.	Lecture-30	https://youtu.be/zOgWEttZj2A?si=VtuLKbenN3XlJhV6
31	The Transport Layer: Introduction	Lecture-31	
32	Services Provided to the Upper Layers,	Lecture-32	https://youtu.be/vrPRMAvOcH0?

	Transport Service Primitives		si=j1uimW6h-osITurD
Submission of Assignment-2 Quiz-02 and Test-02			
33	Elements of transport protocols- Addressing, Connection Establishment	Lecture-33	https://youtu.be/OLY6QnO7eiM?si=vBh0wcVxit4AQvTR
34	Elements of transport protocols- Addressing, Connection Establishment	Lecture-34	https://youtu.be/OLY6QnO7eiM?si=vBh0wcVxit4AQvTR
35	Connection Release	Lecture-35	https://youtu.be/OLY6QnO7eiM?si=vBh0wcVxit4AQvTR
36	Error Control and Flow Control	Lecture-36	https://youtu.be/zqhRMPTAXIc?si=wUFZgIhgr7CMfa7c
37	Multiplexing, Crash Recovery	Lecture-37	https://youtu.be/_ibOrVjxAQc?si=eEYvBirChb08EROh
38	Congestion control- Desirable Bandwidth Allocation, Regulating the Sending Rate.	Lecture-38	
39	The internet transport protocols- Introduction to UDP	Lecture-39	https://youtu.be/37AFBZv4_6Y?si=GPFxB17CzbJooQCx
40	Remote Procedure Call, Real-Time Transport Protocols	Lecture-40	https://www.youtube.com/watch?v=p71tHsdAr1g
41	Remote Procedure Call, Real-Time Transport Protocols	Lecture-41	https://www.youtube.com/watch?v=p71tHsdAr1g
42	The TCP Service Model	Lecture-42	https://www.youtube.com/watch?v=BakuFD10vBE
43	The TCP Protocol, The TCP Segment Header	Lecture-43	https://www.youtube.com/watch?v=YB-k9F-NqxQ
44	TCP Connection Establishment	Lecture-44	https://www.youtube.com/watch?v=WqV0TRTvvqA
45	TCP Connection Release	Lecture-45	https://www.youtube.com/watch?v=yHjr_jY8dvA
Quiz-03 and Test-03 **Submission of Assignment-3** **Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
Weight age	**Q1=5**	**Q2=5**	**Q3=5**	**T1=8**	**T2=8**	**T3=9**	**A1=10**	**A2=10**			
CO1=22	3	3	2	2					**10**	**12**	**22**
CO2=20	2	2	3	3	2				**12**	**8**	**20**
CO3=18				3	3	4			**10**	**8**	**18**
CO4=20					3	5			**08**	**12**	**20**
CO5=10							10		**10**		**10**
CO6=10								10	**10**		**10**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

3.2 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1/CO2				
Quiz-2	10th week	5	CO1/ CO2				
Quiz-3	15th week	5	CO1/ CO2				
Test-1	5th week	8	CO1/CO2/ CO3				
Test-2	10th week	8	CO2/ CO3/CO4				
Test-3	15th week	9	CO3/ CO4				
Assignment-1	7th week	10	CO 5				
Assignment-2	14th week	10	CO 6				
SEE	18th Week	40	CO1-4				

3.3 Grading Criterion

- Based on total marks scored grade is Awarded.

If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2	1

50% of students will score C grade and above - Attainment Level 3	
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

Course Document

Course Code	UE23CS2301
Course Title	**Algorithm Design and Complexity Analysis**
Program Code	CS
Program Title	B.Tech. Computer Science & Engg.
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	
Semester Duration	Weeks(1-16)-Teaching, Learning and Continuous Assessment Weeks (17-18)-SEE Weeks(19-20)-Announcement of Results

1. **Course Size**

Credits	L	T	P	Hours/Week
3	**1**	**2**	**2**	**5**

Total Term/Semester hours: 45

2. **Course Details**

Course Aims and Summary

- The course aims to introduce Algorithm analysis framework by Comparing algorithm design techniques which play a critical role for data stored such as divide and conquer, decrease and conquer, dynamic programming and so on.
- The course narrates terminology associated with Algorithms to work on real world problems and also different design techniques for evaluating its time efficiency.

Course Objectives

Course Learning Objectives: This course will enable students:

- To define the algorithm and its basic properties.
- Explain the analysis and design of algorithm process.

- To demonstrate the performance of algorithms with respect to time and space complexity.
- To explain the concepts of various algorithmic techniques such as brute force, divide and conquer and solve complex computational problems, and analyse their time and space complexities.
- To explain the concepts of greedy method and dynamic programming. Applying for several applications like knapsack problem, spanning tree and so on respectively.
- To illustrate the methods of backtracking and to solve the problems like n-queen's problem, subset sum problem.
- Understand the branch and bound technique. Solve the Travelling Salesperson problem and 0/1 knapsack problem.
- To familiarize the concepts of deterministic and non-deterministic algorithms.
- Study and classify problems into P, NP, NP-Complete, and NP-Hard classes.

Course Outcomes:

Course Outcomes: At the end of the course

CO1	**Recall** the fundamentals of algorithm in problem solving and identify its essential properties.
CO2	**Explain** the concepts of algorithmic ways of problem including time and space efficiency, and asymptotic notations, and illustrate the basic efficiency classes with examples.
CO3	**Apply** various algorithmic techniques such as brute force, divide and conquer to solve complex computational problems.
CO4	**Analyse** and compare different algorithmic strategies, including greedy method, transform and conquer by evaluating their time and space complexities across various scenarios.
CO5	**Evaluate** the suitability and effectiveness of different algorithmic design strategies for a given application requirements with justification.
CO6	**Design & Implement** efficient solutions for real world problems using appropriate algorithm design techniques.

Out come Map:

Cos	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PSO3
CO1	1	1	2			3			2	2	3	1	1	1	3
CO2	1	1	1	2		3			2	2	3	1	1	1	3
CO3	1	1	1	1		3		3	2	3	3	1	1	1	1
CO4	1	1	1	1		3		3	2	3	3	1	1	1	1
CO5	2	1	1	1		3		3	2	2	3	1	1	1	1
CO6	1	1	1	1		3		3	2	2	3	1	1	1	1

Relevance: 1 high, 2 medium, 3 low

Course Content

- **Introduction:** What is an Algorithm? It's Properties. Algorithm Specification- using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency. Performance Analysis: Estimating Space complexity and Time complexity of algorithms. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.
- **Brute force** : Selection sort, String Matching Algorithm with complexity Analysis.
- **Divide and Conquer:** General method, Recurrence equation for divide and conquer, solving it using Master's theorem, Divide and Conquer algorithms , Binary search, Merge sort, Quick sort. **Decrease and Conquer Approach:** Introduction, Insertion sort, Topological Sorting.
- **Greedy Method:** General method, Coin Change Problem, Knapsack Problem. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm with performance analysis. Single source shortest paths: Dijkstra's Algorithm, Huffman Trees and Codes. **Transform and Conquer Approach:** Introduction, Heaps and Heap Sort.
- **Dynamic Programming:** General method with Examples. Transitive Closure: Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem. Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching-Harspool's algorithm.
- **Backtracking:** General method, solution using back tracking to N-Queens problem, Sum of subsets problem. Branch and Bound: Travelling Sales Person problem, 0/1 Knapsack problem

NP-Complete and NP-Hard problems: Basic concepts, non- deterministic algorithms, P, NP, NP- Complete, and NP-Hard classes.

Course Resources

Text Book:

- Anany Levitin: 2nd Edition,"Introduction to the Design and Analysis of Algorithms", 2009. Pearson
- Ellis Horowitz, Satraj Sahni and Rajasekaran ,"Computer Algorithms/C++" , , 2nd Edition, 2014, Universities Press.

References:

- R.C.T.Lee,S.S.Tseng,R.C. Changand T.T sai(2006),Introduction to Design and Analysis of Algorithms A strategic approach, McGraw Hill, In.
- Allen Weiss(2009),Data Structures and Algorithm Analysis in C++,2ndedition,Pearson
- Education, NewDelhi.
- Aho, Ullman, Hopcroft (2009),"Design and Analysis of algorithms", 2nd edition, Pearson education, New Delhi.

Other Resources:

- https://onlinecourses.nptel.ac.in/noc19_cs47/preview
- https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-fall-2011.
- http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
- http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorith ms.
- https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
- https://www.javatpoint.com/daa-tutorial

3.Teaching and Assessment

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0.	Introduction to Algorithms. What is Algorithm? It's Properties.	Lecture-00	Lecture-00
1.	Algorithm Specification using natural language, using Pseudocode convention.	Lecture-01	Lecture-01
2.	Fundamentals of Algorithmic Problem solving.	Lecture-02	Lecture-02
3.	Analysis Framework-Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency.	Lecture-03	Lecture-03
4.	Performance Analysis :Estimating Space complexity and Time complexity of algorithms.	Lecture-04	Lecture-04
5.	Asymptotic Notations, Basic efficiency classes.	Lecture-05	Lecture-05
6.	Mathematical analysis of Non-Recursive Algorithms with Examples	Lecture-06	Lecture-06
7.	Mathematical analysis of Recursive Algorithms with Examples-1	Lecture-07	Lecture-07
8.	Mathematical analysis of Recursive Algorithms with Examples-2	Lecture-08	Lecture-08
9.	Brute force design technique: Selection sort.	Lecture-09	Lecture-09
10.	String matching algorithm with complexity Analysis	Lecture-10	Lecture-10
11.	Divide and Conquer: General method, Recurrence equation for divide and conquer, solving it using Master's theorem.	Lecture-11	Lecture-11
12.	Divide and Conquer algorithms and complexity Analysis of	Lecture-12	Lecture-12
13.	Merge sort.	Lecture-13	Lecture-13
14.	Quick sort, Binary search-1	Lecture-14	Lecture-14
Submission of Assignment-1 Quiz-01 and Test-1			
15.	Binary search-2	Lecture-15	Lecture-15
16.	Decrease and Conquer Approach: Introduction	Lecture-16	Lecture-16
17.	Insertion sort.	Lecture-17	Lecture-17
18.	Topological Sorting.	Lecture-18	Lecture-18
19.	Knapsack Problem.	Lecture-19	Lecture-19

20.	Minimum cost spanning trees: Prim's Algorithm	Lecture-20	Lecture-20
21.	Kruskal's Algorithm with performance analysis.	Lecture-21	Lecture-21
22.	Single source shortest paths: Dijkstra's Algorithm.	Lecture-22	Lecture-22
23.	Optimal Tree problem: Huffman Codes.	Lecture-23	Lecture-23
24.	Transform and Conquer Approach: Introduction Heaps And Heap Sort.	Lecture-24	Lecture-24
25.	Dynamic Programming: General method with Examples Transitive Closure: Warshall's Algorithm.	Lecture-25	Lecture-25
26.	All Pairs Shortest Paths. Floyd's Algorithm	Lecture-26	Lecture-26
27.	Knapsack problem	Lecture-27	Lecture-27
28.	Space-Time Trade offs: Introduction, Sorting by Counting.	Lecture-28	Lecture-28
29.	Input Enhancement in String Matching-Harspool's Algorithm.	Lecture-29	Lecture-29
Submission of Assignment-2 Quiz-02 and Test-02			
30.	Backtracking :General method, solution using back Tracking to N-Queens problem.	Lecture-30	Lecture-30
31.	Sum of subsets problem	Lecture-31	Lecture-31
32.	Branch and Bound: Travelling Sales Person problem	Lecture-32	Lecture-32
33.	0/1 Knapsack problem	Lecture-33	Lecture-33
34.	NP-Complete and NP-Hard problems :Basic concepts	Lecture-34	Lecture-34
35.	Non-Deterministic algorithms.	Lecture-35	Lecture-35
36.	P,NP-complete problems	Lecture-36	Lecture-36
37.	P,NP-complete problems	Lecture-37	Lecture-37
38.	NP-Complete classes.	Lecture-38	Lecture-38
39.	NP-Hard classes.	Lecture-39	Lecture-39
40.	Revision.	Lecture-40	Lecture-40
41.	Revision.	Lecture-41	Lecture-41
42.	Revision.	Lecture-42	Lecture-42
43.	Revision.	Lecture-43	Lecture-43
44.	Revision.	Lecture-44	Lecture-44
Quiz-03 andTest-03 **Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/Course Outcomes	**15**	**25**	**20**	**40**	**100**
CO1	15			04	19
CO2		9		12	21
CO3		10		14	24
CO4		6		10	16
CO5			10		10
CO6			10		10

Schedule of Assessment

Assessment Type	Date	Marks	COs	Quiz	Test	Assignment/ PBL / PrBL	SEE
Weight				15	25	20	40
Duration				30min	60min	6 weeks	3 hours
Quiz-1	5thweek	5	CO1				
Quiz-2	10thweek	5	CO1				
Quiz-3	15thweek	5	CO1				
Test-1	5thweek	8	CO2/CO3/CO4				
Test-2	10thweek	8	CO2/CO3/CO4				
Test-3	15thweek	9	CO2/CO3/CO4				
Assignment-1	7thweek	10	CO5				
Assignment-2	14thweek	10	CO6				
SEE	18thWeek	40	C01/CO2/CO3/ CO4				

Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is: 91 and above O (outstanding); 81-90: A+ (Excellent);71-80: A (Very Good);61-70: B+ (Good);51-60:B(Above Average);

  40-50:C(Average);below40:D(Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S.No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students(XXXX)/Number of students(N) Average Grade:

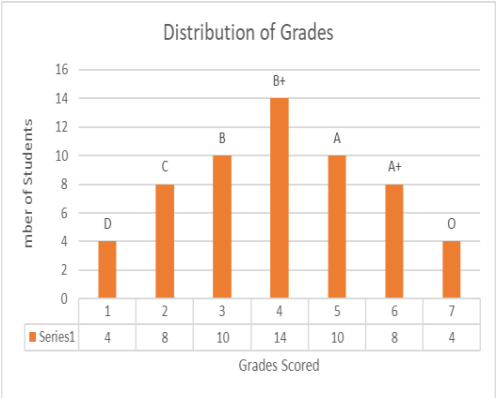
Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes-Targeted	**Targeted Attainment Level**
70% of students will score C grade and above-Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1
70% of students will score C grade and above Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1
70% of students will score C grade and above-Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1
70% of students will score C grade and above-Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1
70% of students will score C grade and above-Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1
70% of students will score C grade and above-Attainment Level 1 60% of students will score C grade and above-Attainment Level 2 50% of students will score C grade and above-Attainment Level 3	1

Performance Recording

Academic Year 2023-24	**Program: B.Tech.,in Computer Science - Cyber Security**	**Semester 3**	**Section A**	**CourseCode UE24CS2302**	**Course Title Algorithm Design and Complexity Analysis** **Course Tutor/s:** **Tutor's ID/Department:**					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O - Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1-Performance										
CO2-Performance										
CO3-Performance										
CO4-Performance									CO-	
CO5-Performance										
CO6-Performance										

Performance Plotting



CO-	CO-	CO-

CO-	CO-

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24CS2302
Course Title	Internet of Things
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**3**	**0**	**0**	**3**

Total Term/ Semester hours: 30

2. Course Details

2.1 Course Aims and Summary

- The Course provides a practical knowledge required to understand and utilize the latest technologies and the role of Internet of Things in daily life.
- The course provides insights of network of interconnected devices that communicate and share data with each other over the internet.
- The course enhances to collect and exchange data, leading to improved efficiency, automation, and enhanced decision-making in various sectors like healthcare, agriculture, smart cities.
- The curse enables the role of IOT in household appliances, vehicles, and industrial machines, equipped with sensors, software, and connectivity are taught with Case study.

2.2 Course Objectives

The objectives of the Course are:

- To introduce basic concept and Evolution of IoT
- To explain the concept of enabling IoT and the Complex Interdependence of Technologies
- To introduce IoT Networking Components and Addressing Strategies
- To describe Sensors and its implications in IoT.
- To explain Sensorial Deviations, Sensing Types and its Sensing Considerations
- To understand the concept of Actuator with its Characteristics for Processing data
- To state Data Format and Importance of Processing in IoT
- To introduce Processing Topologies, IoT Device Design, Selection Considerations and IoT Connectivity Technologies
- To understand Infrastructure Protocols and Data Protocols of IoT
- To Analyse IoT using Case Studies on Agricultural, Vehicular, Healthcare and So on.
- To discuss Paradigms, Challenges, and the Future of IoT.

2.3 Course Outcomes

After undergoing this course students will be able to:

CO1	**Identify** the fundamental concepts of IOT, including its emergence, evolution addressing strategies including protocols like Zigbee, Wi-Fi, Bluetooth, and IPv6.
CO2	**Explain** key enabling technologies, components of lot networks, addressing strategies, characteristics of different types of sensors and actuators, by understanding various IOT connectivity technologies and communication protocols, including IEEE 802.15.4, Zigbee, and MQTT
CO3	**Apply** a simple IOT system, incorporating appropriate sensors, actuators, and connectivity technologies based on specific requirement to optimize communication and data flow within the network with application plan for sectors like agriculture, healthcare, or vehicular systems.
CO4	**Analyze** enabling technologies of IOT in complex interdependencies to identify potential areas for optimization with performance of various IoT components in terms of data processing and offloading.
CO5	**Evaluate** the effectiveness to assess the performance and suitability of different sensors and actuators by justifying the selection of appropriate processing strategies by providing a critical assessment.
CO6	**Develop** and integrate multiple IOT technologies, including sensing, actuation. connectivity, and communication, to address specific and a comprehensive lo system prototype based on emerging paradigms and future trends.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2												2	2	3
CO2	2	2	2										2	2	3
CO3	2	2	2										2	2	3
CO4	2	2	2	2									2	2	3
CO5	2	2	2	2									2	2	3
CO6	2	2	2	2									2	2	3

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Emergence of IoT:** Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT
- **IoT Sensing and Actuation:** Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics
- **IoT Processing Topologies and Types:** Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.
- **IoT Connectivity Technologies:** Introduction, IEEE 802.15.4, Zigbee, Thread, ISA100.11A, WirelessHART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox ,LoRa ,NB-IoT ,Wi-Fi ,Bluetooth**.**
- **IoT Communication Technologies:** Introduction, Infrastructure Protocols: Internet protocol version 6 (IPv6), LOADng, RPL ,6LoWPAN. Data Protocols: MQTT, CoAP, AMQP,XMPP ,SOAP, REST, WebSocket.
- **IOT Case Studies and Future Trends**

  Agricultural IoT – Introduction and Case Studies

  Vehicular IoT – Introduction

  Healthcare IoT – Introduction, Case Studies

  Paradigms, Challenges, and the Future: Introduction, Evolution of New IoT, Paradigms Challenges associated with IoT, Emerging Pillars of IoT

2.5 Course Resources

Text Book:

- Sudip Misra, Anandarup Mukherjee, Arijit Roy, *"Introduction to IoT",* Cambridge University Press 2021.

References:

- Vijay Madisetti and Arshdeep Bahga, *"Internet of Things (A Hands-on-Approach)",*1st Edition, VPT, 2014.
- Cornel Amariei*, "Arduino Development Cook Book",* Birmingham: Packt Publishing Ltd., 2015.
- Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain*,"Internet of things With Raspberry Pi and Arduino"*, Boca Raton: CRC Press, Taylor & Francis Group,2020.
- Marco Schwartz, *"Internet of Things with ESP8266",* Birmingham: Packt Publishing Ltd., 2016**.**

Other Resources

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- https://youtu.be/x0vqdRBj574
- https://youtu.be/L4w0dEQXWI4?si=1Ysim1OcmeYG2D9V
- https://youtu.be/PbdyUD0Sn98?si=k5UjgfW450695GM_
- https://youtu.be/OQ1fehSCaTw?si=lDwnxidyAHtMt9C5
- https://youtu.be/1GcMAiIMQYU?si=W2jkAJBeY2x2b88O

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	**Introduction to IoT**	Lecture-00	Video-00
Issue-Assignment 1 and Assignment-2 Statements			
1	Evolution of IoT	Lecture-01	Video-01
2	Enabling IoT and the Complex Interdependence of Technologies	Lecture-02	Video-02
3	IoT Networking Components	Lecture-03	Video-03
4	Addressing Strategies in IoT	Lecture-04	Video-04

5	**Introduction to IoT Sensing and Actuation**	Lecture-05	Video-05
6	Sensors	Lecture-06	Video-06
8	Sensorial Deviations	Lecture-08	Video-08
9	Sensing Types, Sensing Considerations, Actuators	Lecture-09	Video-09
10	Actuator Types	Lecture-10	Video-10
11	Actuator Characteristics	Lecture-11	Video-11
Quiz -01 and Test-1-Obtain Student Feedback			
12	**IoT Processing Topologies and Types**	Lecture-12	Video-12
13	Data Format, Importance of Processing in IoT	Lecture-13	Video-13
14	Processing Topologies, IoT Device Design and Selection Considerations	Lecture-14	Video-14
15	Processing Offloading	Lecture-15	Video-15
Submission of Assignment-1			
16	**IoT Connectivity Technologies**	Lecture-16	Video-16
17	Introduction to IEEE 802.15.4	Lecture-17	Video-17
18	Zigbee, Thread, ISA100.11A	Lecture-18	Video-18
19	WirelessHART, RFID,NFC	Lecture-19	Video-19
20	DASH7 ,Z-Wave, Weightless ,Sigfox	Lecture-20	Video-20
21	LoRa, NB-IoT ,Wi-Fi ,Bluetooth	Lecture-21	Video-21
Quiz -02 and Test -02			
22	**IoT Communication Technologies**	Lecture-22	Video-22
23	Infrastructure Protocols and Data Protocols	Lecture-23	Video-23
24	**IOT Case Studies and Future Trends**	Lecture-24	Video-24
25	**Agricultural IoT** – Introduction and Case Studies	Lecture-25	Video-25
27	**Healthcare IoT –** Introduction, Case Studies	Lecture-27	Video-27
28	**Paradigms, Challenges, and the Future of IoT**	Lecture-28	Video-28
29	Evolution of New IoT ,Paradigms Challenges	Lecture-29	Video-29
30	Emerging Pillars of IoT	Lecture-30	Video-30
Quiz-03 and Test-03 **Submission of Assignment-2** **Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/ Course Outcomes	15	25	20	40	100
CO1	6			10	16
CO2	9	5		10	24
CO3		10		10	20
CO4		10		10	20
CO5			10		10
CO6			10		10

3.3 Schedule of Assessment

Assessment Type	Date	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1/CO2				
Quiz-2	10th week	5	CO1/ CO2				
Quiz-3	15th week	5	CO1/ CO2				
Test-1	5th week	8	CO2/CO3/C04				
Test-2	10th week	7	CO2/ CO3/CO4				
Test-3	15th week	10	CO2/ CO3/CO4				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	All				

3.3 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

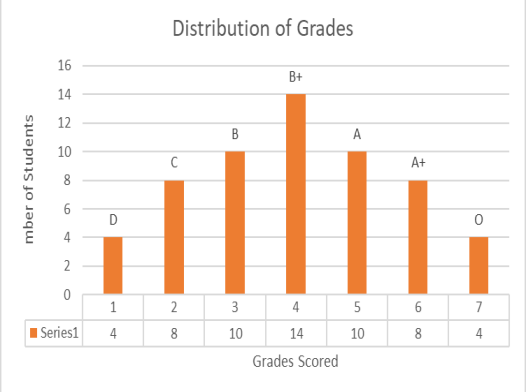
Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

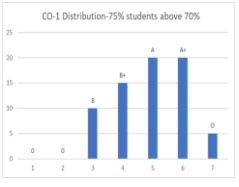
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science and Engineering	Semester 3	Section A	Course Code UE24CS2303	Course Title Internet of Things Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

4.1 **Assignment Details or Problem Based Learning:** Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Object Oriented Programming

Course Code	UE24CS2304
Course Title	**Object Oriented Programming**
Program Code	CS
Program Title	B. Tech Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	Deepika M D
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. **Course Size**

Credits	L	T	P	Hours/Week
3	**2**	**0**	**2**	**4**

Total Term/ Semester hours: 45

2. **Course Details**

2.1 Course Aims and Summary

- To provide a solid foundation in OOP principles such as Abstraction, Inheritance, Polymorphism, and Encapsulation.
- To ensure students can effectively use data types, variables, arrays, operators, and control statements in Java.
- To teach students how to define classes, create objects, and implement methods and constructors.

- To explore inheritance basics, the use of the super keyword, constructor execution, method overriding, and dynamic method dispatch.
- To introduce the concept of packages, member access, and the importing of packages for better code organization.
- To cover the fundamentals of exception handling, different types of exceptions, and the use of try, catch, throw, throws, and finally blocks.
- To Gain skills in multithreaded programming.
- To explore the basics of Java Swing for GUI development.
- Integrate and apply all learned concepts in comprehensive projects

2.2 Course Objectives

- Understand the core principles of Object-Oriented Programming (OOPS), including Abstraction, Inheritance, Polymorphism, and Encapsulation.
- Learn the fundamentals of Java, including data types, variables, arrays, and control statements.
- Familiarize with the process of defining classes, declaring objects, and introducing methods and constructors in Java.
- Comprehend the concept of method overloading, passing objects as parameters, and using nested and inner classes.
- Explore inheritance in Java, including the use of the super keyword, method overriding, and the final keyword in inheritance.
- Grasp the fundamentals of exception handling in Java, including different exception types and the use of try-catch blocks, throw, throws, and finally.
- Understand the Java thread model, including the creation and management of threads and writing simple multi-threaded programs.
- Learn the basics of Java Swing, including the components and containers, and how to develop a simple Swing application.

2.3 Course Outcomes

After undergoing this course students will be able to:

CO1	***Define*** the fundamental concepts, Principles, Terminologies, Features and Characteristics of Object-Oriented Programming.
CO2	***Explain*** classes, methods, exception handling, multithreaded programming and event handling and need of Swings.
CO3	***Apply*** Java applications by utilizing concepts like constructors, overloading, exception handling, multithreading and swings.
CO4	***Analyze*** applications of Java to handle exceptions by utilizing multithreading, and incorporate basic Swing components.
CO5	***Evaluate*** the use of advanced features of java like exception handling, multithreading.
CO6	***Design*** Java applications that integrate advance features like inheritance, interfaces, packages, exception handling and swings

Outcome Map:

COs	**PO 01**	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	2	3	3	1			2		2		1	3	1	1
CO2	1	2	3	3	1			2		2		1	3	1	1
CO3	1	1	2	3	1			2		2		1	3	1	1
CO4	1	1	2	2	1			2		2		1	2	1	1
CO5	1	1	1	2	1			1	2	1	2	1	2	1	1
CO6	1	1	1	2	1			1	2	1	2	1	2	1	1

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **An Overview of Object-Oriented Programming**: OOPS basic Principles: Abstraction, Inheritance, Polymorphism and Encapsulation.
- **Overview of Java**: Data Types, Variables, Arrays, Operators.
  Control Statements: Java's Selection Statements, Iteration Statements and Jump Statements.
- **Introducing Classes:** Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, The this Keyword.

- **Methods and Classes**: Overloading Methods, Objects as Parameters, Argument Passing, Returning Objects, Nested and Inner Classes.
- **Inheritance:** Inheritance Basics, Using super, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Using final with Inheritance.
- **Packages:** Packages, Packages and Member Access, Importing Packages.
- **Exceptions:** Exception-Handling Fundamentals, Exception Types, Using try and catch, throw, throws, finally.
- **Multithreaded Programming**: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Simple Multi thread programs.
- **Introduction to java swings:** Swings overview, Basic Swing Components and containers, A Simple Swing Application, Event handling basics.

2.5 Course Resources

Text Book:

- Java: The Complete Reference, Twelfth Edition, by Herbert Schildt, November 2021, McGraw-Hill, ISBN: 9781260463422

Reference Books:

- Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.
- Rajkumar Buyya, S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
- E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies. 4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017.

Other Resources

- **https://www.w3schools.com/java/**
- **https://www.javatpoint.com/java-tutorial**
- **https://www.youtube.com/watch?v=eIrMbAQSU34**
- **https://www.geeksforgeeks.org/java/**
- **https://www.tutorialspoint.com/java/index.htm**
- **https://beginnersbook.com/java-tutorial-for-beginners-with-examples/**

3.Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos

0	Discussion about Course objectives and Outcomes and mapping of Program Outcomes and course outcomes	Lecture-00	Video-00
Issue-Assignment 1 and Assignment-2 Statements			
1	OOPS basic Principles: Abstraction, Inheritance, Polymorphism and Encapsulation	OOPS_Introduction_1.pptx	https://www.youtube.com/watch?v=m_MQYyJpljg
2	Data Types, Variables, Arrays, Operators, Operators. Control Statements: Java's Selection Statements	OOPS_2.pptx	https://www.youtube.com/watch?v=X0zdAG7gfgs
3	Practical : Laboratory Basic Programs	OOPS_3.pptx	https://www.youtube.com/watch?v=69GRzZh1Sdk&list=PLqleLpAMfxGCQNefKs0_hH1Ah_aTKyuTn
4	Control Statements: Java's Selection Statements, Iteration Statements and Jump Statements	Lecture-04	https://www.youtube.com/watch?v=RmbfpfI0bNk
5	Practical : Laboratory Program 1	Lecture-05	Video-05
6	Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, The this Keyword	Lecture-06	https://www.youtube.com/watch?v=W-D71ZeMixQ&list=PLBlnK6fEyqRiwWLbSXKFtdGV8OVqr9dZr
7	Practical : Laboratory Program 2	Lecture-07	Video-07
8	Overloading Methods, Objects as Parameters, Argument Passing	Lecture-08	https://www.youtube.com/watch?v=KpwBVAYbPDA
9	Returning Objects, Nested and Inner Classes	Lecture-09	https://www.youtube.com/watch?v=J5_Dac4HX-A
10	Practical : Laboratory Program 3	Lecture-10	Video-10
Quiz -01 and Test-1-Obtain Student Feedback			
11	Inheritance Basics, Using super, When Constructors Are Executed	Lecture-11	https://www.youtube.com/watch?v=ahoJlOmmT7M
12	Inheritance Basics, Using super, When Constructors Are Executed	Lecture-12	https://www.youtube.com/watch?v=ahoJlOmmT7M
13	Practical : Laboratory Program 4	Lecture-13	Video-13
14	Method Overriding, Dynamic Method Dispatch	Lecture-14	https://www.youtube.com/watch?v=qbXNFOuD9k4

15	Method Overriding, Dynamic Method Dispatch	Lecture-15	https://www.youtube.com/watch?v=8C_YRYXCuwc
16	Practical : Laboratory Program 5	Lecture-16	Video-16
17	Using final with Inheritance	Lecture-17	https://www.youtube.com/watch?v=oSG-DJQb6yk
18	Packages, Packages and Member Access	Lecture-18	https://www.youtube.com/watch?v=mlVYooy93sE
19	Packages, Packages and Member Access	Lecture-19	https://www.youtube.com/watch?v=mlVYooy93sE
20	Practical : Laboratory Program 6	Lecture-20	Video-20
Quiz -02 and Test -02 Submission of Assignment-1			
21	Exception-Handling Fundamentals, Exception Types	Lecture-21	https://www.youtube.com/watch?v=bxcZ7cXbDI0&list=PLqleLpAMfxGAEfyXJyF-9UOs9C8dmir_Y
22	Exception-Handling Fundamentals, Exception Types	Lecture-22	https://www.youtube.com/watch?v=bxcZ7cXbDI0&list=PLqleLpAMfxGAEfyXJyF-9UOs9C8dmir_Y

23	Practical : Laboratory Program 7	Lecture-23	Video-23
24	Using try and catch, throw, throws, finally	Lecture-24	https://www.youtube.com/watch?v=y-NlcLcxiKY&list=PLlhM4lkb2sEjaU-JAASDG4Tdwpf-JFARN
25	Using try and catch, throw, throws, finally	Lecture-25	https://www.youtube.com/watch?v=y-NlcLcxiKY&list=PLlhM4lkb2sEjaU-JAASDG4Tdwpf-JFARN
26	The Java Thread Model, The Main Thread	Lecture-26	https://www.youtube.com/watch?v=KuvkahVyY9E

27	The Java Thread Model, The Main Thread	Lecture-27	https://www.youtube.com/watch?v=KuvkahVyY9E
28	Practical : Laboratory Program 8	Lecture-28	Video-28
29	Creating a Thread, Creating Multiple Threads	Lecture-29	https://www.youtube.com/watch?v=HkNtLNNe7G8
30	Creating a Thread, Creating Multiple Threads	Lecture-30	https://www.youtube.com/watch?v=HkNtLNNe7G8
31	Simple Multi thread programs	Lecture-31	https://www.youtube.com/watch?v=UfMM924sBvg
32	Simple Multi thread programs	Lecture-32	https://www.youtube.com/watch?v=UfMM924sBvg
33	Swings overview, Basic Swing Components	Lecture-33	https://www.youtube.com/watch?v=dPaUazOJOBc&list=PLsyeobzWxl7pVZdyDXj0arOdTzo4MYekh
34	Swings overview, Basic Swing Components	Lecture-34	https://www.youtube.com/watch?v=dPaUazOJOBc&list=PLsyeobzWxl7pVZdyDXj0arOdTzo4MYekh
35	Basic Swing Components and containers	Lecture-35	https://www.youtube.com/watch?v=1JjTAxbsDqs
36	Basic Swing Components and containers	Lecture-36	https://www.youtube.com/watch?v=1JjTAxbsDqs
37	A Simple Swing Application	Lecture-37	https://www.youtube.com/watch?v=XlwafT0TaK4
38	Event handling basics	Lecture-38	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
39	Event handling basics	Lecture-39	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
40	Event handling basics	Lecture-40	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn

42	Event handling basics	Lecture-42	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
43	Event handling basics	Lecture-43	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
44	Event handling basics	Lecture-44	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
45	Event handling basics	Lecture-45	https://www.youtube.com/watch?v=DNmXTT-hZBM&list=PLUXrqpAZjXYoHPSc0c3Oyz_HC1GRA0ZIn
Quiz-03 and Test-03 Submission of Assignment-2 Obtain Student Feedback			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
	Q1=5	**Q2=5**	**Q3=5**	**T1=7**	**T2=9**	**T3=9**	**A1=10**	**A2=10**			
CO1=17	5	5	5						**15**	**2**	**17**
CO2=20				4	3	2			**9**	**11**	**20**
CO3=20				3	3	4			**10**	**10**	**20**
CO4=14					2	4			**6**	**8**	**14**
CO5=14							10		**10**	**4**	**14**
CO6=16								10	**10**	**5**	**15**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

3.3 Schedule of Assessment

Assessment Type	**Dates**	**Marks**	**COs**	**Quiz**	**Test**	**Assignment/ PBL/ PrBL**	**SEE**
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1				
Quiz-2	10th week	5	CO1, CO2				
Quiz-3	15th week	5	CO1, CO2				
Test-1	5th week	7	CO2,CO3, CO4				
Test-2	10th week	9	CO2,CO3, CO4				
Test-3	15th week	9	CO2,CO3, CO4				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	All				

Grading Criterion

- Based on total marks scored grade is Awarded.

If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1	1

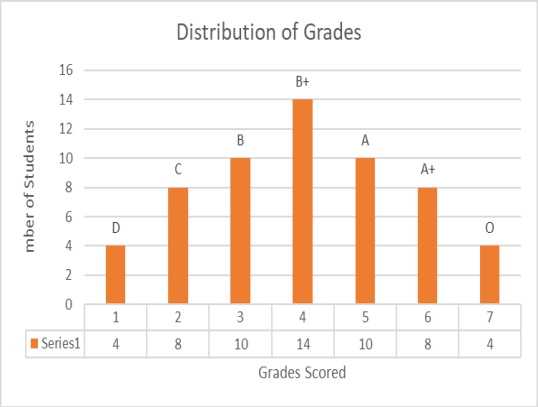
60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

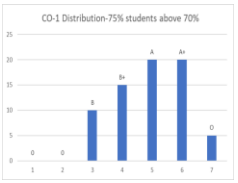
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science and Engineering	Semester 3	Section A	Course Code UE24CS2304	Course Title Object Oriented Programming Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										

CO2- Performance								
CO3- Performance								
CO4- Performance								
CO5- Performance								
CO6- Performance								

Performance Plotting





Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

1. **Other Details**

1.1 Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity: Copying and plagiarism in any form for any of the assessment components will resultin zero marks**.**

Course Document

Course Code	UE24CS2305
Course Title	**Computer Organization and Architecture**
Program Code	CS
Program Title	B. Tech. Computer Science and Engineering
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE-AIML
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science & Engineering
Faculty Member	Dr. Arun Kumar B T, Dr. K Prakash, Chethan GS, Darshan A, Mrs. Pooja G B, Mrs. Ananya H Doddagoudar, Ms. Raksha K, Mrs. Pallavi S
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**3**	**-**	**-**	**3**

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

This course

- Provides an understanding of the core functional units, their operational concepts, and performance metrics, enabling students to analyze and optimize computer systems.
- Covers memory addressing, instruction sequencing, and basic I/O operations, providing the skills needed to write and understand assembly language programs.

- Explores methods for accessing I/O devices, handling interrupts, and implementing direct memory access, equipping students to manage peripheral devices efficiently. .
- Offers knowledge of different memory types, including cache and RAM, and their impact on speed, size, and cost, helping students to optimize memory performance.
- Provides an understanding of CPU operations, including register transfers and ALU operations, and covers single and multiple bus organization for effective data handling.

2.2 Course Objectives

Course Learning Objectives: This course (UE24CS2304) will enable students to Study:

- Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus structure
- Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement
- Machine Instructions and Programs: Memory Location and Addresses
- Instructions and Instruction Sequencing, Addressing Modes, Assembly Language
- Basic Input Operations, Stacks, Queues, Subroutines
- Additional Instructions, Encoding of Machine Instructions
- Input / Output Organization: Accessing I/O Devices, Interrupts, Interrupt Hardware
- Direct Memory Access, Buses, Interface Circuits
- Standard I/O Interfaces – PCI Bus, SCSI Bus, USB
- Memory System: Basic Concepts, Semiconductor RAM Memories
- Read Only Memories, Speed, Size, and Cost, Cache Memories
- Mapping Functions, Replacement Algorithms, Performance Considerations
- Virtual Memories, Secondary Storage-Magnetic Hard Disks
- Basic Processing Unit: Some Fundamental Concepts: Register Transfers
- Performing ALU operations, Fetching a word from Memory
- Storing a word in memory, Execution of a Complete Instruction
- Execution of a Complete Instruction, Single bus Bus Organization, Multiple Bus Organization
- Pipelining: **C**oncepts of pipelining, Role of cache memory, pipeline performance, Data hazards: Operand forwarding, Handling data hazards in software.

Course Outcomes

After undergoing this course, students will be able to:

CO1	**Recall** the core functional units and operational concepts of computers, list memory addressing and instruction sequencing methods. describe basic memory systems and performance evaluating parameters.
CO2	**Understand** memory addressing and instruction sequencing methods, discuss I/O device access and interrupt handling techniques and describe fundamental CPU operations including register transfers and ALU functions.
CO3	**Apply** concept of the bus structure to optimize system performance, memory addressing efficient instruction sequencing, effective interrupt handling strategies in computers.
CO4	**Analyse** the bus structure and its impact on system performance, implementation of assembly language for basic input and output operations.
CO5	**Illustrate** the selection of an optimal bus structure design to enhance system performance, Role of cache memory to fetch the word from memory location transfer data register to memory.
CO6	**Design** an optimal bus structure to maximize system performance in CPU design, provide an example of implementing pipeline to execute the assembly code instructions.

Outcome Map:

COs	**PO 01**	**PO 02**	**PO 03**	**PO 04**	**PO 05**	**PO 06**	**PO 07**	**PO 08**	**PO 09**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1	1	2	0	0	0	0	0	0	0	0	0	2	1	0	2
CO2	1	1	2	0	0	0	0	0	0	0	0	2	1	2	2
CO3	1	1	1	2	2	0	0	0	0	0	0	2	2	2	1
CO4	1	1	1	2	2	0	0	0	0	0	0	2	2	2	1
CO5	1	2	1	2	1	0	0	0	0	0	0	2	2	2	1
CO6	1	1	1	1	2	0	0	0	0	0	0	2	2	2	1

Relevance: 1 high, 2 medium, 3 low

2.3 Course Content

- **Basic Structure of Computers:** Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
- **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions
- **Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.
- **Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms and Performance Considerations. Virtual Memories, Secondary Storage-Magnetic Hard Disks
- **Basic Processing Unit:** Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction, Single bus & Multiple Bus Organization.
- **Pipelining: C**oncepts of pipeline, Role of cache memory, pipeline performance, Data hazards: Operand forwarding, Handling data hazards in software, Instruction hazards, Influence of instruction sets: Addressing modes, condition codes Data path and control considerations, Super scalar operation.

2.4 Course Resources

Text book

- Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

References:

- William Stallings, Computer Organization & Architecture, 9th Edition, Pearson, 1999.

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0		Lecture-00	Video-00
1	**Basic Structure of Computers:** Functional Units	Lecture-01	https://youtu.be/2_tQuIgw5zc?si=vppb72q2WUIZwktF
2	Basic Operational Concepts	Lecture-02	https://youtu.be/x5956NpljE?si=_QIo266SvNWqCSp
3	Bus structure	Lecture-03	https://youtu.be/xBYhHC8_A6o?si=YJQlcCFp1FeevhCZ
4	Performance – Processor Clock	Lecture-04	https://youtu.be/O3LINFDI4sw?si=-dH5t4Pf-fwolcXY
5	Basic Performance Equation	Lecture-05	https://youtu.be/s6kYnw1vbyA?si=_h5KeL3eN62C92zc
6	Clock Rate, Performance Measurement	Lecture-06	https://youtu.be/O3LINFDI4sw?si=epr_ASoTwUoTb7Re
7	Machine Instructions and Programs: Memory Location and Addresses	Lecture-07	https://youtu.be/BHEIdR9g20g?si=KsYrAkDJgqej_J-a
8	Instructions	Lecture-8	https://youtu.be/or0fpUH2oEI?si=bj_3WUkx2psibr2q
9	Instruction Sequencing	Lecture-9	https://youtu.be/e1FrdiP4KdU?si=sg6P79_zHPGTc_Q1
10	Addressing Modes	Lecture-10	https://youtu.be/_CH4cm5PhK8?si=ciEadnS2bdW3RHXT
11	Assembly Language	Lecture-11	https://youtu.be/cTaWkhHChaY?si=rxmNAyxOss9xoyG8

12	Basic Input and Output Operations	Lecture-12	https://youtu.be/XNZVxWLzWmk?si=9IPFwj0NNHm7nnec
13	Stacks	Lecture-13	https://youtu.be/C3ocd1MkUE?si=fHit1P5vq3uJJW
14	Queues	Lecture-14	https://youtu.be/oUdOdtTrWio?si=7LjKPfh4D-CsuI9D
Submission of Assignment-1Quiz-01 and Test-1			
15	Subroutines	Lecture-15	https://youtu.be/IX6PNkHrRo4?si=rehZFk0imB-SY5uo
16	Additional Instructions	Lecture-16	https://youtu.be/xgeP5juh9TQ?si=2gKzQLdvkt1-9dCM
17	Encoding of Machine Instructions	Lecture-17	https://youtu.be/1GIEq_HLaXc?si=qVGEHlldSvMKtqke
18	**Input / Output Organization:** Accessing I/O Devices	Lecture-18	https://youtu.be/On2CqM_TVC8?si=s06obgTy-ePEuCn8
19	Interrupts	Lecture-19	https://youtu.be/1aG3aFEKxyA?si=oSZmdzC4GJi42Y6O
20	Interrupt Hardware	Lecture-20	https://youtu.be/1aG3aFEKxyA?si=YGctihhsC0o-oHHf
21	Direct Memory Access	Lecture-21	https://youtu.be/gGB-X3KmAZU?si=RGpf89NLDwIcgZ3r
22	Buses	Lecture-22	https://youtu.be/xBYhHC8_A6o?si=HjtSHvNPOCLS1Zv5
23	Interface Circuits	Lecture-23	https://youtu.be/AAC-R1_0z-U?si=41r75M0_iaS_zwSs

24	Standard I/O Interfaces – PCI Bus	Lecture-24	https://youtu.be/Ln417iwAGL0?si=Pk1a-AtGbAeo1wkp
25	SCSI Bus	Lecture-25	https://youtu.be/8ok2HtuWyyY?si=L3X-UiSyL60J-uT9
26	USB	Lecture-26	https://youtu.be/QqZHy55bGkI?si=jH6gJMg8DzLSFPQs
27	**Memory System:** Basic Concepts	Lecture-27	https://youtu.be/6w0wS6IVmbI?si=PxliaYq0zxC6sWeq
28	Semiconductor RAM Memories	Lecture-28	https://youtu.be/a--rNdqtwCI?si=Bg56XQ0YLOnEvdeZ
29	Read Only Memories	Lecture-29	https://youtu.be/Cd19ohX0770?si=bT8RKILXldI_0QaM

Submission of Assignment-2 Quiz-02 and Test-02			
30	Speed, Size, and Cost	Lecture-30	Video-30
31	Cache Memories	Lecture-31	Video-31
32	Mapping Functions	Lecture-32	Video-32
33	Replacement Algorithms	Lecture-33	Video-33
34	Performance Considerations	Lecture-34	Video-34
35	Virtual Memories	Lecture-35	Video-35
36	Secondary Storage-Magnetic Hard Disks	Lecture-36	Video-36
37	**Basic Processing Unit:** Some Fundamental Concepts: Register Transfers	Lecture-37	Video-37
38	Performing ALU operations, Fetching a word from Memory	Lecture-38	Video-38
39	Storing a word in memory, Execution of a Complete Instruction	Lecture-39	Video-39
40	Single bus Bus Organization, Multiple Bus Organization	Lecture-40	Video-40

41	**Pipelining:** Concepts of pipelining , Role of cache memory, pipeline performance.	Lecture-41	Video-41
42	Data hazards: Operand forwarding, Handling data hazards in software.	Lecture-42	Video-42
43	Instruction hazards, Influence of instruction sets: Addressing modes.	Lecture-43	Video-43
44	Condition codes Data path and control considerations.	Lecture-44	Video-44
45	Super scalar operation.	Lecture-45	Video-45
Quiz-03 and Test-03 Submission of Assignment-3 **Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

Assessment weight Distribution

Cos with weightage	Quiz = 15 Marks			Test = 25 Marks			Assignment = 20 Marks		CIE =60	SEE = 40
	Q1 =5	Q2 =4	Q3 = 6	T1 = 7	T2 = 8	T3 =10	A1 = 10	A2 = 10		
CO1=18%	3	4	3						10	8
CO2=18%	2		3	1	2	2			10	8
CO3=16%				3	2	4			9	7
CO4=18%				3	3	3		2	11	7
CO5=15%					1	1		8	10	5
CO6=15%							10		10	5

Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5thweek	5	CO1/CO2	5			
Quiz-2	10thweek	4	CO1	4			
Quiz-3	15thweek	6	CO1/CO2	6			
Test-1	5thweek	7	CO2/CO3/CO4		7		
Test-2	10thweek	8	CO2/CO3/CO4/ CO5		8		
Test-3	15thweek	10	CO2/CO3/CO4/ CO5		10		
Assignment-1	7thweek	10	CO4/ CO5			10	
Assignment-2	14thweek	10	CO6			10	
SEE	18thWeek	40					

Grading Criterion

- Based on total marks scored grade is Awarded . If marks scored is:
  91 and above O (outstanding); 81-90: A+ (Excellent);71-80: A (Very Good);61- 70: B+ (Good); 51-60:B (Above Average); 40 -50:C(Average); below 40:D (Not satisfactory).
- If one scores D grade, the candidate is required to re- register for the course if he/she wants to earn the credit at his/her own convenience.

Attainment Calculations:

Recording Marks and Awarding Grades

S.No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX) / Number of students

(N) Average Grade:

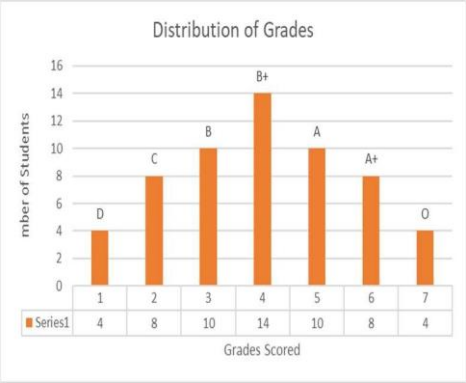
Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes-Targeted	**Targeted Attainment Level**
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1
70% of students will score C grade and above-Attainment Level1 60% of students will score C grade and above-Attainment Level2 50% of students will score C grade and above-Attainment Level3	1

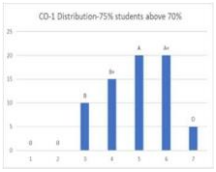
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science Cyber Security	Semester 3	Section A	Course Code UE24CS2304	Course Title Computer Organization and Digital Circuits/Architecture					
					Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the componentsof Assessment	Number of Students - Passed all the component of Examination	ClassAverageMarks	O-Graders >=91	A+ Graders 81 <= M<=90	A Grader 71<= M<= 80	B+ Graders 61 <= M <= 70	B Graders 51 <= M <= 60	C Graders 40 <= M <= 50	D Graders M < 40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1-Performance										
CO2-Performance										
CO3-Performance										
CO4-Performance										
CO5-Performance										
CO6-Performance										

Performance Plotting



CO-1Distribution



CO-2Distribution

CO-3Distribution

CO-4Distribution

CO-5Distribution

CO-6Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

Other Details :

Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided. **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24CS2305
Course Title	**Operating System Concepts**
Program Code	CS
Program Title	B.Tech.
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Members	Dr. Asha K, Veena C S, Yashodha M S, Usha T M, Vinay H S, Sumana, Kumar
Semester Duration	Weeks (1-16)-Teaching, Learning and Continuous Assessment Weeks (17-18)-SEE Weeks (19-20)-Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/Semester hours: 45

2. Course Details

2.1. Course Aims and Summary

- The course aims to provide a comprehensive understanding of fundamental concepts, principles, and functionalities related to operating systems.
- This course aims to enhance the knowledge related to design effective resource management using algorithms effectively.
- The course on theoretical and practical applications in the critical role of operating systems.
- The course is structured to cover aspects of operating systems with various features.
- The course enables illustrations to be hands-on theoretical and practical cases by real-world problems.

2.2. Course Objectives

The objectives of the Course are:

- To Introduce concepts and terminology used in OS
- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different sources
- To demonstrate different APIs/Commands related to processor, memory, storage
- To study the concepts used in various operating systems-as a case study.
- To Comprehend the concept of a process and the importance of process scheduling.
- To Understand the various operations that can be performed on processes.
- To Explore inter-process communication mechanisms.
- To Understand the system model and characterization of deadlocks.
- To Learn methods for handling deadlocks, including prevention, avoidance, detection, and recovery.

2.3 Course Outcomes

After undergoing this course student will be able to:

CO1	**Define** the basic functions and structures of operating systems, including computer system organization, process management, memory management, storage management.
CO2	**Explain** the fundamental concepts and structures of operating systems, including computer system organization, process management, memory management, storage management.
CO3	**Apply** key concepts of operating systems to real-world scenarios, including process management, memory management, storage management.
CO4	**Analyze** the components and operations of operating systems, including process management, memory management, storage management to determine their effectiveness in various computing environments.
CO5	**Evaluate** different process management and memory management techniques/policies across various operating systems and propose their suitability for specific working environments.
CO6	**Design and Develop** advanced programming solutions involving inter-process communication, multiprocessing, and multi-threading, or **create/**enhance operating system tools and utilities to meet specific application requirements by modifying kernel parameters of any open-source operating system.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	1	1	2						3		2	2	2	3
CO2	1	1	1	1						3		2	2	2	3
CO3	1	1	1	1				3		3		1	1	1	2
CO4	1	1	1	1	3			3	3	3		2	1	1	2
CO5	1	1	1	1	3			3	3	3	2	2	1	1	2
CO6	1	1	1	1	2			3	3	3	2	2	1	1	2

Relevance:1 high, 2 medium,3 low

2.4 Course Content

- **Introduction to operating systems, System structures**: What operating systems do; Computer System organization; Computer System architecture; Operating System structure, operations; Protection and Security; Distributed system;
- **Operating System Services**: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot.
- **Process Management**: Process concept; Operations on processes, Basic concepts; Scheduling Criteria; Scheduling Algorithms – FCFS, SJF, Round Robin and Priority Scheduling, Multiple-processor scheduling, Inter process communication **Process Synchronization**: The critical section problem & general solutions and solution with Semaphores; Classical problems of synchronization; **Multi-threaded Processes**: Overview; Multithreading models, Thread scheduling **Deadlocks**: System model; Deadlock characterization; Methods for handling deadlocks;
- **Memory Management**: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging. **Virtual Memory Management**: Background; Demand paging; Page replacement
- **File System**: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing;
- **Secondary Storage Structure:** Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management;

2.5 Course Resources

Text Book:

- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition, Wiley-India, 2015

References:

- Ann McHoes Ida MFylnn, Understanding Operating System, Cengage Learning, 6thEdition
- D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
- P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition,PHI(EEE), 2014.
- William Stallings Operating Systems: Internals and Design Principles ,6thEdition, Pearson.

Other Resources

- Youtube/NPTEL/Swayam/Coursera/Udemy
- https://youtu.be/mXw9ruZaxzQ
- https://youtu.be/vBURTt97EkA
- https://youtu.be/nSsdhEy9y04
- https://youtu.be/LVl37gkVFIo

3.Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
1	Introduction to Operating Systems	Lecture 0	#1 Introduction to the Course | Introduction to Operating Systems
2	What Operating Systems Do	Lecture 1	What Operating System Do || Depending on user view and System view || Operating Systems
3	Computer System Organization	Lecture 2	Computer System Operation in Operating system || Computer System Organization || Operating System
4	Computer System Architecture	Lecture 3	https://youtu.be/So9SR3qpWsM
5	Operating System Structure and Operations	Lecture 4	Structures of Operating System
6	Protection and Security	Lecture 5	Protection in Operating System

7	Distributed Systems	Lecture 6	Distributed Systems | OS | Lec-06 | Bhanu Priya
8	User – Operating System Interface	Lecture 7	User Operating System Interface || CLI || Command Line Interface || Command Interpreter || GUI
9	System Calls	Lecture 8	System Calls
10	Types of System Calls	Lecture 9	Types of System Calls
11	System Programs	Lecture 10	https://youtu.be/UWDzhz8MVqc
	Quiz-1		
12	Operating System Design and Implementation	Lecture 11	Operating System Design & Implementation
13	Operating System Structure	Lecture 12	Operating System Structure
14	Virtual Machines	Lecture 13	https://youtu.be/daDbY2iDmU0
15	Operating System Generation	Lecture 14	Operating System Generation and System Boot
	Assignment-1 announcement with orientation		
16	System Boot	Lecture 16	Operating System Generation and System Boot
17	Process Concept	Lecture 17	What is a Process || Process In Memory || Process Management In Operating System
18	Operations on Processes	Lecture 18	Operations on processes || Process Operations || Process Creation || Process Termination || OS
19	Basic Concepts of CPU Scheduling	Lecture 19	https://youtu.be/EWkQl0n0w5M
20	Scheduling Criteria	Lecture 20	https://youtu.be/rFt1hwh-8zU
21	First-Come, First-Served (FCFS) Scheduling	Lecture 21	Scheduling Algorithms - First Come First Served (FCFS)
22	Shortest Job First (SJF) Scheduling	Lecture 22	https://youtu.be/pYO-FAg-TpQ
23	Round Robin Scheduling	Lecture 23	Round Robin(RR) CPU Scheduling Algorithm in OS with example
	Quiz-2, Assignment -1 wrapup		
24	Priority Scheduling	Lecture 24	Lec 17: Preemptive Priority Scheduling Algorithm in OS with example | Operating System
25	Multiple-Processor Scheduling	Lecture 25	Multiple processor Scheduling in OS
26	Inter-Process Communication	Lecture 26	Inter Process Communication |

			Shared Memory | Message Passing | Operating System | IPC | OS
27	Critical Section Problem	Lecture 27	The Critical-Section Problem
	Assignment -2 Announce and orientation	Lecture 28	
28	Semaphores and General Solutions	Lecture 29	Semaphores
29	Classical Problems of Synchronization	Lecture 30	30 Classical problems of synchronization and producer consumer problem
30	Overview of Multi-Threaded Processes	Lecture 31	Threads in operating system || Single and Multi-threaded processes || Benefits |Server Architecture
31	Multithreading Models	Lecture 32	Multi-threading Models in operating system || Many to one || Many to many || one to one
32	Thread Scheduling	Lecture 33	#15 Thread scheduling, Multithreading Models |OS|
33	Deadlock System Model	Lecture 34	Operating System || deadlock-System model
34	Deadlock Characterization	Lecture 35	deadlock characterization part 1 | necessary conditions for deadlock
35	Methods for Handling Deadlocks	Lecture 36	Methods for Handling Deadlocks || Handling Deadlocks || Operating Systems
36	Background of Memory Management	Lecture 37	Memory Management
37	Swapping	Lecture 38	swapping in operating system | swapping in memory management
38	Contiguous Memory Allocation	Lecture 39	OS43 - Contiguous Memory Allocation | Fragmentation
39	Paging	Lecture 40	paging in operating system | OS Paging with Example | non contiguous memory allocation in os
40	Background of Virtual Memory	Lecture 41	Virtual Memory or Demand Paging or Page Faults in operating systems
41	Demand Paging		Virtual Memory or Demand Paging or Page Faults in operating systems
42	Page Replacement		Need of page replacement or page replacement algorithms in operating systems

43	File Concept, Access Methods, Directory Structure		Access Methods | File Access Methods | operating systems | Sequential | Direct | Indexed | File Syst
44	File System Mounting, File Sharing		File System Mounting | operating systems | file system | file management | mount point
45	Secondary Storage: Disk Structure, Scheduling, and Management		Hard disk Architecture || Magnetic Disk Architecture || Operating Systems || Disk Management
	Quiz-3, Assignment -2 wrapup		

2.6 Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE
CO'S	**15**			**25**			**20**		**60**	**40**
	Q1=3	**Q2=5**	**Q3=7**	**T1=6**	**T2=9**	**T3=10**	**A1=10**	**A2=10**		
CO1=16	3	3	4						**10**	**6**
CO2=19		2	3	1	1	1			**8**	**11**
CO3=17				2	4	4			**10**	**7**
CO4=16				3	4	5			**12**	**4**
CO5=15							10		**10**	**5**
CO6=17								10	**10**	**7**
TOTAL=100	**15**			**25**			**20**		**60**	**40**

Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30min	60min	6 weeks	3 hours
Quiz-1	5thweek	6	CO1				
Quiz-2	10thweek	5	CO1, CO2				
Quiz-3	15thweek	4	CO1, CO2				
Test-1	5thweek	10	C02/CO3/CO4				
Test-2	10thweek	8	CO2/CO3/CO4				
Test-3	15thweek	7	CO2/CO3/CO4				
Assignment-1	7thweek	10	CO5				
Assignment-2	14thweek	10	CO6				
SEE	18thWeek	40	CO1-CO6				

1. **Grading Criterion**

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

  - If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience.

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15 %)	Test (25 %)	Assignment 20%	SEE 40 %	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students

(N) Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

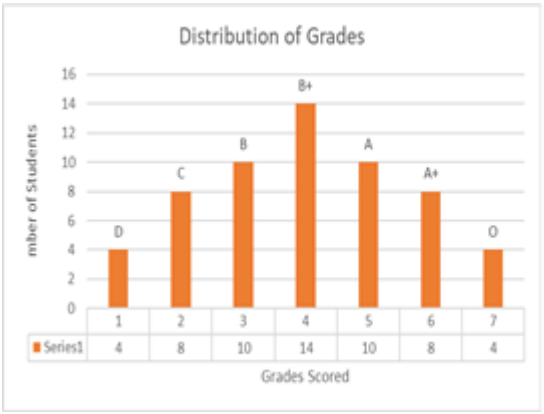
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

Performance Recording

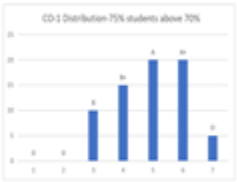
Academic Year 2023-24	**Program:** B.Tech.,in Computer Science and Engineering	**Semester** 2	**Section** A	**Course Code** UE24CS1204	**Course Title** Python Programming **Course Tutor/s:** **Tutor's ID/Department:**					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks		A+ Graders 81<=M<=90					
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										

CO6- Performance								

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

2. Other Details

2.1. Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

2.2. Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Semester – 5

Course Document

Course Code	UE23CY3501
Course Title	Advanced Machine Learning
Program Code	CY
Program Title	B. Tech. Computer Science- Cyber Security
School Code	01
School Title	School of Computer Science and Technology
Department Code	CCY
Department	Department of Computer Science- Cyber Security
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science- Cyber Security
Faculty Member	Kotreshi SN
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	2	5

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- To provide students with a strong foundation in advanced machine learning techniques, including supervised, unsupervised, and deep learning methods, to solve complex computational problems.
- To develop analytical and practical skills in handling, processing, and modelling data using statistical, mathematical, and algorithmic approaches.
- To enable students to design, implement, and evaluate machine learning and deep learning solutions in real-world applications such as predictive modelling, recommender systems, and text analytics.

2.2 Course Objectives

The objectives of the Course are:

- Understand the fundamental and advanced concepts of data analysis, feature engineering, and machine learning algorithms.
- Learn and apply supervised learning methods such as Support Vector Machines and Ensemble Models for classification and regression tasks.

- Explore unsupervised learning techniques, including clustering algorithms, to identify patterns in datasets.
- Gain knowledge of deep learning architectures such as CNNs, RNNs, LSTMs, and GRUs, along with their applications.
- Develop the ability to evaluate and compare different machine learning and deep learning models for solving real-world problems.

2.3 Course Outcomes

After undergoing this course student will be able to:

CO1	**Recall** the fundamental concepts of data analysis, feature engineering, and dimensionality reduction used in advanced machine learning.
CO2	**Explain** the working principles of Support Vector Machines, Ensemble Models, and their role in predictive modeling.
CO3	**Apply** clustering algorithms and supervised learning techniques to analyze and group datasets.
CO4	**Analyze** the performance of machine learning algorithms and identify the most suitable approach for different problem domains.
CO5	**Evaluate** the effectiveness of deep learning models such as CNNs, RNNs, and LSTMs on real-world datasets.
CO6	**Design** and **implement** machine learning and deep learning solutions to solve complex problems in domains such as recommender systems, text analytics, and predictive modeling.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3	2	2	3	3	3	3	2	3	1	1	2	3
CO2	1	1	2	2	2	3	3	3	3	2	3	1	1	1	3
CO3	1	1	2	1	1	3	3	3	2	2	3	1	1	1	2
CO4	1	1	2	1	1	3	3	3	2	2	3	1	1	1	2
CO5	1	1	2	1	1	3	3	3	2	2	3	1	2	1	2
CO6	1	1	2	1	1	3	3	3	2	2	3	1	2	1	1

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Understanding Data**: Introduction, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization. Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Feature Engineering and Dimensionality Reduction Techniques. Overview of advanced machine learning.
- **Support Vector Machines:** Introduction to Support Vector Machines, Optimal Hyperplane, Functional and Geometric Margin, Hard Margin SVM as an Optimization Problem, Soft Margin Support Vector Machines, Introduction to Kernels and Non-Linear SVM, Kernel-based Non-Linear Classifier, Support Vector Regression

- **Ensemble Learning:** Introduction, Parallel Ensemble Models- Voting, Bootstrap Resampling, Bagging, Random Forest; Incremental Ensemble Models- Stacking, Cascading; Sequential Ensemble Models – AdaBoost
- **Clustering Algorithms:** Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, and Grid-based Approach.
- **Deep Learning:** Introduction to Deep Neural Networks, Loss Functions and Optimization, Regularization Methods, Convolutional Neural Networks, Transfer Learning, Applications of Deep Learning, Recurrent Neural Networks, LSTM and GRU

2.5 Course Resources

Text Book:

- S Sridhar, M Vijayalakshmi, "Machine Learning", OXFORD University Press 2021, First Edition.

References:

- Tom M. Mitchell, Machine Learning, McGraw-Hill Education, 2013
- Machine Learning using Python ,Manaranjan Pradhan, U Dinesh Kumar, Wiley 2019
- Machine Learning, Anuradha Srinivasaraghavan, VincyJoeph, Wiley 2019
- Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd, 2nd Ed., 2013
- T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, 1st edition, 2013.

3.Teaching and Assessment

3.1 Teaching

Lecture No.	Lecture Topic	Lecture Slides	Lecture Videos
1	Introduction to Advanced Machine Learning & Overview	Lecture-01	Video-01
2	Understanding Data: Big Data Analysis Framework	Lecture-02	Video-02
3	Descriptive Statistics for Data Analysis	Lecture-03	Video-03
4	Univariate Data Analysis and Visualization	Lecture-04	Video-04
5	Bivariate and Multivariate Data	Lecture-05	Video-05
6	Multivariate Statistics	Lecture-06	Video-06
7	Essential Mathematics for Multivariate Data	Lecture-07	Video-07
8	Feature Engineering Techniques	Lecture-08	Video-08
Issue-Assignment 1 and Assignment-2 Statements			
9	Dimensionality Reduction Techniques	Lecture-09	Video-09
10	Support Vector Machines: Introduction	Lecture-10	Video-10
11	Optimal Hyperplane in SVM	Lecture-11	Video-11
12	Functional and Geometric Margins	Lecture-12	Video-12
13	Hard Margin SVM as Optimization Problem	Lecture-13	Video-13
14	Soft Margin SVM	Lecture-14	Video-14
15	Introduction to Kernels in SVM	Lecture-15	Video-15

16	Non-linear SVM with Kernels	Lecture-16	Video-16
17	Kernel-based Non-linear Classifier	Lecture-17	Video-17
18	Support Vector Regression	Lecture-18	Video-18
Quiz -01 and Test-1-Obtain Student Feedback			
19	Ensemble Learning: Introduction	Lecture-19	Video-19
20	Parallel Models: Voting	Lecture-20	Video-20
21	Bootstrap Resampling & Bagging	Lecture-21	Video-21
22	Random Forests	Lecture-22	Video-22
23	Incremental Ensemble Models: Stacking	Lecture-23	Video-23
24	Incremental Ensemble Models: Cascading	Lecture-24	Video-24
25	Sequential Ensemble Models: Introduction	Lecture-25	Video-25
26	AdaBoost Algorithm	Lecture-26	Video-26
Submission of Assignment-1			
27	Clustering: Introduction & Proximity Measures	Lecture-27	Video-27
28	Hierarchical Clustering Algorithms	Lecture-28	Video-28
29	Partitional Clustering: Introduction	Lecture-29	Video-29
30	k-means Algorithm	Lecture-30	Video-30
31	k-medoids Algorithm	Lecture-31	Video-31
32	Density-based Clustering Methods	Lecture-32	Video-32
33	Grid-based Clustering Approach	Lecture-33	Video-33
Quiz -02 and Test -02			
34	Deep Learning: Introduction to Neural Networks	Lecture-34	Video-34
35	Loss Functions in Deep Learning	Lecture-35	Video-35
36	Optimization Methods in Deep Learning	Lecture-36	Video-36
37	Regularization Methods	Lecture-37	Video-37
38	Convolutional Neural Networks (CNNs): Basics	Lecture-38	Video-38
39	CNNs: Applications	Lecture-39	Video-39
40	Transfer Learning	Lecture-40	Video-40
41	Applications of Deep Learning in Real-world Problems	Lecture-41	Video-41
42	Recurrent Neural Networks (RNNs): Basics	Lecture-42	Video-42
43	Long Short-Term Memory (LSTM)	Lecture-43	Video-43
44	Gated Recurrent Unit (GRU)	Lecture-44	Video-44
45	Summary & Integration of ML and Deep Learning Approaches	Lecture-45	Video-45
Quiz-03 and Test-03 **Submission of Assignment-2 ; Obtain Student Feedback**			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

Cos with weightage	Quiz = 15 Marks			Test = 25 Marks			Assignment = 20 Marks		CIE =60	SEE = 40
	Q1 =5	Q2 =4	Q3 = 6	T1 = 7	T2 = 8	T3 =10	A1 = 10	A2 = 10		
CO1	3	4	3						10	8
CO2	2		3	1	2	2			10	8
CO3				3	3	4	2		12	10
CO4				3	3	4	2		12	10
CO5							6		6	4
CO6								10	10	

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1/CO2				
Quiz-2	10th week	5	CO1				
Quiz-3	15th week	5	CO1/CO2				
Test-1	5th week	8	CO2/ CO3/CO4				
Test-2	10th week	8	CO2/ CO3/CO4				
Test-3	15th week	9	CO2/ CO3/CO4				
Assignment-1	7th week	10	CO3/ CO4/CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1-CO5				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

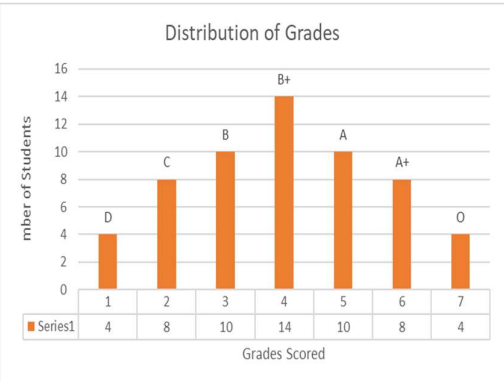
Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1	1

60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

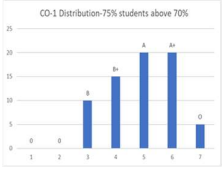
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science- Cyber Scurity	Semester 5	Section A	Course Code UE23CS3501	Course Title Advanced Machine Learning Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

4.1 Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE23CY3502
Course Title	Software Engineering
Program Code	CY
Program Title	B. Tech. Computer Science-Cyber Security
School Code	01
School Title	School of Computer Science and Technology
Department Code	CS-CY
Department	Department of Computer Science-Cyber Security
Faculty Code	3A
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science-Cyber Security
Faculty Member	Dr. Rachana P G
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/ Semester hours: 45

2. Course Details

2.1. Course Aims and Summary

- This course aims to provide a strong foundation in software engineering principles, including the definition, characteristics, and challenges of software and its development processes.
- It is designed to build knowledge of software process models (generic, prescriptive, evolutionary, concurrent, unified, and agile), along with process assessment and improvement strategies,
- Students will develop the ability to apply requirements engineering and object-oriented modelling with UML for effective software specification and design.
- The course emphasizes system modelling, software testing, and software evolution**,** enabling students to ensure quality, adaptability, and maintainability of software systems.
- Students will gain practical exposure to Agile methodologies and tools through case studies or mini-projects, preparing them for real-world collaborative software development.

2.2. Course Objectives

The objectives of the Course are:

- To introduce the fundamentals, characteristics, and challenges of software development.
- To understand the importance of systematic software engineering principles in building reliable systems.
- To study generic software process models and their applications.
- To gain knowledge of prescriptive, unified, personal, and team process models in software development.
- To understand the principles of requirements engineering.
- To distinguish between functional and non-functional requirements.
- To learn the preparation and structure of a Software Requirements Specification (SRS) document.
- To study the processes of requirements elicitation, analysis, validation, and management.
- To introduce the concepts of object orientation and themes of OO development.
- To learn abstraction and modeling as software design techniques.
- To develop the ability to create class models using object and class concepts, associations, generalization, and inheritance.
- To understand the role of context, interaction, structural, and behavioral models in system representation.
- To study the principles of model-driven engineering.
- To understand different software testing strategies such as development testing, test-driven development, release testing, and user testing.
- To study software evolution processes, program dynamics, and software maintenance.
- To introduce Agile methodologies, principles of agility, cost of change, and practical use of Agile tools through mini-projects.

2.2. Course Outcomes

After undergoing this course students will be able to:

CO1	***Define*** Define the fundamentals, characteristics, challenges of software engineering, and describe functional and non-functional requirements along with basic process models.
CO2	***Explain*** Explain the structure and significance of generic, prescriptive, and evolutionary process models, and the role of requirements engineering processes in preparing and validating a Software Requirements Specification (SRS).
CO3	***Apply*** Apply object-oriented modeling concepts using UML notations to construct class models, associations, inheritance, and also apply system modeling techniques such as context and interaction diagrams.
CO4	***Analyze*** Analyze software requirements and system models to identify design alternatives, assess behavioral and structural aspects, and determine suitable process models for various project contexts.

CO5	***Evaluate*** Evaluate software testing strategies and assess the impact of software evolution and maintenance on overall software quality.
CO6	***Create*** Create a mini-project or case study using Agile principles and tools to demonstrate iterative software development practices.

Outcome Map:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	2	3	3	3					3		2	2	2	3
CO2	1	1	2	2	3			2		2		2	2	2	3
CO3	1	2	1	2	1			3	2	2		2	1	1	2
CO4	1	1	1	1	2			2	2	2		1	1	1	2
CO5	1	1	2	1	2			1	2	2	2	2	1	1	1
CO6	2	2	1	2	1	2		2	1	1	1	1	1	1	1

Relevance: 1 high, 2 medium, 3 low

2.3. Course Content

Fundamentals of Software Engineering : Definition, Characteristics, and Challenges of Software, Process Models: A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models. Unified Process, Personal and Team process models

Requirements Engineering: Functional and non-functional requirements. The software requirements document. Requirements specification. Requirements engineering processes. Requirements elicitation and analysis. Requirements validation, Requirement management.

Object Oriented Modelling concepts: What is Object orientation? What is OO development? OO Themes; Modelling as Design technique: Modelling as Design technique, Modelling, abstraction. The Three models. Class Modelling: Object and Class Concept, Link and associations concepts; Generalization and Inheritance, A sample class model.

System Models : Context models ,Interaction models ,Structural models ,Behavioral models ,Model-driven engineering

Software Testing and Software Evolution: Development testing, Test-driven development, Release testing, User testing. Evolution processes. Program evolution dynamics. Software maintenance.

Agile Development: What is Agility?, Agility and the cost of change. What is an agile Process?, Extreme Programming (XP), Other Agile Process Models, A tool set for Agile process.

Case Study or Mini Project (Agile tools).

2.4. Course Resources Prescribed Text Book:

1. "Software Engineering-A Practitioners approach".

   Authors: Roger S. Pressman

   Publisher: Tata McGraw Hill

   Edition: Latest available

   Covers Fundamentals of Software Engineering , Understanding Requirements , Requirement Modeling Strategies ,Agile Development.

2. "Object-Oriented Modeling and Design with UML"

   Author: Michael Blaha, James Rumbaugh

   Publisher: Pearson Education

   Edition: latest

   Covers Object-Oriented Modeling and Design with UML.

3. "Software Engineering"

   Author: Ian Somerville

   Publisher: Pearson Education Edition: 9th

Focuses on System Models and System Testing.

Other Resources

https://www.cs.ox.ac.uk/pro/subjects/APE.html
https://www.geeksforgeeks.org/software-engineering/software-engineering-agile-software-development/
https://www.coursera.org/learn/agile-software-development

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Discussion about Course objectives and Outcomes and Mapping of Program Outcomes and Course outcomes		
Issue-Assignment 1 and Assignment-2 Statements			
1.	**Fundamentals of Software Engineering** Definition, Characteristics, Terminologies on Software Engineering	https://www.bdu.ac.in/cde/REVISED SLM/PG/MCA/Software%20Engineering.pdf	https://www.youtube.com/watch?v=IHx9ImEMuzQ&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=1&pp=iAQB
2.	Challenges of Software	https://www.bdu.ac.in/cde/REVISED SLM/PG/MCA/Software%20Engineering.pdf	https://www.youtube.com/watch?v=IHx9ImEMuzQ&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=1&pp=iAQB
3.	Process Models: A generic process model, Process assessment and improvement	https://www.visual-paradigm.com/guide/software-development-process/what-is-a-software-process-model/	https://www.youtube.com/watch?v=0q9jBPhI-fA&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=4&pp=iAQB
4.	Prescriptive process models: Waterfall model, Incremental process models	https://www.visual-paradigm.com/guide/software-development-process/what-is-a-software-process-model/	https://www.youtube.com/watch?v=M4ugSEs5sVo&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=6&pp=iAQB
5.	Evolutionary process models,	https://www.visual-paradigm.com/guide/software-development-process/what-is-a-software-process-model/	https://www.youtube.com/watch?v=M4ugSEs5sVo&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=6&pp=iAQB
6.	Concurrent models,	https://aws.amazon.com/what-is/sdlc/	https://www.youtube.com/watch?v=v5K9yzHCZx4&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=3&pp=iAQB0gcJCa0JAYcqIYzv
7.	Specialized process models.	https://aws.amazon.com/what-is/sdlc/	https://www.youtube.com/watch?v=v5K9yzHCZx4&list=PLQ-

			nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=3&pp=iAQB0gcJCa0JAYcqIYzv
8.	Unified Process, Personal and Team process models	https://aws.amazon.com/what-is/sdlc/	https://www.youtube.com/watch?v=gT1SiZttBDE&pp=ygUzUm9sZSBvZiBTb2Z0d2FyZSBFbmdpbmVlcmluZyAgICAgaW4gQUkvTUwgUHJvamVjdHMu
9.	Revision on Above Concepts		https://www.youtube.com/watch?v=CN-qsm1f_aY&list=PLQ-nEJNYlEV29CBLzIDxcogm6CEZjVad2&index=16&pp=iAQB
10.	**Requirements Engineering:** Functional and non-functional requirements		
11.	The software requirements document.		
12.	Requirements specification		
13.	Requirements engineering processes		
14.	Requirements elicitation and analysis		
15.	Requirements validation		
Quiz -01 and Test-1-Obtain Student Feedback			
16.	Requirement management		
17.	**Object Oriented Modelling concepts:** What is Object orientation?		
18.	What is OO development? OO Themes		
19.	Modelling as Design technique		
20.	Modelling, abstraction		
21.	The Three models: Class Modelling		
22.	Object and Class Concept, Link and associations concepts		
23.	Generalization and Inheritance		

24.	A sample class model		
25.	**System Models:**Context models		
26.	Interaction models		
27.	Structural models		
28.	Behavioral models		
29.	Model-driven engineering		
30.	Model-driven engineering		
Quiz-02 and Test-02 Submission of Assignment-1			
31.	**Software Testing and Software Evolution**: Development testing		
32.	Test-driven development		
33.	Release testing		
34.	User testing		
35.	Evolution processes		
36.	Program evolution dynamics		
37.	Software maintenance		
38.	**Agile Development**: What is Agility?		
39.	Agility and the cost of change. What is an agile Process?		
40.	Extreme Programming (XP)		
41.	Other Agile Process Models		
42.	A tool set for Agile process		
43.	Case Study or Mini Project (Agile)		
44.	Case Study or Mini Project (Agile)		
45.	Case Study or Mini Project (Agile)		
Quiz-03 and Test-03 Submission of Assignment-2 Obtain Student Feedback			
Examination Preparation Break			
Term/Semester End Examination			

2.5. Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE
CO'S	**15**			**25**			**20**		**60**	**40**
	Q1=5	**Q2=5**	**Q3=5**	**T1=8**	**T2=8**	**T3=9**	**A1=10**	**A2=10**		
CO1=21	3	4	3						**10**	**8**
CO2=21	2		3	2	2	1			**10**	**8**
CO3=21				3	3	4			**10**	**10**
CO4=17				3	3	4			**10**	**10**
CO5=10							10		**10**	**4**
CO6=10								10	**10**	
TOTAL=100	**15**			**25**			**20**		**60**	**40**

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1				
Quiz-2	10th week	5	CO1,CO2				
Quiz-3	15th week	5	CO1				
Test-1	5th week	8	CO2/CO3/CO4				
Test-2	10th week	8	CO2/CO3/ CO4				
Test-3	15th week	9	CO2/CO3/ CO4				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1/CO2 /CO3/CO4				

3. **Grading Criterion**

- Based on total marks scored grade is Awarded.

  If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience.

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

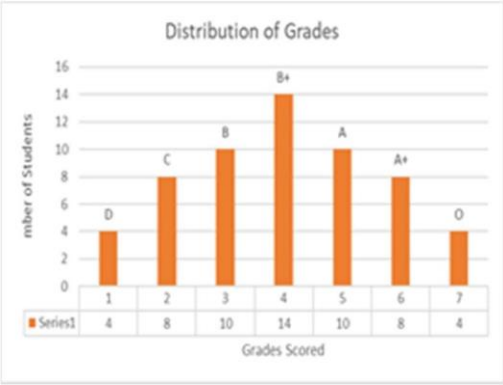
Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

Performance Recording

Academic Year 2025-26	**Program:** B.Tech., in Artificial Intelligence &Machine Learning	**Semester** 5	**Section** 3A	**Course Code** UE23AI3504	**Course Title** Software Engineering Practices with Agile Methodologies **Course Tutor/s:** **Tutor's ID/Department: 11376/AIML**					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks		A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution

CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

4.1. Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2. Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE24IY3503
Course Title	**Malware Analysis**
Program Code	IY
Program Title	B. Tech. Computer Science – Information Security
School Code	01
School Title	School of Computer Science and Technology
Department Code	CSE
Department	Department of Computer Science and Engineering
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science and Engineering
Faculty Member	
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	**3**	**0**	**0**	**3**

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- The course provides an insight to Malware and types of malware such as viruses, worms, Trojans, ransom-ware.
- The course illustrates the characteristics, propagation methods, and analysis of malware.
- The course illustrates the role played by various analysis types namely static , dynamic, behavioural, and code-level.
- The course enhances the understanding of file to process activities such as formats, disassembly, reverse engineering.

- The course also provides valuable information on malware's functionality, structure, and potential vulnerabilities.

2.2 Course Objectives

The objectives of the Course are:

- To introduce the malware taxonomy and malware analysis tools.
- To identify and analyse malware samples using static, dynamic analysis, and reverse engineering techniques.
- To detect and analyse malicious documents and mobile malware.
- Understand the basics of malware and its classification.
- Understand different types of malware, such as viruses, worms, Trojans, ransomware
- They will learn about their characteristics, propagation methods, and the potential impact they can have on computer systems.
- Analysis such as static analysis, dynamic analysis, behavioural analysis, and code-level analysis.
- They will learn how to select the appropriate methodology based on the objectives
- Static analysis techniques: which involve examining malware without executing it.
- They will study file formats, disassembly, reverse engineering, and code analysis to extract valuable information about malware's functionality, structure, and potential vulnerabilities.
- Dynamic analysis techniques involve executing malware in a controlled environment.
- Concepts such sandboxing, monitoring system behaviour, network traffic analysis, and malware interaction to gain insights into malware's activities, communication channels

2.3 Course Outcomes

After undergoing this course student will be able to:

CO1	**Possess** the skills to carry out static and dynamic malware analysis on various malware samples.
CO2	**Understand** the executable formats, Windows internals, and APIs
CO3	**Apply** techniques and concepts to unpack, extract, and decrypt malware.
CO4	**Comprehend** reverse-engineering of malware.
CO5	**Understand** anti-malware analysis techniques.
CO6	**Achieve** proficiency with industry-standard malware analysis tools.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	3	2	3	3	2							2	2	2
CO2	2	3	2	3	3	2							2	2	2
CO3	2	3	2	3	3	2							2	2	2
CO4	2	3	2	3	3	2							2	2	2
CO5	2	3	2	3	3	2							2	2	2
CO6	2	3	2	3	3	2							2	2	2

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

Unit-1 Fundamentals of Malware Analysis. Malware taxonomy - Malware analysis techniques – Packed and Obfuscated Malware. Portable Executable File Format: Headers and Sections (187). Malware Analysis in Virtual Machines. Malware Analysis Tools: ProcMon/ ProcExplore. BinText, FileAlyzer, OllyDbg, etc.

Unit-2 Static Analysis: File signature analysis. Identifying file dependencies -Database of file hashes. String analysis - Local and online malware. Sandboxing - Levels of Abstraction. x86 Architecture. x86/x86_64 Assembly.

Unit-3 Static Analysis Tools: PeiD, Dependency Walker, and Resource Hacker. Dynamic Analysis Source level vs. Assembly level Debuggers. Kernel vs. User-Mode Debugging. Exceptions - Modifying Execution with a Debugger. Modifying Program Execution in Practice. DLL analysis - Dynamic Analysis Tools: Virustotal, Malware Sandbox, Windows Sysinternals. Reverse engineering malicious code. Identifying malware passwords - Bypassing authentication.

Unit-4 Advanced malware analysis: Virus, Trojan and APK Analysis. Reverse Engineering Tools: IDA Pro and OLLYDBG. Malicious Document Analysis:PDF and Microsoft Office document structures. Identify PDF and office document vulnerabilities. Analysis of suspicious websites. Examining malicious documents: word, XL, PDF, and RTF files.

Unit-5 Malware extraction and analysis tools. Anti-Reverse-Engineering: Anti-Disassembly. Anti-Debugging - Anti-Forensic Malware. Packers and Unpacking –Shell code Analysis - 64-Bit Malware. Mobile Malware Analysis: Mobile application penetration testing. Android and iOS Vulnerabilities. Exploit Prevention - Handheld Exploitation. Android Root Spreading and Distribution Android.

2.5 Course Resources

Text Book:

- Abhijit Mohanta, Anoop Saldanha, Malware Analysis and Detection Engineering a Comprehensive Approach to Detect and Analyze Modern Malware, 2020, 1st edition,

Apress (ISBN 978-1-4842-6192-7), United States.

- M. Sikorski and A. Honig, Practical Malware Analysis: The Hands-on Guide to Dissecting Malicious Software. 2012, 1st edition, No Starch Press San Francisco, CA. (ISBN No.: 9781593272906), United States.

References:

1) Prakash Kuppuswamy, Dr Saeed QY Al Khalidi "UNDERSTANDING THE BASICS OF CYBER SECURITY", New Delhi Publication https://ndpublisher.in/ndpbookpage.php?book=484
https://www.amazon.in/dp/B0D2R8HMZ6?ref=myi_title_dp

2) Monnappa K A, Learning Malware Analysis- Explore the concepts, tools, and techniques to analyze and investigate Windows malware, 2018, 1st edition, Packt Publishing, (ISBN 978-1-78839-250-1), United Kingdom.

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Discussion about Course objectives and Outcomes and Mapping of Program Outcomes and Course outcomes	Lecture-00	Video-00
Issue-Assignment 1 and Assignment-2 Statements			
1.	Fundamentals of Malware Analysis Malware taxonomy -, -/	Lecture-01	Video-01
2.	Malware analysis techniques – Packed and Obfuscated Malware	Lecture-02	Video-02
3.	Portable Executable File Format: Headers and Sections	Lecture-03	Video-03
4.	Malware Analysis in Virtual Machines	Lecture-04	Video-04
5.	Malware Analysis Tools: ProcMon	Lecture-05	Video-05
6.	Malware Analysis Tools: ProcExplore	Lecture-06	Video-06
7.	Malware Analysis Tools: BinText, FileAlyzer, OllyDbg and etc.	Lecture-07	Video-07
8.	Static Analysis File signature analysis.	Lecture-08	Video-08
9.	Identifying file dependencies and Database of file hashes.	Lecture-09	Video-09
10.	String analysis, Local and online malware sandboxing	Lecture-10	Video-10
11.	Levels of Abstraction - x86 Architecture -x86/x86_64 Assembly	Lecture-11	Video-11
12.	Static Analysis Tools: PeiD, Dependency Walker, Resource Hacker.	Lecture-12	Video-12
13.	Dynamic Analysis: Source level vs. Assembly level Debuggers.	Lecture-13	Video-13
14.	Kernel vs. User- Mode Debugging	Lecture-14	Video-14
15.	Exceptions - Modifying Execution with a Debugger	Lecture-15	Video-15
Quiz -01 and Test-1-Obtain Student Feedback			
16.	Modifying Program Execution in Practice - DLL analysis	Lecture-16	Video-16
17.	Dynamic Analysis Tools: Virus total	Lecture-17	Video-17
18.	Malware Sandbox, Windows Sys Internals	Lecture-18	Video-18
19.	Reverse Engineering: Reverse engineering malicious code and Reverse Engineering Tools: IDA Pro and OLLYDBG	Lecture-19	Video-19
20.	Identifying malware passwords	Lecture-20	Video-20
21.	Bypassing authentication	Lecture-21	Video-21
22.	Advanced malware analysis	Lecture-22	Video-22
23.	Virus, Trojan	Lecture-23	Video-23
24.	APK Analysis	Lecture-24	Video-24
25.	Reverse Engineering Tools: IDA Pro and OLLYDBG	Lecture-25	Video-25
26.	Malicious Document	Lecture-26	Video-26
27.	Analysis PDF and Microsoft Office document structures	Lecture-27	Video-27

28.	Identify PDF and office document vulnerabilities	Lecture-28	Video-28
29.	Analysis of suspicious websites	Lecture-29	Video-29
30.	Examining malicious documents: word, XL	Lecture-30	Video-30
31.	PDF, and RTF files - Malware extraction and analysis tools.	Lecture-31	Video-31
32.	Anti-Reverse-Engineering	Lecture-32	Video-32
33.	Anti-Disassembly	Lecture-33	Video-33
34.	Anti-Debugging	Lecture-34	Video-34
35.	Anti-Forensic Malware	Lecture-35	Video-35
36.	Packers and Unpacking	Lecture-36	Video-36
37.	Shell code Analysis	Lecture-37	Video-37
38.	64-Bit Malware	Lecture-38	Video-38
39.	Mobile Malware Analysis: Mobile application penetration testing	Lecture-39	Video-39
40.	Android and IoS Vulnerabilities	Lecture-40	Video-40
41.	Exploit Prevention	Lecture-41	Video-41
42.	Handheld Exploitation	Lecture-42	Video-42
43.	Android Root Spreading	Lecture-43	Video-43
44.	Distribution Android	Lecture-44	Video-44
45.	Distribution Android	Lecture-45	Video-45
Quiz-03 and Test-03 Submission of Assignment-2 Obtain Student Feedback			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/ Course Outcomes	15	25	20	40	100
CO1	3	5	3	5	16
CO2	3	5	3	7	18
CO3	3	5	3	7	18
CO4	2	3	3	7	15
CO5	2	3	4	7	16
CO6	2	4	4	7	17

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	6	CO1/CO2				
Quiz-2	10th week	5	CO3/ CO4				
Quiz-3	15th week	4	CO5/ CO6				
Test-1	5th week	10	CO1/CO2				
Test-2	10th week	8	CO3/ CO4				
Test-3	15th week	7	CO5/ CO6				
Assignment-1	7th week	09	CO 1-3				
Assignment-2	14th week	11	CO 4-6				
SEE	18th Week	40	All				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90: A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60: B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)

- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades:

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

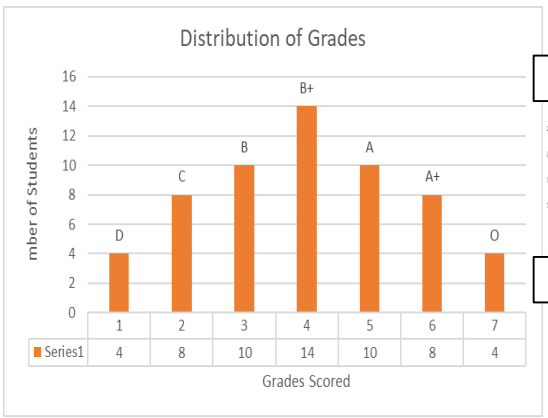
Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

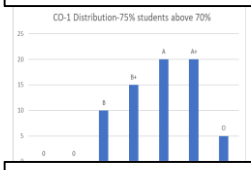
Performance Recording:

Academic Year 2023-24	Program: B.Tech., in Computer Science – Information Security	Semester 5th	Section A	Course Code UE24IY3503	Course Title Malware Analysis Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks		A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

4. Other Details

4.1. Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Semester – 5

Course Document

Course Code	UE23IY3504
Course Title	Information and Network Security
Program Code	IY
Program Title	B. Tech. Computer Science- Information Security
School Code	01
School Title	School of Computer Science and Technology
Department Code	CIY
Department	Department of Computer Science- Information Security
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science- Information Security
Faculty Member	Kotreshi SN
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/ Semester hours: 45

2. Course Details

2.1 Course Aims and Summary

- To introduce students to the fundamental principles of security, cryptography, and cryptographic algorithms.
- To develop the ability to apply cryptographic tools such as hashing, authentication protocols, and key management in secure communication.
- To prepare students to analyze and design security mechanisms in real-world applications such as networks, wireless communication, mobile security, and digital identity management.

2.2 Course Objectives

The objectives of the Course are:

- Understand the fundamental principles of cryptography and its historical development.
- Learn and apply hash functions, random numbers, and protocols for authentication and data integrity.
- Explore different cryptographic protocols and analyze their effectiveness.
- Gain knowledge of key management techniques, including public key infrastructure.

- Study real-world applications of cryptography in securing Internet systems, wireless networks, mobile communication, payment systems, and identity management.

2.3 Course Outcomes

After undergoing this course student will be able to:

CO1	**Recall** the fundamental concepts of cryptography and security principles.
CO2	**Explain** hash functions, random numbers, and authentication methods in cryptographic systems.
CO3	**Apply** cryptographic algorithms and protocols to secure communication and data exchange.
CO4	**Analyze** cryptographic protocols and key management schemes for security effectiveness.
CO5	**Evaluate** the strengths and limitations of cryptographic techniques in various security applications.
CO6	**Design** cryptography-based security solutions for real-world problems in networking, wireless, mobile, and digital identity systems.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	1	2	3	2	2	3	3	3	3	2	3	1	1	2	3
CO2	1	1	2	2	2	3	3	3	3	2	3	1	1	1	3
CO3	1	1	2	1	1	3	3	3	2	2	3	1	1	1	2
CO4	1	1	2	1	1	3	3	3	2	2	3	1	1	1	2
CO5	1	1	2	1	1	3	3	3	2	2	3	1	2	1	2
CO6	1	1	1	1	1	3	3	3	2	2	3	1	2	1	1

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Introduction**. How to Speak Crypto. Classic Crypto. Simple Substitution Cipher. Cryptanalysis of a Simple Substitution, Definition of Secure. Double Transposition Cipher. One-time Pad. Project VENONA. Codebook Cipher. Ciphers of the Election of 1876. Modern Crypto History. Taxonomy of Cryptography. Taxonomy of Cryptanalysis.
- What is a **Hash Function**? The Birthday Problem. Non-cryptographic Hashes. Tiger Hash. HMAC. Uses of Hash Functions. Online Bids. Spam Reduction, Other Crypto-Related Topics. Secret Sharing. Key Escrow. Random Numbers. Texas Hold 'em Poker. Generating Random Bits. Information Hiding.
- **Random number generation**. Providing Freshness. Fundamentals of entity authentication. Passwords. Dynamic password schemes. Zero-knowledge mechanisms. Cryptographic Protocols: Protocol Basics. Objectives of a protocol. Analyzing a simple protocol. Authentication and key establishment protocols.
- **Key management** fundamentals. Key lengths and lifetimes. Key generation. Key establishment. Key storage. Key usage. Governing key management. Public-Key Management: Certification of public keys. The certificate lifecycle. Public-key management models. Alternative approaches.
- **Cryptographic Applications:** Cryptography for securing the Internet. Cryptography for wireless local area networks. Cryptography for mobile telecommunications. Cryptography for secure payment card transactions. Cryptography for video broadcasting. Cryptography for identity cards.

2.5 Course Resources

Text Book:

- Information Security: Principles and practice, 2nd edition by Mark Stump, Wiley publications
- Everyday Cryptography: Fundamental Principles and applications, Keith M Martin Oxford Scholarship Online : December 2013

- **References:**
  - Applied Cryptography protocols, Algorithms and source codes in C by Bruce Schneider.

2.6 Laboratory Experiments

1. To implement and analyze the process of breaking the Shift Cipher.
2. To implement and analyze the process of breaking the Mono-alphabetic Substitution Cipher.
3. To study and demonstrate the concept of the One-Time Pad and Perfect Secrecy.
4. To implement Message Authentication Codes and analyze their role in ensuring data integrity.
5. To study Cryptographic Hash Functions and demonstrate their applications.
6. To implement the Symmetric Key Encryption Standard (DES) and analyze its working.
7. To implement the Symmetric Key Encryption Standard (AES) and analyze its working.
8. To study and implement the Diffie-Hellman Key Establishment protocol.
9. To study and demonstrate the working of Public-Key Cryptosystems (PKCS v1.5).
10. To implement and analyze the concept of Digital Signatures.

References:

https://cse29-iiith.vlabs.ac.in/List%20of%20experiments.html

3.Teaching and Assessment

3.1 Teaching

Lecture No.	Lecture Topic	Lecture Slides	Lecture Videos
1	Introduction to Cryptography	Lecture-01	Video-01
2	Classic Crypto: Substitution Cipher	Lecture-02	Video-02
3	Cryptanalysis of Substitution Cipher	Lecture-03	Video-03
4	Definition of Secure Systems	Lecture-04	Video-04
5	Double Transposition Cipher	Lecture-05	Video-05
6	One-time Pad	Lecture-06	Video-06
7	Project VENONA	Lecture-07	Video-07
8	Codebook Cipher	Lecture-08	Video-08
Issue-Assignment 1 and Assignment-2 Statements			
9	Election of 1876 Ciphers	Lecture-09	Video-09
10	Modern Crypto History & Taxonomy	Lecture-10	Video-10

11	Introduction to Hash Functions	Lecture-11	Video-11
12	The Birthday Problem	Lecture-12	Video-12
13	Non-Cryptographic Hashes	Lecture-13	Video-13
14	Tiger Hash	Lecture-14	Video-14
15	HMAC	Lecture-15	Video-15
16	Applications of Hash Functions (Online Bids)	Lecture-16	Video-16
17	Applications: Spam Reduction	Lecture-17	Video-17
18	Secret Sharing	Lecture-18	Video-18
Quiz -01 and Test-1-Obtain Student Feedback			
19	Key Escrow	Lecture-19	Video-19
20	Random Numbers & Texas Hold'em Example	Lecture-20	Video-20
21	Generating Random Bits	Lecture-21	Video-21
22	Information Hiding	Lecture-22	Video-22
23	Random Number Generation Techniques	Lecture-23	Video-23
24	Providing Freshness	Lecture-24	Video-24
25	Fundamentals of Entity Authentication	Lecture-25	Video-25
26	Passwords & Dynamic Schemes	Lecture-26	Video-26
Submission of Assignment-1			
27	Zero-Knowledge Mechanisms	Lecture-27	Video-27
28	Cryptographic Protocols: Basics	Lecture-28	Video-28
29	Objectives of Protocols	Lecture-29	Video-29
30	Analyzing a Simple Protocol	Lecture-30	Video-30
31	Authentication Protocols	Lecture-31	Video-31
32	Key Establishment Protocols	Lecture-32	Video-32
33	Key Management Fundamentals	Lecture-33	Video-33
Quiz -02 and Test -02			
34	Key Lengths and Lifetimes	Lecture-34	Video-34
35	Key Generation and Establishment	Lecture-35	Video-35
36	Key Storage and Usage	Lecture-36	Video-36
37	Governance in Key Management	Lecture-37	Video-37
38	Public-Key Management & Certification	Lecture-38	Video-38
39	The Certificate Lifecycle	Lecture-39	Video-39
40	Public-Key Management Models	Lecture-40	Video-40
41	Alternative PKI Approaches	Lecture-41	Video-41
42	Cryptography for Internet Security	Lecture-42	Video-42
43	Cryptography for Wireless LANs & Mobile Communication	Lecture-43	Video-43
44	Cryptography for Secure Payments & Broadcasting	Lecture-44	Video-44
45	Cryptography for Identity Cards & Summary	Lecture-45	Video-45

Quiz-03 and Test-03 **Submission of Assignment-2 ; Obtain Student Feedback**
Examination Preparation Break
Term/Semester End Examination

3.2 Assessment weight Distribution

Cos with weightage	Quiz = 15 Marks			Test = 25 Marks			Assignment = 20 Marks		CIE =60	SEE = 40
	Q1 =5	Q2 =4	Q3 = 6	T1 = 7	T2 = 8	T3 =10	A1 = 10	A2 = 10		
CO1	3	4	3						10	8
CO2	2		3	1	2	2			10	8
CO3				3	3	4	2		12	10
CO4				3	3	4	2		12	10
CO5							6		6	4
CO6								10	10	

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/ PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1/CO2				
Quiz-2	10th week	5	CO1				
Quiz-3	15th week	5	CO1/CO2				
Test-1	5th week	8	CO2/ CO3/CO4				
Test-2	10th week	8	CO2/ CO3/CO4				
Test-3	15th week	9	CO2/ CO3/CO4				
Assignment-1	7th week	10	CO3/ CO4/CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1-CO5				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
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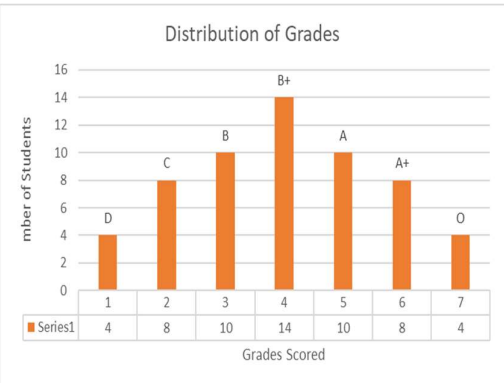
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2	1

50% of students will score C grade and above - Attainment Level 3	
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

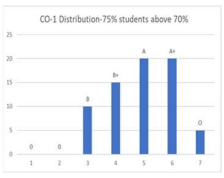
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science- Cyber Scurity	Semester 5	Section A	Course Code UE23CS3501	Course Title Advanced Machine Learning Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<=M<=90	A Grader 71<=M<=80	B+ Graders 61<=M<=70	B Graders 51<=M<=60	C Graders 40<=M<=50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting



CO-1 Distribution



CO-2 Distribution

CO-3 Distribution

CO-4 Distribution

CO-5 Distribution

CO-6 Distribution

4. Other Details

4.1 Assignment Details or Problem Based Learning: Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

Course Document

Course Code	UE23IY3540
Course Title	Data Privacy
Program Code	CY
Program Title	B. Tech. Computer Science- Cloud Computing
School Code	01
School Title	School of Computer Science and Technology
Department Code	CY & IY
Department	Department of Computer Science- Cyber Security
Faculty Code	E
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Computer Science- Cyber Security
Faculty Member	
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
3	3	0	0	3

Total Term/ Semester hours: 45

0. Course Details

2.1 Course Aims and Summary

The aim of this course is to equip students with a comprehensive understanding of data privacy concepts, principles, and practical techniques for safeguarding sensitive information in various data environments. The course explores the importance of balancing data privacy with utility, ethical considerations, and regulatory frameworks. Students will learn key statistical disclosure control methods, microdata protection techniques, and advanced anonymization approaches for static, multidimensional, and complex data structures such as graphs, time series, and transactional datasets. Emphasis is placed on understanding disclosure risks, applying privacy models like *k*-Anonymity, *l*-Diversity, and *t*-Closeness, and addressing evolving threats to anonymized data. The course also covers dynamic data protection mechanisms, including tokenization, to prepare students for real-world privacy-preserving data management challenges across diverse domains.

2.2 Course Objectives:

- Understand the fundamental concepts, importance, and need for data privacy in various domains.
- Explain the balance between data privacy and utility, including ethical principles, guidelines, and regulatory aspects.
- Identify different types of data such as tabular data, microdata, and complex data structures, and recognize their specific privacy challenges.
- Analyze disclosure risks and apply statistical disclosure control methods to protect sensitive information.
- Apply microdata masking techniques—both perturbative and non-perturbative—while assessing information loss.
- Implement privacy-preserving methods for multidimensional datasets using k-Anonymity, l-Diversity, and t-Closeness models.
- Design anonymization techniques for complex data types, including graphs, time series, longitudinal, and transactional datasets.
- Evaluate threats to anonymized data and assess vulnerabilities introduced by different anonymization methods.
- Demonstrate dynamic data protection strategies such as tokenization and compare them with alternative privacy-preserving techniques.
- Develop solutions that integrate privacy principles into data management practices to address real-world challenges.

2.3 Course Outcomes (COs):

After undergoing this course student will be able to:

CO1	Recall and **identify** fundamental concepts, terminology, ethical principles, and regulatory frameworks related to data privacy, statistical disclosure, microdata and tabular data, anonymization techniques, dynamic data protection, and associated threats.
CO2	**Explain** the necessity of balancing data utility and privacy, interpret various data sharing scenarios, and **summarize** how disclosure risks manifest in microdata, static datasets, complex structures, and dynamic environments.
CO3	**Apply** appropriate microdata masking and statistical disclosure control techniques—both perturbative and non-perturbative—across tabular, multidimensional, graph, time-series, longitudinal, and transaction data, while assessing resulting information loss.
CO4	**Analyze** and **differentiate** key anonymization methods (e.g., k-Anonymity, l-Diversity, t-Closeness, tokenization) and their suitability for various data types; critically examine threats posed by specific techniques or data structures.
CO5	**Evaluate** the effectiveness and limitations of different privacy-preserving strategies and anonymization techniques, balancing ethical/legal guidelines and assessing vulnerabilities, disclosure risks, and mitigation efficacy across static, complex, and dynamic datasets.
CO6	**Design** and **construct** comprehensive, ethically-informed data anonymization frameworks—integrating both statistical and dynamic protection methods (including tokenization)—tailored to

	multidimensional, complex, and evolving data types, while ensuring compliance with principles, regulations, and disclosure-control best practices.

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	3	–	–	–	1	–	2	–	3	–	–	2	2	2
CO2	2	1	–	–	–	2	–	2	–	3	–	–	2	2	2
CO3	1	2	2	2	2	–	–	–	–	–	–	–	2	2	2
CO4	2	1	2	2	–	3	–	2	–	–	–	–	2	2	2
CO5	2	1	2	2	–	1	3	2	–	–	3	–	2	2	2
CO6	1	2	1	2	2	2	3	1	2	2	2	2	2	2	2

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

Data privacy and Importance: Need for Sharing Data- Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Disclosure - Tabular Data - Micro data - Approaches to Statistical disclosure control –Ethics – principles-guidelines and regulations.

Microdata: Disclosure -Disclosure risk -Estimating re-identification risk -Non-Perturbative Micro data masking - Perturbative Micro data masking -Information loss in Micro data.

Static Data Anonymization on Multidimensional Data: Privacy – Preserving Methods - Classification of Data in a Multidimensional Dataset - Group based Anonymization: k-Anonymity, l-Diversity, t-Closeness.

Anonymization on Complex Data Structures: Privacy-Preserving Graph Data, Privacy-Preserving Time Series Data, Time Series Data Protection Methods, Privacy Preservation of Longitudinal Data, Privacy Preservation of Transaction Data.

Threats to Anonymized Data: Threats to Anonymized Data, Threats to Data Structures, Threats by Anonymization Techniques: Randomization, k-Anonymization, l-Diversity, t-Closeness.

Dynamic Data Protection: Dynamic Data Protection: Tokenization, Understanding Tokenization, Use Cases for Dynamic Data Protection, Benefits of Tokenization Compared to Other Methods, Components for Tokenization.

Suggested Activities / Mini Projects:

- Static Data Anonymization Project
- Complex Data Privacy Simulation
- Tokenization Prototype for Dynamic Data
- Privacy-Preserving Data Mining
- Re-identification Risk Estimation Tool

2.5 Course Resources

Textbooks:

1. "**Data Privacy: Principles and Practice"**, **Nataraj Venkataramanan, Ashwin Shriram**, 2016, 1st Edition, *Publisher* : *Taylor & Francis*. (ISBN No.: 978-1-49-872104-2), *United Kingdom.*

References

1. "Statistical Disclosure Control" – Anco Hunde pool, Josep Domingo-Ferrer, Luisa Franconi, Sarah Giessing, Eric Schulte Nordholt, Keith Spicer, Peter-Paul de Wolf, 2012, 1st Edition *Wiley*. (ISBN No.: 978-1-11-997815-2), *United States.*

2. " **Statistical Confidentiality: Principle and Practice" George T. Duncan. Mark Elliot, Juan-Jose Salazar-GonZalez**, 2011, 1st Edition, Springer. (ISBN No.: 978-1-44-197801-1).

Supplementary Online Resources:

- Introduction to Data Privacy
  - https://www.nist.gov/privacy-framework
  - https://www.coursera.org/learn/data-privacy
- Microdata Privacy & Masking
  - https://cran.r-project.org/web/packages/sdcMicro/index.html
  - https://www.red-gate.com/hub/product-learning/data-masker/practical-data-masking
- Static Data Anonymization on Multidimensional & Complex Data
  - https://arx.deidentifier.org
  - https://amnesia.openaire.eu
- Data Anonymization Threats
  - https://dataverse.harvard.edu
  - https://privacytools.seas.harvard.edu/
- Privacy-Preserving Data Mining
  - https://link.springer.com/book/10.1007/978-0-387-70992-5
  - https://www.ibm.com/docs/en/optim-data-privacy

0. Teaching and Assessment

1. Teaching

Lecture No.	Lecture Topic	Lecture Slides	Lecture Videos
0	Introduction to Data Privacy, What Is Data Privacy and Why Is It Important, Protecting Sensitive Data.	Lecture-00	https://www.youtube.com/watch?v=soliOHbzJog
1	Privacy and Anonymity, Need for Sharing Data, Data Mining and	Lecture-01	https://youtu.be/RRt08MvK4tE

	Analysis, Software Application Testing.		https://youtu.be/RRt08MvK4tE
2	Business Operations, Methods of Protecting Data.	Lecture-02	https://youtu.be/rurdUNzlTgE
3	Importance of Balancing Data Privacy and Utility, Measuring Privacy of Anonymized Data, Measuring Utility of Anonymized Data	Lecture-03	https://youtu.be/BQlP3uOIzAs
4	Introduction to Anonymization Design Principles	Lecture-04	https://youtu.be/Sx7TvLGFQLY
5	Nature of Data in the Enterprise, Multidimensional Data	Lecture-05	Video-05
6	Challenges in Privacy Preservation of Multidimensional Data	Lecture-06	Video-06
7	Graph Data	Lecture-07	Video-07
8	Static Data Anonymization: Multidimensional Data – Introduction, Classification of Privacy Preserving Methods.	Lecture-08	Video-08
9	Classification of Data in a Multidimensional Data Set	Lecture-09	Video-09
10	Protecting Explicit Identifiers, Protecting Quasi-Identifiers	Lecture-10	Video-10
11	Challenges in Protecting QI, Protecting Sensitive Data (SD)	Lecture-11	Video-11
12	Group-Based Anonymization: k-Anonymity	Lecture-12	Video-12
13	k-Anonymity	Lecture-13	Video-13
14	l-Diversity	Lecture-14	Video-14
15	t-Closeness	Lecture-15	Video-15
Assignment -1, Quiz -1 and Test-1 : Obtain Student Feedback			
16	Static Data Anonymization: Complex Data Structures - Introduction	Lecture-16	Video-16
17	Privacy Preserving Graph Data	Lecture-17	Video-17
18	Structure of Graph Data	Lecture-18	Video-18
19	Privacy Model for Graph Data	Lecture-19	Video-19
20	Privacy Model for Graph Data	Lecture-20	Video-20
21	Privacy Preserving Time Series Data	Lecture-21	Video-21
22	Time Series Data Protection Methods	Lecture-22	Video-22

23	Privacy Preservation of Longitudinal Data	Lecture-23	Video-23
24	Threats to Anonymized Data	Lecture-23	Video-23
25	Threats to Data Structures	Lecture-25	Video-25
26	Threats to Data Structures , Threats by Anonymization Techniques	Lecture-26	Video-26
27	Threats by Anonymization Techniques	Lecture-27	Video-27
28	Threats by Anonymization Techniques	Lecture-28	Video-28
29	Privacy Preserving Data Mining: introduction	Lecture-29	Video-29
30	Data Mining: Key Functional Areas of Multidimensional Data	Lecture-30	Video-30
31	Clustering	Lecture-31	Video-30
32	Privacy Preserving Test Data Manufacturing: Introduction	Lecture-32	Video-32
Assignment 2, Quiz -2, Test-2 and Submission of Assignment-1			
33	Test Data Fundamentals	Lecture-33	Video-33
34	Testing, Test Data	Lecture-34	Video-34
35	A Note on Subsets	Lecture-35	Video-35
36	Utility of Test Data: Test Coverage	Lecture-36	Video-36
37	Utility of Test Data: Test Coverage	Lecture-37	Video-37
38	Privacy Preservation of Test Data	Lecture-38	Video-38
39	Protecting Quasi-Identifiers	Lecture-39	Video-39
40	Protecting Sensitive Data (SD)	Lecture-40	Video-40
41	Quality of Test Data	Lecture-41	Video-41
42	Quality of Test Data	Lecture-42	Video-42
43	Anonymization Design for PPTDM	Lecture-43	Video-43
44	Insufficiencies of Anonymized Test Data	Lecture-44	Video-44
45	Insufficiencies of Anonymized Test Data	Lecture-45	Video-45
Quiz-03 and Test-03 and Submission of Assignment-2 Obtain Student Feedback			
Examination Preparation Break			
Term/Semester End Examination			

0. Assessment weight Distribution

	Quiz			Test			Assignment		CIE	SEE	Total marks
CO'S	**15**			**25**			**20**		**60**	**40**	**100**
Weight age	**Q1=5**	**Q2=5**	**Q3=5**	**T1=8**	**T2=8**	**T3=9**	**A1=10**	**A2=10**			
CO1=18	3	3	2	2					**10**	**8**	**18**
CO2=24	2	2	3	3	2				**12**	**12**	**24**
CO3=18				3	3	4			**10**	**8**	**18**
CO4=20					3	5			**08**	**12**	**20**
CO5=10							10		**10**		**10**
CO6=10								10	**10**		**10**
TOTAL	**15**			**25**			**20**		**60**	**40**	**100**

0. Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/PBL/ PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5th week	5	CO1/CO2				
Quiz-2	10th week	5	CO3/ CO4				
Quiz-3	15th week	5	CO5/ CO6				
Test-1	5th week	8	CO1/CO2/CO3				
Test-2	10th week	8	CO2/ CO3/CO4				
Test-3	15th week	9	CO3/ CO4				
Assignment-1	7th week	10	CO5				
Assignment-2	14th week	10	CO6				
SEE	18th Week	40	CO1- CO4				

0. Grading Criterion

- Based on total marks scored grade is Awarded.

  If marks scored is:

  - 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Attainment Calculations:

Recording Marks and Awarding Grades

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								

3								
N								
Total							**XXXXX**	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)
Average Grade:
Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	**Targeted Attainment Level**
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1
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70% of students will score C grade and above - Attainment Level 1 60% of students will score C grade and above - Attainment Level 2 50% of students will score C grade and above - Attainment Level 3	1

Performance Recording

Academic Year 2025-26	B. Tech. Computer Science-Business Systems	Semester 5	Section A	Course Code UE23CS3501	Course Title Course Tutor/s: Tutor's ID/Department:					
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the component of Examination	Class Average Marks	O-Graders >= 91	A+ Graders 81<= M<= 90	A Grader 71<= M<= 80	B+ Graders 61<= M<= 70	B Graders 51<= M<= 60	C Graders 40<= M<= 50	D Graders M<40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										

Performance Plotting

Mapping of Course Outcomes with Program Outcomes

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1															
CO 2															
CO 3															
CO 4															
CO 5															
CO 6															

0. Other Details

1. **Assignment Details or Problem Based Learning:** Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.
2. **Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity**: Copying and plagiarism in any form for any of the assessment components will result in zero marks.

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