BMS INSTITUTE OF TECHNOLOGY &MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2024– 25

Choice Based Credit System (CBCS)

UG PROGRAM: Department of Computer Science Engineering (CSE) | **Semester: VII**

Sl. No.	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week				Credits	Examination			
					L	T	P	PW		Duration in Hours	CIE Marks	SEE Marks	Total Marks
1	HS	21HSS71	Research Methodology	CSE	2	0	0	0	2	2	50	50	100
2	AEC	21CS72	Data Visualization Using Python	CSE	For Theory Course: 1	0	0	0	1	1	50	50	100
					For Practical course: 0	0	2	0		2			
3	PE	21CS73X	Professional Elective III	CSE	3	0	0	0	3	3	50	50	100
4	PE	21CS74X	Professional Elective IV	CSE	3	0	0	0	3	3	50	50	100
5	OE	21CS75X	Open Elective II	CSE	3	0	0	0	3	3	50	50	100
6	PW	21CSP76	Project Work Phase I	CSE	0	0	0	10	5	-	100	-	100
TOTAL					**12**	**0**	**2**	**10**	**17**		**350**	**250**	**600**

Professional Elective - Group III

Course Code	Course Title
21CS731	Deep Learning
21CS732	Data Warehousing and data mining
21CS733	Advanced Java
21CS734	Compiler Design
21CS735	Object Oriented Modeling and Design

Professional Elective - Group IV

Course Code	Course Title
21CS741	Distributed Data Architecture-NoSQL
21CS742	Cloud Computing
21CS743	Cyber Security
21CS744	Artificial Intelligence
21CS745	Software Testing

Open Elective (OE) - Group II

Course Code	Course Title
21CS751	Cloud Computing
21CS752	Introduction to AR/VR
21CS753	Introduction to JAVA
21CS754	Introduction to Algorithms

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute affiliated to VTU)

Scheme of Teaching and Examination: Effective from AY 2021– 22 Choice Based Credit System (CBCS)

UG PROGRAM: Department of Computer Science Engineering (CSE) — **Semester: VIII**

Sl. No	Course Category	Course Code	Course Title	Teaching Dept.	Teaching Hours /Week				Credits	Examination			
					L	T	P	PW		Duration in Hours	CIE Marks	SEE Marks	Total Marks
1	PE	21CSE81X	MOOC Professional Elective Courses	CSE	-	-	-	-	3	3	30	70	100
2	INT	21INT82	Research / Industrial Internship	CSE	0	0	0	14	7	3	50	50	100
3	PW	21CSEP83	Project Work Phase II	CSE	0	0	0	20	10	3	100	100	200
TOTAL					0	0	0	34	**20**	-	**200**	**200**	**400**

MOOC Professional Elective Courses: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students during the VI semester only. Students are required to choose only the courses which are suggested by the respective BoS. Duration of the online course should be of a minimum of 12 weeks. Students can able to complete the specified online courses with a qualifying certificate issued by the competent authority. The online courses can be completed anytime starting from VI semester onwards and the credits will be considered during the VIII semester only. The courses are to be offered on the SWAYAM – NPTEL platform only. The credits earned for this course will not be considered for claiming the credits under the Honors Degree programme.

MOOC Professional Elective			**MOOC Professional Elective**		
Course Code	**NPTEL Course ID**	**Course Title**	**Course Code**	**NPTEL Course ID**	**Course Title**
21CSE81A	https://onlinecourses.nptel.ac.in/noc24_cs90/preview	Social Network Analysis	21CSE81F	https://onlinecourses.nptel.ac.in/noc24_cs104/preview	Applied Accelerated Artificial Intelligence
21CSE81B	https://onlinecourses.nptel.ac.in/noc24_cs94/preview	Ethical Hacking	21CSE81G	https://onlinecourses.nptel.ac.in/noc24_cs91/preview	Software Testing
21CSE81C	https://onlinecourses.nptel.ac.in/noc24_cs95/preview	Introduction to Industry 4.0 and Industrial Internet of Things	21CSE81H	https://onlinecourses.nptel.ac.in/noc24_cs107/preview	Statistical Learning for Reliability Analysis
21CSE81D	https://onlinecourses.nptel.ac.in/noc24_cs102/preview	Reinforcement Learning	21CSE81I	https://onlinecourses.nptel.ac.in/noc24_cs126/preview	Design & Implementation of Human-Computer Interfaces
21CSE81E	https://onlinecourses.nptel.ac.in/noc24_cs89/preview	Deep Learning for Computer Vision	21CSE81J	https://onlinecourses.nptel.ac.in/noc24_mg92/preview	E-Business
			21AM81E	onlinecourses.nptel.ac.in/noc21_ma38/preview	Essential Mathematics for Machine Learning

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER -VII

Data Visualization Using Python (0:0:2) 1

(Effective from the academic year 2021-22)

Course Code	21CS72	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	20	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications
2. Using Python programming language to develop programs for solving real-world problems
3. Implementation of Matplotlib for drawing different Plots
4. Demonstrate working with Seaborn, Bokeh.
5. Working with Plotly for 3D, Time Series and Maps.

Experiments

1a) Write a python program to find the best of two test average marks out of three test's marks accepted from the user.
1b) Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.

2a) Defined as a function F as Fn = Fn-1 + Fn-2. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.
2b) Develop a python program to convert binary to decimal, octal to hexadecimal using functions.

3a) Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.
3b) Write a Python program to find the string similarity between two given strings

4a) Write a Python program to Demonstrate how to Draw a Bar Plot using Matplotlib.
4b) Write a Python program to Demonstrate how to Draw a Scatter Plot using Matplotlib.

5a) Write a Python program to Demonstrate how to Draw a Histogram Plot using Matplotlib.
5b) Write a Python program to Demonstrate how to Draw a Pie Chart using Matplotlib.

6a) Write a Python program to illustrate Linear Plotting using Matplotlib.
6b) Write a Python program to illustrate liner plotting with line formatting using Matplotlib.

7) Write a Python program which explains uses of customizing seaborn plots with Aesthetic functions.

8a) Write a Python program to explain working with bokeh line graph using Annotations and Legends.
8b) Write a Python program for plotting different types of plots using Bokeh.

9) Write a Python program to draw 3D Plots using Plotly Libraries.

10) Build a Tableau dashboard of chocolate sales for 5 different countries and show top 10 salespersons of each country. Host this on Tableau public cloud domain.

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Course outcomes: CO 1. Demonstrate the use of IDLE or PyCharm IDE to create Python Applications CO 2. Use Python programming constructs to develop programs for solving real-world problems CO 3. Use Matplotlib for drawing different Plots CO 4. Demonstrate working with Seaborn, Bokeh for visualization. CO 5. Use Plotly for drawing Time Series and Maps.	
Text books:	
1.	Mario Dobler, Tim Großmann, **Data Visualization with Python: Create an impact with meaningful data insights using interactive and engaging visuals,** Packt Publishing Limited.
References:	
1.	https://www.youtube.com/watch?v=_uQrJ0TkZlc

BMS Institute of Technology and Management, Bengaluru 560064
Choice Based Credit System (CBCS)
SEMESTER - VII

Research Methodology (2:0:0)2

Common to all Branches

(Effective from the academic year 2024-25 for 2021 Scheme)

Course Code	21HSS71	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:0	SEE Marks	50
Total Number of Lecture Hours	26	Exam Hours	02

CREDITS : 02

Course objectives:

This course will enable students to

1. Give an overview of the research methodology, research problem.
2. Gain knowledge on research design.
3. Design of sampling survey and measurement & scaling.
4. Understand data collection and data preparation.
5. Familiarize interpretation and writing research reports.

Module – 1

Introduction: Importance of Research and Development (R&D) for development of Nation, Introduction to research and research methodology.
Meaning of Research, objectives of Research, Types of research, Research Approaches, Significances of Research, Research Process, Criteria of Good Research.

Defining the Research Problem: What is a Research Problem? Selecting the Research Problem, Necessity of Defining the Problem, Techniques Involved in Defining a problem. **(6 Hours)**

Module – 2

Research Design: Meaning of Research Design, need for Research design, Feature of a Good design, Important concepts relating to Research Design: Dependent, independent and extraneous variable, Control, Confounded relationship. Research Design in case of exploratory research studies, in case of descriptive and diagnostic research studies Basic Principles of Experimental Designs. **(5 Hours)**

Module – 3

Design of sampling survey: Sample Design: Objective, sampling units and frame, size of sample, parameter of interest, selection of proper sample design, pilot survey and budgetary constraints. Sampling errors, non-sampling errors, Sample survey vs. census survey, on-probability samplings.

Measurement and scaling: Quantitative and qualitative data, Classification of measurement scales. Goodness of measurement scales: Techniques of developing measurement tools, scaling, Scale classification bases, scaling techniques. **(5 Hours)**

Module – 4

Data Collection: Experiments and Surveys, collection of primary data: observation method, Interview method. Collection of data through questionnaires, Collection of data through schedules. Collection of secondary data. Selection of appropriate method for data collection, case study method.

Data Preparation: Questionnaire checking, editing, coding, tabulation, data cleaning, data adjusting, problems in preparation process, missing values and outliers, type of analysis.

(5 Hours)

Module – 5

Interpretation and Report Writing

Meaning of Interpretation, Techniques of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of Research Report, Types of Reports: Technical report, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research. **(5 Hours)**

Course outcomes:

The students will be able to:

CO1: Describe research methodology and research problem.
CO2: Illustrate research design and various types.
CO3: Discuss sampling survey and measurement.
CO4: Summarise data collection and preparation.
CO5: Explain techniques of interpret research reports.

Text Book:

1. CR Kothari and Gaurav Garg, Research Methodology, New Age International Publishers, 2020.

References:

1. Panneerselvam R, Research Methodology, Prentice Hall of India, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U K, An introduction to Research Methodology, RBSA Publishers, 2002**.**
3. Ranjit Kumar, Research Methodology, 4th Edition, SAGE Publications Ltd. 2014.

ASSESSMENT METHODS:

CIE Components (50 Marks)

The pattern of the CIE question paper is MCQ.

Three Unit Tests each of 40 Marks, MCQ type (duration 01 hour). Sum of the three Internal Assessments Tests Marks will be out of 120 Marks and scaled down to 30 Marks.

Two Assignment : 20 Marks
Two AATs : 20 Marks

Sum of the Assignment and AATs will be out of 40 Marks and scaled down to 20 Marks .

Internal Assessments Tests : 30 Marks
Assignment and AAT : 20 Marks
Total CIE Marks : 50 Marks

SEE Components (50 Marks)

- The pattern of the SEE question paper is MCQ.
- SEE question paper will be set for 100 questions of each of 01 marks.

Assessment Details (both CIE and SEE):

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).
- The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2022 Scheme

SEMESTER – VII

ADVANCED JAVA (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CSE733	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to: (List as per the requirement of your course)

1. Identify the need for advanced Java concepts like Enumerations and Collections
2. Adapt servlets to build server side programs
3. Make use of JDBC to access database through Java Programs
4. Demonstrate the use of Java concepts to develop component-based Java software

Preamble: This course enables the student to learn the advanced concepts of Java with Object Oriented Programming. They will be able to manipulate collections for real world problem with the usage of servlet and databases.

Module – 1

Enumerations, Autoboxing and Annotations(metadata):

Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member annotations, Built-In annotations.

Text book 1: Ch.12 **(8 hours)**

Module – 2

The collections and Framework:

Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection Via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, Working with Maps, Comparators, The Collection Algorithms, Why Generic Collections? The legacy Classes and Interfaces, Parting Thoughts on Collections.

Text Book 1: Ch.17 **(8 hours)**

Module – 3

String Handling:

The String Constructors, String Length, Special String Operations, String Literals, String Concatenation, String Concatenation with Other Data Types, String Conversion and toString( ) Character Extraction, charAt( ), getChars( ), getBytes( ) toCharArray(), String Comparison, equals( ) and equalsIgnoreCase( ), regionMatches( ) startsWith( ) and endsWith( ), equals( ) Versus == , compareTo( ) Searching Strings, Modifying a String, substring( ), concat( ), replace( ), trim( ), Data Conversion Using valueOf( ), Changing the Case of Characters Within a String, Additional String Methods, StringBuffer , StringBuffer Constructors, length( ) and capacity( ), ensureCapacity( ), setLength( ), charAt( ) and setCharAt( ), getChars( ),append( ), insert( ), reverse( ), delete( ) and deleteCharAt( ), replace( ), substring( ), Additional StringBuffer Methods, StringBuilder

Text Book 1: Ch.15 **(8 hours)**

Module – 4

Life Cycle of a Servlet
Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects.

Text Book 1: Ch. 31
Text Book 2: Ch. 11 **(8 hours)**

Module – 5

The Concept of JDBC
JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.
Text Book 2: Ch. 06 **(8 hours)**

Course Outcomes:

The students will be able to:
CO1: Illustrate the need for advanced Java concepts in developing modular and efficient programs.
CO2: Analyse how servlets fit into Java-based web application architecture.
CO3: Apply JDBC API to access the database information.
CO4: Develop reusable software components using Java & J2EE concepts.

Textbooks:

1. Herbert Schildt: JAVA the Complete Reference, 11th Edition, Tata McGraw Hill, 2020.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.

References:

1. Uttam K Roy, Advanced JAVA programming, Oxford University press, 2015.
2. Y. Daniel Liang: Introduction to JAVA Programming, 7thEdition, Pearson Education, 2007.
3. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education,2004.

Alternate Assessment Tools (AATs) suggested:

- MOOCS
- Mini Project
- Program Based Assignment of higher cognitive levels.

Web links / e – resources:
https://www.codecademy.com/learn/learn-java
https://www.udemy.com/course/java-tutorial/
https://hyperskill.org/tracks/8
https://www.educative.io/courses/learn-java-from-scratch

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 scheme

SEMESTER VII

COMPILER DESIGN (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS734	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Describe the phases of compiler.
2. Familiarize with various parsing techniques and design them for different grammars.
3. Understand the code generation and optimization techniques.

Preamble: The world depends on programming languages, because all the software running on all the computers will be written in some programming language. But, before a program can be run, it must be translated into a form in which it can be executed by a computer. The software systems that do this translation are called compilers. In this course, students will learn to how to design and implement compilers.

Module – 1

Language processors: The structure of a Compiler; The evolution of programming languages; The science of building a Compiler; Applications of compiler technology; Programming language basics. **Lexical analysis:** The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

T1 : 1.1 - 1.6, 3.1 - 3.4 **(8 hours)**

Module – 2

Syntax Analysis – 1: Introduction, the role of the Parser, Error-Recovery Strategies, writing a Grammar, Top-down Parsing: Recursive-Descent Parsing, First and Follow, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing

T1 : 4.1, 4.3, 4.4 **(8 hours)**

Module – 3

Syntax Analysis – 2: Bottom-up Parsing: Reductions, Handle Pruning, Shift-Reduce Parsing, Conflicts During Shift-Reduce Parsing. **Introduction to LR Parsing:** Simple LR; More powerful LR parsers, Parser Generators.

T1 : 4.5-4.9 **(8 hours)**

Module – 4

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD', Applications of SDT, **Intermediate Code Generation:** Variants of syntax trees, Three-address code, Types and Declarations, Translation of expressions, Type Checking, Control flow; Back patching; Switch statements;

T1 : 5.1-5.3, 6.1-6.8 **(8 hours)**

Module – 5

Code Generation: Issues in the design of Code Generator, The Target Language, Addresses in the target code, Basic blocks and Flow graphs, Optimization of basic blocks, A Simple Code Generator.

T1: 8.1-8.6 **(8 hours)**

Course Outcomes:

The students will be able to: **(List the COs as per the course requirements)**

CO1: Acquire fundamental understanding of the structure of a Compiler.

CO2: Apply the concept of tokenization, parsing, code generation, code optimization for the given piece of code written in any language.

CO3: Analyse the given set of grammars.

CO4: Demonstrate the grammars for a given code.

Textbooks:

1. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers-Principles, Techniques and Tools, Pearson, 2nd edition, 2007.
2. Doug Brown, John Levine, Tony Mason, Lex & YACC, O'Reilly Media, October 2012.

References:

1. Compiler Design, K Muneeswaran, Oxford University Press 2013.
2. System programming and Compiler Design, K C Louden, Cengage Learning

Alternate Assessment Tools (AATs) suggested:

Lex and YACC –The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers.

Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program.

Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse**.**

A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity.

Text book 2: Chapter 1, 2 and 3.

Web links / e – resources:

1. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/
2. https://dl.acm.org/doi/pdf/10.5555/578789
3. https://courses.grainger.illinois.edu/cs421/sp2011/lectures/lecture7-2up.pdf
4. https://www.javatpoint.com/compiler-tutorial

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 scheme

SEMESTER VII

Object Oriented Modelling and Design (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS735	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course objectives:

This course will enable students to:

1. Select the basic elements of modeling such as Things, Relationships and Diagrams depending on the views of UML Architecture and SDLC.
2. Apply basic and Advanced Structural Modeling Concepts for designing real time applications.
3. Design Class and Object Diagrams that represent Static Aspects of a Software System.
4. Analyze Dynamic Aspects of a Software System using Use Case, Interaction and Activity Diagrams.

Preamble: Object and classes are important for software developing life cycle this course says about organize them in form of Use-Case Modelling**,** sequence diagram, activity diagram and Behaviour diagram.

Module – 1

Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived Data; Packages. State Modeling: Events, States, Transitions and Conditions, State Diagrams, State diagram behavior.

Text Book-1: 4, 5 (8 hours)

Module – 2

UseCase Modelling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behaviour-The state chart Diagram; Integrated Object-oriented Models.

Text Book-2:Chapter- 6:Page 210 to 250 (8 hours)

Module – 3

Process Overview, System Conception and Domain Analysis: Process Overview: Development stages; Development life Cycle; System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Domain Analysis: Overview of analysis; Domain Class model: Domain state model; Domain interaction model; Iterating the analysis.

Text Book-1:Chapter- 10,11,and 12 **(8 hours)**

Module – 4

Use case Realization: The Design Discipline within up iterations: Object Oriented Design The Bridge between Requirements and Implementation; Design Classes and Design within Class Diagrams; Interaction Diagrams-Realizing Use Case and defining methods; Designing with

Communication Diagrams; Updating the Design Class Diagram; Package Diagrams Structuring the Major Components; Implementation Issues for Three-Layer Design.

Text Book-2: Chapter 8: page 292 to 346 **(8 hours)**

Module – 5

Design Patterns: Introduction; what is a design pattern?, Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).
Text Book-3: Ch-1: 1.1, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8,Ch-3,Ch-4. **(8 hours)**

Course Outcomes: The students will be able to:

CO1: Describe the concepts of object-oriented and basic class modelling.
CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
CO3: Choose and apply a befitting design pattern for the given problem.

TextBooks:

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005.
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning, 2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns -Elements of Reusable Object-Oriented Software, Pearson Education,2007.

Reference Books:

1. Grady Booch et. al.: Object-Oriented Analysis and Design with Applications,3rd Edition,Pearson Education,2007.
2. Frank Buschmann, ReginеMeunier, Hans Rohnert, Peter Sommerlad, Michel Stal: Pattern Oriented Software Architecture. A system of patterns , Volume 1, John Wiley and Sons.2007.
3. Booch, Jacobson, Rambaugh : Object-Oriented Analysis and Design with Applications, 3rd edition, pearson, Reprint 2013

Alternate Assessment Tools (AATs) suggested:

1.Project based learning will make students to understand object oriented concept correctly

Web links / e – resources:

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) 2021 Scheme

SEMESTER -VII

Deep Learning (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS731	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable the students to:

1 Understand the fundamental concepts of deep learning, including artificial neural networks, feedforward networks, convolutional networks, recurrent neural networks and their applications in various domains.

2. Gain reasonable proficiency in implementing and training deep learning models using gradient-based learning techniques, such as backpropagation, and applying regularization methods etc. to improve model performance.

3. Analyze the structure and working of convolutional neural networks, including the convolution operation, pooling and efficient convolution algorithms, and apply them to tasks like image classification and object detection.

Preamble: Deep learning is a sub-field of Machine learning, it is a key enabler of AI powered technologies being developed across the globe. In this course, students will learn an intuitive approach to build complex models that help machines to solve real-world problems with human-like intelligence. Deep learning is an aspect of data science that drives many applications and services that improve automation, performing analytical and physical tasks without human intervention. This enables development of products and services such as digital assistants, voice-enabled devices, self-driving cars, Generative AI and GANs.

Module – I

Introduction to Deep Learning: Introduction, Deep learning Model, Historical Trends in Deep Learning, Machine Learning Basics: Learning Algorithms, Supervised Learning Algorithms, Unsupervised Learning Algorithms**.**

T1: Ch 1, 5.1, 5.7, 5.8 **(8 hours)**

Module – II

Feedforward Networks: Introduction to feedforward neural networks, Gradient-Based Learning, Hidden Units, Architecture Design, Backpropagation and Other Differentiation Algorithms, Historical Notes.

T1: Ch 6 **(8 hours)**

Module – III

Optimization for Training Deep Models: Empirical Risk Minimization, Challenges in Neural Network Optimization, Basic Algorithms: Stochastic Gradient Descent, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates: The AdaGrad algorithm, The RMSProp algorithm, Choosing the Right Optimization Algorithm**.**

T1: Ch 8.1 to 8.5 **(8 hours)**

Module – IV

Convolutional Networks: The Convolution Operation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

T1: Ch 9.1 to 9.9 **(8 hours)**

Module – V

Recurrent and Recursive Neural Networks: Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

T1: Ch 10.1 to 10.6, 10.10 **(8 hours)**

Course outcomes:

The student will be able to:

CO1. Apply the mathematical concepts of deep learning.

CO2. Apply various deep learning techniques for real-world applications.

CO3. Examine the various deep learning models and architectures.

CO4. Design and implement deep learning architectures for diverse data.

Text books:

1.	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.

References:

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009.

2. N.D.Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016.

3.Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications.

Alternate Assessment Tools (AATs) suggested:

- Presentation on Case Study/Real-time Applications for Deep Learning.
- Implementation of Sample Programs of Deep Learning Concepts.

Web links / e – resources:

- **https://www.coursera.org/specializations/deep-learning**
- **https://onlinecourses.nptel.ac.in/noc20_cs62/preview**
- **https://onlinecourses.nptel.ac.in/noc20_cs50/preview**

B.E. COMPUTER SCIENCE & ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER – VI

Data warehousing and Data mining (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**21CS732**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Be familiar with mathematical foundations of data warehousing and OLAP.
2. Implement classical models and algorithms in data warehouses and data mining & OLAP queries.
3. Discover interesting patterns using clustering, classification, association finding on real world data.
4. Develop skill in selecting the different algorithms and analyse it with the support of tools for solving practical problems.

Preamble:

This course focuses on the concepts, techniques, design and applications of data warehousing and OLAP. The students opting for this course will understand and implement classical algorithms in data warehousing. The course demonstrates how to analyse the data, identify the problems, and choose the relevant algorithms to apply. The students will be able to assess the strengths and weaknesses of the algorithms and analyse their behaviour on real datasets.

Module – 1

Data warehousing and OLAP: Data Warehouse basic concepts, Data Warehouse Modeling, Data Cube and OLAP: Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Software, Typical OLAP Operations.

Textbook 2: Ch.4.1,4.2

R1(Ch-8: 8.1 - 8.5) (08 Hours)

Module – 2

Data warehouse implementation &Data Mining : Introduction, What is Data Mining?, Motivating Challenges, Data Mining Tasks, Which technologies are used for data mining, Kinds of pattern that can be mined, Data Mining Applications, Data Pre-processing, Data cleaning, data integration, data reduction and data transformation, An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.

Textbook 2: Ch.4.4

Textbook1(Ch-1: 1.1 – 1.4) (08 Hours)

Textbook1(Ch-2: 2.3.1 – 2.3.7)

Module – 3

Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FPGrowth Algorithm, Evaluation of Association Patterns.

Textbook 1: Ch 6.1 to 6.7 (Excluding 6.4)

(08 Hours)

Module – 4

Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.

T1(Ch-4: 4.1 - 4.3) (08 Hours)

Module – 5

Clustering Techniques: Overview, Features of cluster analysis, Types of Data and Computing Distance, Types of Cluster Analysis Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Quality and Validity of Cluster Analysis.

T1(Ch-7: 7.1 - 7.5) (08 Hours)

Course Outcomes:

The students will be able to:

- **CO1**: Demonstrate knowledge of the basic concepts and modelling involved in data Ware housing.
- **CO2**: Examine data and select suitable methods for applying data mining techniques and methods to data sets.
- **CO3**: Analyze the frequent patterns using association analysis algorithms.
- **CO4**: Demonstrate various algorithms based on data mining tools & OLAP.

Textbooks:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Addison-Wesley, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

References:

1. G. K. Gupta, "Introduction to Data Mining with Case Studies", 3rd Edition, PHI, New Delhi, 2009.
2. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth Impression,2012.

Alternate Assessment Tools (AATs) suggested:

- **Case Study on different Classification and clustering techniques.**
- **Case Study on different OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.**

Web links / e – resources:

1. https://www.pearsonhighered.com/assets/preface/0/1/3/3/0133128903.pdf
2. https://developers.google.com/machine-learning/clustering/clustering-algorithms

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER– VII

Cloud Computing (3:0:0) 3

(Effective from the academic year 2024-25)

Subject Code	21CS742	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable the students to:

1. Explain the fundamentals of cloud computing
2. Illustrate the cloud application programming and Aneka platform
3. Contrast different cloud platforms used in industry
4. Understand framework of Aneka cloud for data intensive Application

Preamble:

In today's rapidly evolving technological landscape, cloud computing has emerged as a transformative force, reshaping the way businesses and individuals interact with digital resources. By offering scalable, on-demand access to computing power, storage, and various applications, cloud computing provides unprecedented flexibility and efficiency.

Module– 1

Introduction: Significance and scope of Cloud Computing, Cloud Computing in Economic growth of Nation, Impact of Cloud Computing on societal problems, sustainable solutions, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead,.

Text book 1: Chapter -1 **(8 Hours)**

Module– 2

Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google App Engine, Microsoft Azure,

Text book 1: Chapter -3 **(8 Hours)**

Module– 3

Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Para virtualization, VMware: Full Virtualization, Microsoft Hyper-V.

Text book 1: Chapter -3 **(8 Hours)**

Module– 4

Cloud Computing: Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy

Text book 1: Chapter -4 **(8 Hours)**

Module– 5

Amazon Web Services : Explore the UI, Navigation, Pricing, Lambda , Security IAM : IAM Console , Roles, Policies, and Users , Roles for Lambda, Your First Code Hello World, Testing . CloudWatch, Environment Variables, Using Environment Variables in Hello World, HTTP Event: Exploring API Gateway, Using API Gateway as a Trigger , Response to Trigger, Storage Event, Using S3 as a Trigger, Response to Trigger

Text book 2: Chapter -3 **(8 Hours)**

Course outcomes:

The students will be able to:

CO1 Understand the basic concepts and terminologies of cloud computing
CO2 Apply the concept of cloud computing to different real word examples
CO3 Analysis the cloud frameworks and technologies for different IT Industry
CO4 Design real word cloud applications
CO5 Study the framework of Aneka cloud for data intensive Application

Text Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi. Computing Mastering Cloud, McGraw Hill Education, 2013, 3rd Edition, ISBN (10 digits): 1-25-902995-6.
2. Maddie Stigler, Beginning Serverless: Computing Developing with Amazon Web Services, Microsoft Azure, and Google Cloud, Apress Berkely CA publisher, Beginning Serverless Computing: Developing with Amazon Web Services, Microsoft Azure, and Google Cloud | SpringerLink

References

1. Dan C. Marinescu, Morgan Kaufmann, Cloud Computing Theory and Practice, Elsevier, 2nd Edition 2013.

Alternate Assessment Tools (AATs) suggested:

1. Technical Presentations
2. Project-Based Assessments

Web links / e resources:

1. Cloud Computing - Overview (youtube.co m)
https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J

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B.E. COMPUTER SCIENCE AND ENGINEERING Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER -VII

Cyber Security (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS743	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students :

1. To understand various types of cyber-attacks , cyber-crimes and IT Act 2000
2. To learn threats and risks within context of the cyber security
3. To have an overview of the cyber laws & concepts of cyber forensics
4. To study the defensive techniques against these attacks
5. Explore privacy issues in different domains in the framework of law and Regulations

Preamble

This course introduces to undergraduate students the concepts, technologies, practices and challenges associated with cybersecurity as applied in organizations. Protection as well as disclosure of information pose unique challenges and also allude to economic and technological implications. The course takes a broad view of cyber security along with information privacy by analyzing relevant organizational, human, legal and policy issues. Through this course, students will explore cyber security along with information privacy with a managerial focus. Students are expected to develop a wholesome understanding about cyber security and privacy risks to businesses covering governance, compliance and risk mitigation and closely study certain domains.

Module I

Introduction to Cyber Security:

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy, The Indian IT ACT 2000 and amendments.

Text Book 1 : Chapter 1 , 2 & 6 (1.1-1.5, 2.1-2.7, 6.4- 6.8) (8 hours)

Module II

Methods used in Cybercrime

Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware,Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL-injection, Buffer Overflow.

T**ext Book 1 : Chapter 4 (4.1-4.11) (8 hours)**

Module III

Phishing , Identity Theft and Digital Forensics

Introduction, Phishing Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy- Phishing. Identity Theft PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber Forensics and Digital Evidence, Digital Forensics Life Cycle.

Text Book 1 : Chapter 5 (5.1- 5.3) (8 hours)

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Module IV

Some Key commands

Unix Command Lines, Backtrack Linux, Mac Ports, Cygwin, Windows Power Shell, NetCatCommands NetCat Uses, SSH, Data Pipe, Fpipe.

Text Book 2 : Chapter 2 (**8 hours)**

Module V

Privacy Issues: What is privacy ? What is the data life cycle? What are the key privacy concern in the cloud? Who is responsible for protecting privacy? Challenges to privacy risk management and compliance in relation to cloud computing, legal and regulatory implications, US laws and regulations, international laws and regulations.

C**ybercrime: Examples and Mini-Cases**

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Book 3: Chapter 7 **(8 hours)**

Course outcomes:

CO1: Define and illustrate cyber security concepts, methods used in cybercrime and role of IT ACT 2000 for the given case.

CO2: Discuss the methods used for identity theft and Illustrate the digital forensics cycle for the given problem.

CO3: Illustrate the use of key commands and design policies, procedures and mechanisms to manage Privacy issues in different domains for the given problem in reference to given laws / regulations.

CO4: Analyze the given cyber security problem/ case study to infer the lapses or role of technology and law and demonstrate the suitable tool to analyze the given cyber incident/ attack including digital forensics.

CO5: Develop techniques to mitigate attacks for the identified problem/ case study.

Text books:

1.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley.
2.	Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2) (https://knowledge103.wordpress.com/wp-content/uploads/2016/07/anti-hacker-tool-kit-4th-editioncyber-security.pdf)
3.	Cloud Security and privacy, an enterprise perspective on Risks and Compliance by Tim Mather, Subra Kumaraswamy, Shahed Latif, O'REILLY publication, 2009 First Edition, ISBN 13: 978-81-8404-815-5.

References:

1	Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2	Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber security - CRC Press
3	Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations - Cengage Learning

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Alternate Assessment Tools (AATs) suggested: (any Two)	
1.	**Problem Based Learning** : Explore the selected case study/ problem of cyber-security preferably from hacker-earth or any recommended source and implement a mechanism , develop executable code for mitigating the attack/ threat.
2.	**MOOC** : Complete the online Course (MOOC) of 10 hours duration certification in the domain of cyber security/privacy/ digital forensics/ ethical hacking and submit the certificate .
3.	**Tool usage :** Investigate any contemporary cyber security/ forensic problem and solve using the modern relevant tools available as open source.
4.	**Mini-project :** Carry out a mini project with suitable methodology on the selected problem (hackerearth/ leetcode / Git hub/) and prepare a report/ paper in IEEE format.
5.	**Team work** : Students in a group of 3 to 4 members to demonstrate the open source tools for password cracking, SQL injection and DDOs attacks etc.

Web links / e-resources:

1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview, (Cyber Security and Privacy, By Prof. Saji K Mathew | IIT Madras)
2. https://onlinecourses.nptel.ac.in/noc22_cs13/preview (Ethical Hacking By Prof. Indranil Sen Gupta | IIT Kharagpur).
3. https://www.salvationdata.com/work-tips/the-top-20-open-source-digital-forensic-tools-for-2024/ (The top 20 open source Digital Forensics Tools for 2024)
4. https://github.com/topics/digital-forensics/
5. https://www.eccouncil.org/
6. https://www.simplilearn.com
7. https://www.mygreatlearning.com
8. https://github.com/AbdulMoizAli/SQL-Injection-Demo, (SQL injection Demo.)
9. https://www.infosecinstitute.com/resources/hacking/10-popular-password-cracking-tools/(10 most popular password cracking tools)
10. https://www.cloudflare.com/en-gb/learning/ddos/ddos-attack-tools/how-to-ddos/,
11. https://www.bluevoyant.com/knowledge-center/understanding-digital-forensics-process-techniques-and-tools

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B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 scheme

SEMESTER – VII

Artificial Intelligence (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS744	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Gain a historical perspective of AI and its foundations.
2. Become familiar with basic principles of AI toward problem solving.
3. Get to know approaches of inference, perception, knowledge representation, and learning.

Preamble: Artificial Intelligence (AI) is a field with a rich history and solid foundations that have evolved over decades. Originating from early computational theories and the quest to create machines capable of mimicking human thought, AI has grown into a multifaceted discipline. To understand AI comprehensively, it is essential to gain a historical perspective, tracing its development from the pioneering work of Alan Turing and John McCarthy to the sophisticated systems of today. Familiarity with the basic principles of AI is crucial for addressing a wide range of problem-solving scenarios. These principles include algorithms, data structures, and computational complexity, which together form the backbone of AI applications. By applying these principles, AI systems can analyze data, recognize patterns, and make decisions with minimal human intervention.

Module – I

Introduction: What is AI? Foundations and History of AI Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.

Text book 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4 **(8 hours)**

Module – II

Problem-solving: Problem-solving agents, Example problems, Searching for Solutions Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;

Text book 1: Chapter 3- 3.1, 3.2, 3.3, 3.4 **(8 hours)**

Module – III

Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic

Text book 1: Chapter 3-3.5,3.6 Chapter 4 – 4.1, 4.2 Chapter 7- 7.1, 7.2, 7.3, 7.4, 7.5 **(8 hours)**

Module – IV

First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution

Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5 **(8 hours)**

Module – V

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited

Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition

Text Book 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 Text Book 2: Chapter 20 **(8 hours)**

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Course outcomes:

CO1: Apply knowledge of agent architecture, searching and reasoning techniques for different applications.
CO2: Compare various Searching and Inferencing Techniques.
CO3: Develop knowledge base sentences using propositional logic and first order logic
CO4: Describe the concepts of quantifying uncertainty.
CO5: Use the concepts of Expert Systems to build applications.

Text books:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson,2015
2. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition,Tata McGraw Hill,2013

References:

1. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011.
2. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980.
3. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Alternate Assessment Tools (AATs) suggested:

- MOOC courses

Web links / e – resources:

- https://www.coursera.org/learn/introduction-to-ai
- https://study.iitm.ac.in/ds/course_pages/BSCS3003.html
- https://onlinecourses.nptel.ac.in/noc23_cs09/preview
- https://www.ibm.com/topics/machine-learning
- https://www.coursera.org/specializations/deep-learning

B.E. COMPUTER SCIENCE AND ENGINEERING

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SEMESTER -VII

Software Testing (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS745	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Explain different testing techniques.
2. Differentiate the various testing techniques.
3. Apply suitable technique for designing of flow graph.
4. Analyze the problem and derive suitable test cases.

Preamble This course enhances the testing skills of students enabling them to apply various testing techniques in appropriate scenarios. It also trains the students to improve the quality of a software project and to review a software project to ensure that quality remains high throughout the project.

Module I

Basics of Software Testing: Humans, Errors and Testing, Software Quality, Requirements Behavior and Correctness, Correctness versus Reliability, Testing and Debugging, Test Metrics, Testing and Verification, Test-generation Strategies, Static Testing.

A Perspective on Testing: Definitions, Test Cases, Insights from Venn Diagram, Identifying Test Cases, Error and fault taxonomies, Levels of testing.

Paul C. Jorgensen: Software Testing, A Craftsman's Approach,

Textbook 1: Ch1, Textbook 2:Ch. 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.8, 1.11, 1.12. (8 hours)

Module II

Functional Testing: Boundary Value Testing - Boundary value analysis, Robustness testing, Worst-case testing, Special Value Testing,

Equivalence Class Testing: Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem

Textbook 1: Ch. 5, 6 (8 hours)

Module III

Decision Table Based Testing: Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem

Path testing: DD paths, Test coverage metrics, Basis path testing

Dataflow testing: Definition-Use testing, Slice-based testing

Textbook 1: Ch 7,8.18.2,8.3, 9 (8 hours)

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Module IV
Life Cycle Based Testing: Traditional water fall testing, Testing in Iterative Life Cycles, Agile Testing **Integration Testing:** A closer look at the SATM system, Decomposition-based, call graph-based, Path based integrations. **Textbook 1: Ch. 11.1,11.2,11.3 , Ch 13.1,13.2,13.3,13.4 (8 hours)**
Module V
System Testing: Threads, Requirement Specification, Finding Threads, Structural strategies for thread tesing, SATM test threads System testing guidelines, ASF testing example. **Interaction Testing:** Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing **Textbook 1: Ch 14,Ch 15 (8 hours)**
Course outcomes: At the end of the course students should be able to: CO 1. Explain the significance of software testing and quality assurance in software development CO 2. Apply the concepts of software testing to assess the most appropriate testing method. CO 3. Analyze the importance of testing in software development. CO 4. Evaluate the suitable testing model to derive test cases for any given software

Text books:	
1.	4rd Edition, Auerbach Publications, 2017.
2.	Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2017.
References:	
1.	Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015.
2.	Mauro Pezze, Michal Young: Software Testing and Analysis Process, Principles and Techniques, Wiley India, 2009.
	Alternate Assessment Tools(AATs): Online Certification on Selenium tool for beginners Explore any testing tool and apply it on any software application for testing and submit the report
	Web links / e resources: https://archive.nptel.ac.in/courses/106/101/106101163/

B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER VII

Distributed Data Architecture-NoSQL (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS741	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph).
2. Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases.
3. Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.

Preamble: This course introduces the students to distinguish the different types of NoSQL databases and makes understand the impact of the cluster on database design. It also covers the concepts of distribution models, map-reduce operations and document databases. Students will be able to assess various applications using NoSQL databases.

Module 1

Introduction to NOSQL: Why NoSQL? The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. More Details on Data Models; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access.

Textbook1: Chapter 1,2,3 **(8 hours)**

Module 2

Distribution Models: Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes.

Textbook1: Chapter 4,5,6 **(8 hours)**

Module 3

Map-Reduce: Basic Map-Reduce, Partitioning and Combining, Composing Map-Reduce Calculations, A Two Stage Map-Reduce Example, Incremental Map-Reduce Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi-operation Transactions, Query by Data, Operations by Sets.

Textbook1: Chapter 7,8 **(8 hours)**

Module 4

Document Databases: What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

Textbook1: Chapter 9 **(8 hours)**

Module 5

Graph Databases: What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.

Textbook1: Chapter 11 **(8 hours)**

Course Outcomes:

The students will be able to:

CO1: Recognize the detailed architecture of Column Oriented NoSQL databases, Document databases, and Graph databases.

CO2: Use the concepts pertaining to all the types of databases CO3:
Analyse the structural Models of NoSQL.

CO4: Assess various applications using NoSQL databases.

Textbooks:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012

References:

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN 13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

Alternate Assessment Tools (AATs) suggested:

1. Massive Open Online Courses (MOOC'S) certification on MongoDB
2. Project Based Learning using NoSQL databases.

Web References:

1. https://www.ibm.com/cloud/learn/nosql-databases
2. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
3. https://www.geeksforgeeks.org/introduction-to-nosql/
4. https://www.javatpoint.com/nosql-databa

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Choice Based Credit System (CBCS)
SEMESTER – VII

AUGMENTED REALITY AND VIRTUAL REALITY (3:0:0) 3
(Effective from the academic year 2024 -25)

Course Code	21CS752	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. Gain a foundational understanding of Augmented Reality (AR) and Virtual Reality (VR).
2. Acquire essential technical skills needed for AR and VR development, including programming, 3D modelling, and using game development engines like Unity.
3. Understand how AR systems track objects and estimate their positions.
4. Gain knowledge of 3D computer graphics fundamentals, rendering techniques, and the tools and libraries available for 3D modelling and rendering in AR.
5. Learn design principles and interaction techniques specific to AR, including software architecture, design patterns, and user interface design.

Preamble:

Augmented reality is an interactive experience in which a real-world environment is enhanced with computer-generated visual elements, sounds, and other stimuli. It can provide a user with a heightened, more immersive experience than they would experience otherwise, which adds to the user's enjoyment or understanding. virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings. AR blends virtual content with the real world, enhancing the user's perception of reality in the physical world. VR completely immerses users in a simulated environment, totally disconnecting them from the physical world. The course also focuses on Calibration and Registration, Understanding the tool Unity, Pose Estimation and Tracking, Computer Vision for AR and Designing AR Systems.

Module – 1

Introduction to Augmented Reality: History of AR, AR Scenarios, the future of AR, Applications of AR.

Virtually Everything for Everyone: What is Virtual reality?, Differences between virtual reality and Augmented reality, Applications versus games, Types of VR experiences, types of HMD, How virtual reality works?, Technical Skills that are important to VR.

Textbook 1: Chapter 1 and Textbook 2: Chapter 1 **(08 Hours)**

Module – 2

Understanding Unity, Content and scale: Technical requirements, Installing Unity, Getting started with unity, Creating a simple diorama.

Setting up your project for VR: Introducing the Unity XR platform, Choosing your target VR Platform and toolkits, Enabling virtual reality for your platform, Building and run your project, Building for Oculus Quest

Textbook 2: Chapter 2, Chapter 3 **(08 Hours)**

Module – 3

Pose Estimation and Tracking: Pose Tracking in AR, Classifications of Tracking, Stationary Tracking System, Mobile Sensor-Based Tracking, Optical Tracking, Hybrid Tracking, Marker-Based Tracking and AR, Diminished Reality, Marker-less Tracking and AR.

Textbook 1: Chapter 3 (Sections 3.2 to 3.10) **(08 Hours)**

Module – 4

3D Graphics in AR: Basics of 3D Computer Graphics, 3D Rendering, 3D Model Importers/Loaders, 3D modeling software's, Available Graphics libraries.

Textbook 1: Chapter 5 **(08 Hours)**

Module – 5

Designing AR Systems: Design principles for AR, Designing interactions for AR, Software Architecture and Design Patterns for AR, Designing AR interfaces, Examples of AR Interfaces.

Textbook 1: Chapter 6 **(08 Hours)**

Course Outcomes:

The students will be able to:

CO1: Understand the AR/VR applications and usage, HMDs, and necessary technical skills.

CO2: Demonstrate understanding of technical requirements and VR development basics with oculus integration

CO3: Analyze various pose tracking techniques, 3D graphics and design interactions and principles in AR.

CO4: Build and deploy AR and VR projects on target platforms, such as Oculus Quest, using appropriate toolkits and development practices

Textbooks

1. Chetankumar G Shetty, "Augmented Reality: Theory, Design and Development", McGrawHill Publications 2020.
2. Jonathan Linowes -"Unity 2020 Virtual Reality Projects" Third Edition Packt> Paperback – 30 July 2020

Reference Books

1. Jonathan Linowes, Krystian Babilinski, "Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit and Vuforia", Paperback – Import,Packt Publishing Limited, 9 October 2017.
2. Schmalstieg/Hollerer, "Augmented Reality: Principles & Practice", Paperback–12, Pearson Education India, October 2016.
3. Chitra Lele, "Artificial Intelligence Meets Augmented Reality: Redefining Regular Reality", Paperback – 1, BPB Publications, January 2019.

Alternate Assessment Tools (AATs) suggested:

- Design and development of AR/VR model
- MOOC course

Web links / e – resources:

- NPTEL Course on Virtual Reality by Prof Steven LaValle, IIT Madras,https://nptel.ac.in/courses/106/106/106106138/
- NPTEL Course on Virtual Reality Engineering by Prof.M Manivannan, IIT Madras, https://nptel.ac.in/courses/121/106/121106013/
- NPTEL Course on Introduction to Computer Graphics by Prof. Prem K Kalra, IIT Delhi, https://nptel.ac.in/courses/106/102/106102065/
- NPTEL Course on Computer Graphics by Prof. Sukhendu Das, IIT Madras, https://nptel.ac.in/courses/106/106/106106090/
- NPTEL Course on Computer Graphics by Prof. Samit Bhattacharya, IIT Guwahati, https://nptel.ac.in/courses/106/103/106103224/

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER -VII

INTRODUCTION TO JAVA (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS753	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Learn fundamental features of object oriented language and JAVA
2. Set up Java JDK environment to create, debug and run simple Java programs.
3. Learn object oriented concepts using programming examples.
4. Study the concepts of importing of packages and exception handling mechanism.
5. Discuss the String Handling examples with Object Oriented concepts.

Module – 1

An Overview of Java:

Object-Oriented Programming, A First Simple Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings.

Text book 1: 2, 3 **(8 hours)**

Module – 2

Operators & Class Fundamentals

Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements. Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class,

Text book 1: 4, 5 ,6 **(8 hours)**

Module – 3

Closer Look at Classes:

A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Using Abstract Classes, Using final with Inheritance, The Object Class.

Text book 1: 7.1-7.9, 8. **(8 hours)**

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Module – 4

Packages and Interfaces:

Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses. Enumerations, Type Wrappers.

Text book 1: 9, 10, 12.1,12.2 **(8 hours)**

Module – 5

I/O, Applets, and Other Topics:

I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Reading and Writing Files, Applet Fundamentals, The transient and volatile Modifiers, Using instanceof, strictfp, Native Methods, Using assert, Static Import, Invoking Overloaded Constructors Through this( ), String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

Text book 1: 13, 15 **(8 hours)**

Course outcomes:

CO1: Acquire the knowledge of Object-oriented concepts using JAVA
CO2: Apply OOP concepts to develop Java programs for a given scenario.
CO3: Analyse the real-world applications of Object Oriented and Java Framework.
CO4: Design and Develop solutions to the problems using Strings, packages, Interfaces etc.
CO5: Develop solutions to the given problems using contemporary Tools/IDE of JAVA programming.

Text books:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)

References:

1. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

Alternate Assessment Tools (AATs) suggested:

- Coding Assignments
- Quizzes/Seminar
- MOOC certificate and Presentation of Java Concepts

Web links / e – resources:

- https://www.coursera.org/learn/java-introduction?msockid=188119c08e3065d035d60a7e8f8264be
- https://oli.cmu.edu/courses/introduction-to-programming-in-java-o-f/
- https://www.codecademy.com/learn/java-introduction

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B.E. COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER -VII

Introduction to Algorithms (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	21CS754	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Explain the methods of analyzing the algorithms and to analyze performance of Algorithms.
2. State algorithm's efficiencies using asymptotic notations.
3. Solve problems using algorithm design methods such as the brute force method, greedy method, divide and conquer, decrease and conquer, transform and conquer, Dynamic programming, backtracking and branch and bound.
4. Choose the appropriate data structure and algorithm design method for a specified Application.

Preamble:

The advancement in science and technology enhance the performance of processor, which proportionally affect the characteristics of computer system, such as security, scalability and reusability. Important problems such as sorting, searching, string processing, graph problems, Combinational problems, numerical problems are basic motivations for designing algorithm and analyzing it. Since algorithm design techniques are growing at a fast pace, it has become important to upgrade the knowledge in order to meet growing industry demand.

Module – I

INTRODUCTION: Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms.

Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

Textbook 1: Chapter 1 (Sections 1.1,1.2), Chapter 2(Sections 2.1,2.2,2.3,2.4), Chapter 3(Section 3.1,3.2)
Textbook 2: Chapter 1(section 1.1,1.2,1.3) (8 hours)

Module – II

DIVIDE AND CONQUER: Divide and Conquer: General Method, Finding the maximum & minimum, Binary Search, Merge Sort, Quick Sort and its performance.

Decrease and Conquer Approach: Introduction, Insertion sort, Topological Sorting. It's efficiency analysis.

Textbook 2: Chapter 3(Sections 3.1,3.3,3.4,3.5,3.6)
Textbook 1: Chapter 4 (Sections 4.1,4.2,4.3), Chapter 5(Section 5.1,5.3) (8 hours)

Module – III

THE GREEDY METHOD: The General Method, Knapsack Problem, Job Sequencing with Deadlines. **Minimum-Cost Spanning Trees:** Prim's Algorithm, Kruskal's Algorithm. **Single Source Shortest Paths**: Dijkstra's Algorithm.

Textbook 1: Chapter 9 (Section: 9.1,9.2,9.3)
Textbook2: Chapter 4(Sections 4.1,4.3,4.5,4.6) (8 hours)

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Module – IV
DYNAMIC PROGRAMMING: The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: Bellman-Ford Algorithm. **Textbook 1: Chapter 8(Section 8.1,8.2,8.4)** **Textbook 2: Chapter 5 (Sections 5.1,5.2,5.4,5.9) (8 hours)**
Module – V
Backtracking: n-Queens problem, Subset – Sum Problem. **Branch-and-Bound**: Assignment Problem **NP-Complete and NP-Hard problems:** Introduction to NP-Hard and NP-Complete Problems. **Textbook 1: Chapter 12 (Sections 12.1,12.2) Chapter 11(11.3)** **Textbook 2: Chapter 7 (Sections 7.1,7.2,7.3,7.4,7.5) Chapter 11 (Section 11.1) (8 hours)**

Course outcomes:

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

CO1: Understand the working of various algorithms and its techniques.

CO2: Apply appropriate algorithm design strategies for problem solving.

CO3: Analyze various algorithms and derive its time complexity.

Text books:

1. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, University press, 2007.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 2nd Edition, PHI, 2006.

Alternate Assessment Tools (AATs) suggested:

1. Students should solve GATE/Placement Problems.
2. Students will be given with different snippets of code / Algorithms to analyze its time complexity.

Web links / e – resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs47/preview
   (Design and analysis of algorithms By Prof. Madhavan Mukund | Chennai Mathematical Institute)

B.E COMPUTER SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VII

Cloud Computing (3:0:0) 3

(Effective from the academic year 2024-25)

Subject Code	21CS751	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

Course Objectives:

This course will enable the students to:

1. Explain the fundamentals of cloud computing
2. Illustrate the cloud application programming and Aneka platform
3. Contrast different cloud platforms used in industry
4. Understand framework of Aneka cloud for data intensive Application

Preamble:

In today's rapidly evolving technological landscape, cloud computing has emerged as a transformative force, reshaping the way businesses and individuals interact with digital resources. By offering scalable, on-demand access to computing power, storage, and various applications, cloud computing provides unprecedented flexibility and efficiency.

Module – 1

Introduction: Significance and scope of Cloud Computing, Cloud Computing in Economic growth of Nation, Impact of Cloud Computing on societal problems, sustainable solutions, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead,.

Text book 1: Chapter -1 (8 Hours)

Module – 2

Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google App Engine, Microsoft Azure,

Text book 1: Chapter -3 (8 Hours)

Module – 3

Virtualization, Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Para virtualization, VMware: Full Virtualization, Microsoft Hyper-V.

Text book 1: Chapter -3 (8 Hours)

Module – 4

Cloud Computing: Architecture, Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy

Text book 1: Chapter -4 (8 Hours)

Module – 5

Amazon Web Services : Explore the UI, Navigation, Pricing, Lambda , Security IAM : IAM Console , Roles, Policies, and Users , Roles for Lambda, Your First Code Hello World, Testing . CloudWatch, Environment Variables, Using Environment Variables in Hello World, HTTP Event: Exploring API Gateway, Using API Gateway as a Trigger , Response to Trigger,Storage Event, Using S3 as a Trigger, Response to Trigger

Text book 2: Chapter -3 (8 Hours)

Course outcomes:

The students will be able to:

1. Understand the basic concepts and terminologies of cloud computing
2. Apply the concept of cloud computing to different real word examples
3. Analysis the cloud frameworks and technologies for different IT Industry
4. Design real word cloud applications
5. Study the framework of Aneka cloud for data intensive Application

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

Text Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi. Computing Mastering Cloud, McGraw Hill Education, 2013,3rd Edition, ISBN (10 digits): 1-25-902995-6.

2. Maddie Stigler, Beginning Serverless: Computing Developing with Amazon Web Services, Microsoft Azure, and Google Cloud, Apress Berkely CA publisher, Beginning Serverless Computing: Developing with Amazon Web Services, Microsoft Azure, and Google Cloud | SpringerLink

References

1. Dan C. Marinescu, Morgan Kaufmann, Cloud Computing Theory and Practice, Elsevier, 2nd Edition 2013.

Alternate Assessment Tools (AATs) suggested:

1. Technical Presentations
2. Project-Based Assessments

Web links / e – resources:

1. Cloud Computing - Overview (youtube.co m) https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J