`

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)
Yelahanka, Bengaluru 560119

Bachelor of Engineering

Department of Information Science and Engineering

VII and VIII Semester Scheme and Syllabus
2022 Scheme
Effective from the AY 2024-25

Approved in the BoS meeting held on 26/07/2024

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Vision and Mission of the Department

Vision

Emerge as center of learning in the field of Information Science & Engineering with technical competency to serve the society.

Mission

To provide excellent learning environment through balanced curriculum, best teaching methods, innovation, mentoring and industry institute interaction.

Program Educational Objectives (PEOs)

PEOs	
PEO 1	Successful professional career in Information Science & Technology.
PEO 2	Pursue higher studies and research for advancement of knowledge in IT industry.
PEO 3	Exhibit professionalism and team work with social concern

Program Specific Outcomes (PSOs)

PSOs	
PSO-1	Apply the knowledge of information technology to develop software solutions.
PSO-2	Design and develop hardware systems, manage and monitor resources in the product life cycle

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮತ್ತು ವ್ಯವಸ್ಥಾಪನಾ ಮಹಾವಿದ್ಯಾಲಯ
BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

Ref.: BMSIT&M/Exam/2023-24/ 103 **Date:** 21.09.2024

CONTINUOUS INTERNAL EVALUATION
AND
SEMESTER END EXAMINATION PATTERN
(Applicable to UG students of 2021 Batch, effective from the Academic year 2024-25 onwards)

The UG students admitted during 2021-22 are hereby informed to note the following with reference to Continuous Internal Evaluation and Semester End Examination pattern:

The weightage for Continuous Internal Evaluation (CIE) is 50%, and for Semester End Examinations (SEE), it is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 out of 50), while for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50). A student will be declared to have passed the course if they secure at least 40% (40 out of 100) in the combined total of the CIE and SEE.

The details below summarize the CIE and SEE Pattern for the courses of 2021 scheme of various credits:

4 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs to be conducted for **40 Marks** (90 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 Marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of **10 Marks**, total **20 Marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks (3 hours).
- **Question Paper Pattern:**
  - **Part - A:** Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.
  - **Part - B:** There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question.**

- **SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.**

3 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs to be conducted for **40 Marks** (90 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 Marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of **10 Marks**, total **20 Marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks (3 hours).
- **Question Paper Pattern:**
  - **Part - A:** Comprises 20 objective type questions carrying 1 Mark each with a total 20 Marks.
  - **Part - B:** There will be **5 modules**. Each module will have **TWO questions carrying 16 marks** each. There will be a maximum of three sub section for each question. **Student has to answer any ONE full question.**

- **SEE Marks = 20 + 80 = 100 marks and can be scale down to 50 marks.**

2 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- Internal Assessment (IA) Tests: 2 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of 10 marks, total **20 marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE Marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of 20 marks (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

SEE is conducted for 100 Marks (2 hours).

Question Paper Pattern:

- The pattern of the question paper is MCQ.
- SEE question paper will be set for 100 questions each of 01 marks. The same is scale down to 50 marks. Minimum SEE Marks: 40% (i.e. 20 Marks out of 50)

1 CREDIT COURSES

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Internal Assessment (IA) Tests:** 2 IAs of MCQ type to be conducted for 40 Marks (60 minutes each). Total of 2 tests will be 80 and the same can be scale down to **30 marks.**
- **Alternate Assessment Tool (AAT):** 2 AATs each of 10 marks, total **20 marks.** Any Two AATs can be used from the list. If it is project based, one AAT shall be given.
- **Total CIE marks** = 30 + 20 = **50 Marks**
- Student has to score a minimum of **20 Marks** (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for **50 Marks** (1 hours).
- **Question Paper Pattern:**
  - The pattern of the question paper is MCQ.
  - SEE question paper will be set for 50 questions each of 01marks. The same is scale down to **50 Marks**.

1 CREDIT LABORATORY COURSE / PROFESSIONAL CORE LABORATORY / ABILITY ENHANCEMENT COURSE

I. CONTINUOUS INTERNAL EVALUATION (CIE): 50 MARKS

- **Cumulative Assessment (CA)** of each experiment is 20 Marks (Conduction 10 marks + Records 5 marks +Viva 5marks). The average of all the experiments to be taken for **20 Marks.**
- **Open Ended Experiments (OE) 10 Marks.**
- **2 IAs Test** to be conducted for 100 marks. General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.: 60 marks and Viva: 20 marks. The average of 2 IA marks is scale down to **20 Marks**.
- **CIE marks** =20 (CA) +10 (OE) + 20 (IA test) = **50 Marks.**
- Student has to score a minimum of **20 Marks** (40%).

II. SEMESTER END EXAMINATIONS (SEE): 50 MARKS

- SEE is conducted for 100 Marks.
- Examinations to be conducted jointly by Two examiners.
- All the experiments are to be included for practical examination.
- General rubrics suggested for SEE are: Writeup 20 marks, Conduction of the experiments, calculations, graphs, results, etc.,: 60 marks and Viva: 20 marks.

Learning Activities for AATs:

A faculty member may choose the following AATs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 21/09/2024

Dean AA 21.09.24

Principal 21/9/2024

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2021 batch.
3. Examination Section

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 Information Science Engineering (ISE) | **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**	ISE	2	0	0	0	2	2	50	50	100
2	AEC	**21IS72**	**DevOps**	ISE	For Theory Course: 1	0	0	0	1	1	50	50	100
					For Practical course: 0	0	2	0		2			
3	PE	**21IS73X**	**Professional Elective III**	ISE	3	0	0	0	3	3	50	50	100
4	PE	**21IS74X**	**Professional Elective IV**	ISE	3	0	0	0	3	3	50	50	100
5	OE	**21CS75X**	**Open Elective II**	ISE	3	0	0	0	3	3	50	50	100
6	PW	**21ISP76**	**Project Work Phase I**	ISE	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
21IS733	Robotic Process Automation
21CS734	Compiler Design

Professional Elective - Group IV	
Course Code	**Course Title**
21IS741	Cyber Physical Systems
21IS742	Internet of Things
21IS743	Block Chain Essentials and DApps
21IS744	Edge Computing

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

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

Choice Based Credit System (CBCS)

UG PROGRAM: Department of Information Science Engineering (ISE) | **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	21ISE81X	MOOC Professional Elective Courses	ISE	-	-	-	-	3	3	30	70	100
2	INT	21INT82	Research / Industrial Internship	ISE	0	0	0	14	7	3	50	50	100
3	PW	21ISEP83	Project Work Phase II	ISE	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		
Course Code	**NPTEL Course ID**	**Course Title**
21ISE81A	https://onlinecourses.nptel.ac.in/noc24_cs90/preview	**Social Network Analysis**
21ISE81B	https://onlinecourses.nptel.ac.in/noc24_cs94/preview	**Ethical Hacking**
21ISE81C	https://onlinecourses.nptel.ac.in/noc24_cs95/preview	**Introduction to Industry 4.0 and Industrial Internet of Things**
21ISE81D	https://onlinecourses.nptel.ac.in/noc24_cs102/preview	**Reinforcement Learning**
21ISE81E	https://onlinecourses.nptel.ac.in/noc24_cs89/preview	**Deep Learning for Computer Vision**

MOOC Professional Elective		
Course Code	**NPTEL Course ID**	**Course Title**
21ISE81F	https://onlinecourses.nptel.ac.in/noc24_cs104/preview	**Applied Accelerated Artificial Intelligence**
21ISE81G	https://onlinecourses.nptel.ac.in/noc24_cs91/preview	**Software Testing**
21ISE81H	https://onlinecourses.nptel.ac.in/noc24_cs107/preview	**Statistical Learning for Reliability Analysis**
21ISE81I	https://onlinecourses.nptel.ac.in/noc24_cs126/preview	**Design & Implementation of Human-Computer Interfaces**
21ISE81J	https://onlinecourses.nptel.ac.in/noc24_mg92/preview	**E-Business**
21AM81E	onlinecourses.nptel.ac.in/noc21_ma38/preview	**Essential Mathematics for Machine Learning**

B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

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: Acquire some basic concepts of research and its methodologies.

CO2: Describe the different types of research design methods.

CO3: Explain the various sampling, measurement, and scaling techniques

CO4: Analyse the ethical practices in conducting research and dissemination of results in different forms using data collection and data preparation methods

CO5: Apply various techniques to 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. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER – VII

DevOps (0:0:2) 1

(Effective from the academic year 2024-25)

Course Code	**21IS72**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**0:0:2**	SEE Marks	**50**
Total Number of Contact Hours	**15**	Exam Hours	**03**

Course Objectives:

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

1. Understand and apply the DevOps tools used in SDLC.
2. Examine the docker containerization in detail.

Preamble: The DevOps Foundation course provides a comprehensive overview of understanding the DevOps competencies needed to accelerate time-to-market by improving the flow of value through the continuous delivery pipeline. Students will map the current value stream through their delivery pipeline from idea to cash, and identify practices that will eliminate bottlenecks to workflow.

List of Programs

1. To perform version control on websites/software using GIT With browser.
2. To perform version control on websites/software using IT with push and pull commands.
3. Installation of Docker and study of commands for containerization.
4. To create Docker containers of different operating system images.
5. Exploring Containerization and Application Deployment with Docker and Docker Hub.
6. Install and configure sonarqube on your local machine.
7. Create a Jenkins CICD Pipeline with SonarQube Integration to perform Static Code Analysis

Course Outcomes: The students will be able to:

CO1:	Understand the concept of Devops and workflow.
CO2:	Experiment with GIT, IT, Dockers and Containerization.
CO3:	Jenkins CICD Pipeline using tools like SonarQube.

Textbooks:

1. Effective DevOps Building a Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davis and Ryn Daniels, June 2016: First Edition Published by O'Reilly Media Inc.

References:

1. The Devops Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations, by Gene Kim , Jez Humble, 2016, It Revolution Press.
2. DevOps on the Microsoft Stack, by Wouter de Kort, Aperss.

Alternate Assessment Tools (AATs) suggested:

- **Demonstrate the use of one or two DevOps tools in SDLC lifecycle.**

Web links / e – resources:

1. **https://www.youtube.com/results?search_query=github+tutorial**
2. **https://www.youtube.com/results?search_query=setup+and+configure+SONAR+Q**
3. **https://www.youtube.com/watch?v=A0g7I4A6GN4&pp=ygUWY29udGFpbmVycyBhbmQgZG9ja2Vycw%3D%3D**

Professional Elective - Group III

B.E. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 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.

- **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. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER – VII

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 the concepts of data warehouse modelling

CO2: Evaluate different models used for OLAP and data preprocessing

CO3: Design and validate the business rules using data mining techniques for a given data pattern.

CO4: Evaluate various data mining techniques which suit given data sets using modern tools

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,
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. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

SEMESTER – VII

Robotic Process Automation (3:0:0) 3

(Effective from the academic year 2024 -2025)

Course Code	**21IS733**	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. Gain a clear understanding of RPA and benefits, understanding the limits and constraints of automation.
2. Understand the basic AA components, features and technology.
3. Acquire the knowledge on purpose and use of the control center.
4. Understand the various use cases and write bots.

Preamble: RPA bots have become stronger than before as AI molds them into more reliable digital workers and IT teams provide them with more solid data foundations. Robotic process automation helps in the application of specific technologies that can automate mundane, routine, standardized tasks, creating higher productivity and value with lesser investment.

Module – 1

Scope and techniques of automation: What should be automated, what can be automated, techniques of automation, what can RPA do? Benefits of RPA, components of RPA, RPA Platforms: Automation Anywhere, UiPath, Blue Prism, Work Fusion, Thoughtonomy, KOFAX, The Future of Automation

T1: Ch1, T2: Ch1 **(9 Hours)**

Module – 2

Record and play: UiPath Stack: UiPath Studio, UiPath Robot, UiPath Orchestrator, Projects, The User Interface, Task Recorder, Examples: Emptying trash in Gmail and Emptying Recycle Bin,**Sequence, Flowchart and Control Flow:** Sequencing the workflow, Activities, Control Flow, Various Types of loops, decision Making, Examples.

T1: Ch2, Ch3 **(7 Hours)**

Module – 3

Data Manipulation-Variables and Scope Collections-Arguments - Purpose and use-Data table usage with examples, Clipboard Management-File operation with step-by-step example-CSV/Excel to data table and vice versa [with a step-by-step example).

T1 : **Ch4** **(7 Hours)**

Module – 4

Taking Control of the Controls- Finding and attaching windows- Finding the control- Techniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer-Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of 0CR available- How to use 0CR- Avoiding typical failure points.

T1: Ch5 **(9 Hours)**

Module – 5

Exception Handling: Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots, Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA
Recap: Summary of the Course
T1:Ch8 **(8 Hours)**

Course Outcomes: The students will be able to:

CO1: Understand the basic concepts of RPA, various components and platforms of RPA.

CO2: Apply the record and play feature, task recorder for simple web applications/ tasks using UiPath tools.

CO3: Analyze suitable variables, control flows and data manipulation techniques for solving problems

CO4: Develop Process automation applications, debug errors and handle the exceptions using UiPath.

Textbooks:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Packt, March 2018, ISBN: 9781788470940.
2. Tom Taulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,2020, lSBN-13 (electronic):978-7-4842-5729-6, Publisher: A press

References:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant.
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation.

Alternate Assessment Tools (AATs) suggested:

1. Certification course from UiPath
2. Mini project

Web links / e – resources:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://github.com/PacktPublishing/Robotic-Process-Automation-Projects

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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.

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

Professional Elective – Group IV

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SEMESTER – VII

Cyber-Physical Systems (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**21IS741**	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:

1. This course provides an introduction to CPS,
2. CPS foundations including the symbolic synthesis and modeling paradigms
3. Engineering problems in CPS
4. Applications from various domains.

Preamble: Cyber-physical systems, which consist of physical systems tightly integrated and/or controlled by software, are ubiquitous in many safety critical domains, including automotive, avionics, railways, healthcare, atomic energy, power, and industrial automation. The principles of design and implementation of cyber-physical systems are remarkably different from that of other embedded systems because of the tight integration of real valued and dense time real time systems with software based discrete automated control. To better compete in the global market, successful companies are finding that investments in hardware and software are no longer enough. Human elements with specialized engineering and design skills have become the essential part of equation

Module – 1

Introduction to Cyber-physical systems: Introduction, CPS Characterization. CPS characteristics, Further CPS characterization through market analysis. Analysis of Representative CPS domains – CPS in Manufacturing, Healthcare, Smarts grids, Transportation and Smart cities.

Text book 1: chapter 1.1, 2.1 to 2.2 & 3.1 to 3.5 (8 Hours)

Module – 2

Symbolic Synthesis for Cyber-Physical Systems: Introduction and Motivation, Basic Techniques, Preliminaries, Problem Definition. Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques, Construction of Symbolic Models Continuous-Time Controllers, Software Tools, Summary and Open Challenges

Text book 2: Chapter 4.1 to 4.4 (8 Hours)

Module – 3

Energy Cyber-Physical Systems: Introduction and Motivation, System Description and Operational Scenarios, Key Design Drivers and Quality Attributes, Key Systems Principles, Architecture 1 Performance Objectives, A Possible Way Forward, Cyber Paradigm for Sustainable SEES, Physics-Based Composition of CPS for an SEES, DyMon DS-Based Standards for CPS of an SEES, Interaction Variable–Based Automated Modeling and Control.

Text book 2: Chapter 2.1 to 2.4 (8 Hours)

Module – 4

Medical Cyber-Physical Systems: Introduction and Motivation, System Description and Operational Scenarios, Virtual Medical Devices, Clinical Scenarios, Key Design Drivers and Quality Attributes, Trends

Quality Attributes and Challenges of the MCPS Domain, High-Confidence Development of MCPS, On-

Demand Medical Devices and Assured Safety, Smart Alarms and Clinical Decision Support Systems, Closed-Loop System, Assurance Cases.
Text book 2 : Chapter 1.1 to 1.3 (8 Hours)

Module – 5

Security of Cyber-Physical Systems: Introduction and Motivation, Basic Techniques Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques, System Theoretic Approaches, Summary and Open Challenges.
Text book 2: Chapter 7.1 to 7.4 (8 Hours)

Course Outcomes:
The students will be able to: (List the COs as per the course requirements)
CO1: Acquire the fundamental knowledge of cyber physical systems.
CO2: Apply the symbolic synthesis in the context of cyber physical systems.
CO3: Analyze the significance of energy and medical cyber systems.
CO4: Examine the security measures in cyber physical systems.

Textbooks:

1. Christian Brecher, Danda B. Rawat, Houbing Song, Sabina Jeschke, "Cyber-Physical Systems Foundations, Principles and Applications", Elsevier Science, 27 August 2016.
2. Rajkumar R, De Niz D, Klein M. "Cyber-physical systems". Addison-Wesley Professional; 2016

1. Alur R. Principles of cyber-physical systems. MIT Press; 2015 Apr 10.
2. Lee EA, Seshia SA. Introduction to embedded systems: A cyber-physical systems approach. MIT Press; 2017.

Alternate Assessment Tools (AATs) suggested:

- **MOOC courses**
- **Group discussion on real time problems**

Web links / e – resources:

- **https://archive.nptel.ac.in/courses/106/105/106105241/**
- **https://online.vtu.ac.in/course-details/Foundations-of-Cyber-Physical-Systems**

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SEMESTER – VII

Internet of Things (0:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**21IS742**	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. Assess the genesis and impact of IoT applications, architectures in real world.
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT.
4. Infer the role of Data Analytics and Security in IoT.
5. Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Preamble:

With the advent of the Internet of Things (IoT), fed by sensors soon to number in the trillions, working with intelligent systems in the billions, and involving millions of applications, the Internet of Things will drive new consumer and business behaviour that will demand increasingly intelligent industry solutions, which, in turn, will drive trillions of dollars in opportunity for IT industry and even more for the companies that take advantage of the IoT.

Module – 1

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Computer Stack.

Text Book 1: Chapter 1,2

(08 Hours)

Module – 2

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies
(Upto IEEE 802.15.4g and 802.15.4e)

Text Book 1: Chapter 3,4 (08 Hours)

Module – 3

Associated IoT Technologies: IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service.

Text Book 2: Chapter 6 – 6.1 to 6.5, Chapter 10– 10.1 to 10.6 (08 Hours)

Module – 4

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics

Text Book 1: Chapter 7 (08 Hours)

Module – 5

IOT CASE STUDIES AND FUTURE TRENDS

Agricultural IoT – Introduction and Case Studies

Vehicular IoT – Introduction

Healthcare IoT – Introduction, Case Studies

Textbook 2: Chapter 12- 12.1-12.2, Chapter 13– 13.1; Chapter 14- 14.1-14.2 (08 Hours)

Course Outcomes:

The students will be able to:

CO1: Understand the characteristics and scopes of IoT

CO2 : Apply the knowledge of device management, networking to build an IoT solution..

CO3.: Analyze the different associated technologies for IoT system

CO4 : Interpret the case study material related to IoT.

CO5 : Develop an IoT application using modern tool and submit report.

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

References:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Alternate Assessment Tools (AATs) suggested:

Implement a project using different sensors and submit report

Web links / e – resources:

https://www.sciencedirect.com/science/article/abs/pii/S0167739X13000241

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SEMESTER – VII

Block Chain Essentials and DApps (3:0:0)

(Effective from the Academic Year 2024-25)

Subject Code	**21IS743**	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. Understand the structure of a blockchain and why/when it is better than a simple distributed database.
2. Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities.
3. Evaluate the setting where a blockchain based structure may be applied, its potential and its limitations.
4. By implementing, learners will have idea about private and public Blockchain, and smart contract.

Preamble:

Blockchain, the underlying technology powering cryptocurrencies like Bitcoin and Ethereum, has emerged as a groundbreaking innovation with far-reaching implications across industries. Its decentralized and immutable nature promises to revolutionize traditional systems, offering unprecedented levels of transparency, security, and efficiency.

Module – I

Introduction: The growth of blockchain technology: progress towards maturity, increasing interest, Distributed systems. The history of blockchain and bitcoin: The events that led to blockchain, electronic cash. Blockchain: Blockchain defined, Blockchain architecture, Generic elements of a blockchain, Benefits, features, and limitations of blockchain, Types of blockchain. Consensus: Consensus mechanism, Types of consensus mechanisms, Consensus in blockchain**.**

Textbook1: Chapter 1 **(8 Hours)**

Module – II

Decentralization using blockchain, Methods of decentralization: Disintermediation, Contest-driven decentralization. Routes to decentralization: How to decentralize, Decentralization framework example, Blockchain and full ecosystem decentralization: Storage, Communication, Computing power and decentralization. Pertinent terminology: Smart contracts, Autonomous agents, Decentralized organizations, decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies, Decentralized applications. Platforms for decentralization: Ethereum, MaidSafe, Lisk, EOS. Innovative trends: Decentralized web, Decentralized identity, Decentralized finance(DeFi).

Textbook1: Chapter 2 **(8 Hours)**

Module – III

Ethereum an overview: The yellow paper, Ethereum a user's perspective. The Ethereum network: The mainnet, testnets, Private nets. Components of the Ethereum ecosystem: Keys and addresses, Accounts, Transactions and messages, Ether cryptocurrencies/tokens(ETC and ETH). The Ethereum Virtual Machines(EVM):Execution environment, The machine state, The iterator function. Smart contracts: Native contracts.

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

Module – IV

Further Ethereum: Blocks and Blockchain, The genesis block, The block validation mechanism, Block finalization, Block difficulty mechanism, Gas, Fee schedule. Wallets and client software: Wallets, Geth, Eth, Parity, Trinity, Light clients, Installation and usage, MetaMask. Nodes and miners: The consensus mechanism, Forks in the blockchain, Ethash. APIs, tools, and DApps: Applications (DApps and DAOs) developed in Ethereum, Tools, Geth JSON RPC API.

Textbook1: Chapter 12 **(8 Hours)**

Module – V

Development Tools and Frameworks: Languages, Compilers: The solidity compiler, Tools and Libraries: Node.js, Ganache. Frameworks: Truffle, Drizzle, Embark, Brownie, Waffle, Etherlime, OpenZeppelin. Contract development and deployment: Writing smart contracts, Testing smart contracts, Deployment smart contracts. The layout of a Solidity source code file: Version pragma, Import, Comments. The Solidity language: Variables, Data types, Control structures, Events Inheritance, Libraries, Functions, Error handling.

Textbook1: Chapter 14 **(8 Hours)**

Course outcomes:

The students will be able to:

CO1: Understand and explore the workings of Blockchain technology.

CO2: Apply the Decentralized technologies for blockchain used for different real-time applications.

CO3: Analyse and demonstrate the working of the Ethereum tool for Smart Contracts.

CO4: Develop the decentralised apps on Ethereum using solidity.

- **SEE** will be conducted for 100 marks.
  - **Part A:** First question with 20 MCQs carrying 1 mark each.
  - **Part B:** Each full question is for 16 marks. (Answer five full questions out of 10 questions with intra modular choice). In every question, there will be a maximum of three sub-questions.
- **CIE** will be announced prior to the commencement of the course.
  - 25 marks for the test. An average of three tests will be taken.
  - 25 marks for Alternate Assessment Method.

Textbooks:

1. **Mastering Blockchain**: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, Third Edition, Imran Bashir.

1. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan , Blockchain Technology: Cryptocurrency and Applications Oxford University Press 2019.
2. Arvind Narayanan et. Al. Bitcoin and cryptocurrency technologies: a comprehensive Introduction Princeton University Press 2016.

Alternate Assessment Tools (AATs) suggested:

- Case studies / Caselets.
- Demonstration of real time application with block chain using Ganache

Web links / e – resources:

- https://ethereum.org/en/developers
- https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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SEMESTER – VII

Edge Computing (3:0:0) 3

(Effective from the academic year 2024-25)

Course Code	**21IS744**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	SEE Marks	**50**
Total Number of Contact Hours	**40**	Exam Hours	**3**

Edge computing has emerged as one of the most effective solutions to network problems associated with massive volumes of data generated in today's world. Edge computing enables faster and more comprehensive data analysis, creating the opportunity for deeper insights and faster response time. To be in line with emerging technology, students should understand the concepts of edge computing.

Course Objectives:

Understand the importance of edge computing.
Differentiate between fog,edge and cloud computing
Real world applications of edge computing

Module – 1

Edge Computing Completing the Cloud, Advantages of FEC: SCALE, How FEC Achieves, These Advantages: SCANC, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges, Addressing the Challenges in Federating Edge Resources.

Chapter 1,2 (08 Hours)

Module – 2

Integrating IoT + Fog + Cloud Infrastructures: System Modeling and Research Challenges Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds

Chapter 3,4

(08 Hours)

Module – 3

Optimization Problems in Fog and Edge Computing ,Middleware for Fog and Edge Computing: Design Issues

Chapter 5,6 (08 Hours)

Module – 4

Data Management in Edge Computing: Data Management, Data Life Cycle, Data Characteristics, Data Pre-Processing and Analytics, Data Privacy, Data Storage and Data Placement.

Chapter 8 (08 Hours)

Module – 5

Edge computing case studies:

Exploiting Edge Computing in Health Monitoring, Smart Surveillance Video Stream Processing at the Edge for Real-Time Human Objects Tracking, Edge Computing Model for Evolving Smart Transportation Applications

Chapter 12,13,14

(08 Hours)

Course outcomes:

The students will be able to:

1. Understand the paradigms of the Edge computing
2. Apply conceptual framework for optimization problems, data management in Edge computing
3. Relate and analyze the core principles of an edge cloud with reference architecture
4. Analyze the case studies and realize the need of edge computing

Text Books:

1.Fog and Edge Computing: Principles and Paradigms by Rajkumar Buyya, Satish Narayana Srirama.

Alternate Assessment Tools (AATs) suggested:

Case Study on real time applications

Open Elective-II

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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.

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

B.E. INFORMATION SCIENCE AND ENGINEERING

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SEMESTER – VII

Introduction to AR/VR (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**

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.

- 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. INFORMATION 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: Demonstrate the fundamentals of Java programming constructs.
CO2: Interpret the object-oriented features of Java programming language.
CO3: Apply the object-oriented programming constructs to solve complex problems
CO4: Develop the solutions using the OOP concepts for simple to complex problems.
CO5: Design applications using Object Oriented programming for real time applications.

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)

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.

- 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. INFORMATION SCIENCE AND ENGINEERING

Choice Based Credit System (CBCS) applicable for 2021 Scheme

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: Apply appropriate algorithm design strategies for problem solving. CO2: Analyze various algorithms and derive its time complexity. CO3: Develop algorithms using different algorithmic techniques.
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. 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)