Nagarjuna College of Engineering & Technology, Bengaluru

An Autonomous Institute, Affiliated to VTU Belagavi

Scheme & Syllabus
of 2021 Batch
VII Semester

As per the NEP 2020 Guidelines,
Choice-Based Credit System
&
Outcome-Based Education

CSE (Data Science)

w.e.f.
Academic Year 2024-2025

Vision

To prepare the next generation practitioners and researcher for data centric world by bringing together interdisciplinary faculty across the globe.

Mission

M1: To provide Skill Based Education to master the students in problem solving and analytical skills to enhance their niche expertise in the field Data Science

M2: To educate the students with latest technologies to update their knowledge in the field of Data Science

M3: To enable students to experience the Content Based Learning with premier quality data science education, research and industrial collaboration

M4: To enable students to become leaders in the Industry and Academia Nationally as well as internationally

M5: To guide students in research on Data Science, with the aim of having an ethical impact on society by tackling societal grand challenges

PROGRAM OUTCOMES (POs): Graduates of the Computer Science and Engineering – Data Science Program will be able to achieve the following

POs:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and Computer Science and Engineering principles to the solution of complex problems in Computer Science and Engineering.

PO2: Problem Analysis: Identify, formulate, research literature, and analyses complex Computer Science and Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex Computer Science and Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of Complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to Computer Science and Engineering problems.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Computer Science and Engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Computer Science and Engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional Computer Science and Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Science and Engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex Computer Science and Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Computer Science and Engineering projects and in multidisciplinary environments.

PO12: Life Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO)

PSO1: Ability to analyse complex computing issues and apply the principlesto achieve related solution.

PSO2: Ability to design, implement and evaluate computing based solutionsto meet range of computing requirements based in the data science.

PSO3: Ability to effectively communicate within diverse work group relatedto professional framework.

Program Educational Objectives (PEOs)

PEO 1: To make students competent for higher studies and employable, to meet industrial requirements.

PEO 2: To develop students having core competence in science, mathematics and fundamentals of Data Science to address ever changing industrial requirements globally.

PEO 3: To create academically conducive environment to learn engineering skills in the domains such as Data Analytics, Data Modelling, Data Visualization and Allied Technologies.

PEO 4: To enrich students with professional ethics, leadership qualities, and entrepreneurial skills.

PEO 5: An ability to engage in lifelong learning for effective adaptation to technological developments.

NAGARJUNA COLLEGE OF ENGINEERING & TECHNOLOGY, BENGALURU

B.E. in CSE (Data Science)

Scheme of Teaching and Examinations 2021

Outcome-Based Education (OBE) and Choice Based Credit System

(CBCS)(Effective from the academic year 2021 - 22)

Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lectur	Tutorial	Practical /Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	PCC 21CDT71	Business Intelligence	Any CS Board Department	3	0	0	0	3	50	50	100	3
2	PCC 21CDT72	Intelligent Database Management System		2	0	0	0	3	50	50	100	2
3	PEC 21XX73X	Professional elective Course-II		3	0	0	0	3	50	50	100	3
4	PEC 21XX74X	Professional elective Course-III		3	0	0	0	3	50	50	100	3
5	OEC 21XX74X	Open elective Course-II	Concerned Department	3	0	0	0	3	50	50	100	3
6	Project 21CDP76	Project work		Two contact hours /week For interaction between the faculty and students.				3	100	100	200	10
								Total	**350**	**350**	**700**	**24**

VIII SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	Seminar 21CDS81		Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01
2	INT 21INT82		Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15
3	NCMC	21NS83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	0
		21PE83	Physical Education (PE) (Sports and Athletics)	PE									
		21YO83	Yoga	Yoga									
									Total	**250**	**150**	**400**	**16**

Professional Elective - II

21CDT731	Financial Analytics	21CDT734	Computer Vision
21CDT732	Blockchain Technology		
21CDT733	Artificial Intelligence		

Professional Elective - III

21CDT741	Text Analytics & Natural Language Processing	21CDT744	Cyber Security for Data Science
21CDT742	Digital Image Processing		
21CDT743	Robotic Process Automation		

Open Electives - II offered by the Department to other Department students			
21CDO751	R Programming	21CDO754	Data Science & Visualization
21CDO752	Social Network Analytics		
21CDO753	Digital Marketing Analytics		

Note: PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**–Open Elective Course, **AEC** –Ability Enhancement Courses.
L –Lecture, T – Tutorial, P- Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Note: VII and VIII semesters of IV year of the programme

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the programme.

PROJECT WORK (21XXP76): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To instil responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

TECHNICAL SEMINAR (21XXS81): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report:50 marks
Presentation skill:25 marks
Question and Answer: 25 marks. ■ No SEE component for Technical Seminar

Non – credit mandatory courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of theregistered course.

(2) In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shallbe mandatory for the award of degree.

BUSINESS INTELLIGENCE

Course Code	**21CDT71**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisites: Database, Excel, Basic Business Concepts.

Course Objectives:

The Course Objectives are to:

1. Introduce a managerial perspective of Business Intelligence (BI), and Analytics and DecisionSupport.
2. Provide introduction to three levels of analytics: descriptive, predictive and prescriptive,
3. Provide exposure to analytics techniques and their applications,
4. Introduce to specific software tools that can be used for developing applications
5. Provide introduction to emerging technologies that are likely to impact on the development and useBI applications.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

An Overview of Business intelligence, Analytics and Decision Support: Changing Business Environments and Computerized Decision Support; Framework for Business intelligence (BI); Intelligence Creation, Use, and BI Governance; Transaction Processing versus Analytic Processing; Successful BI Implementation; Analytics Overview; and Introduction to Big Data Analytics.

08 Hours

Module - II

Data Warehousing: Data Ware Housing (DW) Definitions and Concepts; DW Process Overview, Architectures; Data Integration, and the Extraction, Transformation and Load (ETL) Processes; DW Development; DW Implementation Issues; Real Time DW; and DW Administration, Security Issues and Future Trends. Business Reporting, Visual Analytics and Business Performance Management Business Reporting Definitions and Concepts: Data and Information Visualization; Different Types of Charts and Graphs; Emergence of Data Visualization and Visual Analytics; Performance Dash Boards; Business Performance Management; Performance Measurement; Balanced Score Boards; and Six Sigma as a Performance Measurement System. **08 Hours**

Module - III

Data mining: Data Mining (DM) Concepts and Applications; DM Processed Methods Software Tools; and DM Privacy Issues, Myths and Blunders.

08 Hours

Module - IV

Text and Web Analytics: Text Analytics (TA) and Text Mining (TM) Overview; Natural Language Processing; TM Applications' Process; Sentiment Analysis; Web Mining (WM) Overview; Search Engines; Web Usage Mining (Web Analytics); and Social Analytics.

08 Hours

Module - V

Big Data Analytics: Data Scientist; Big Data Vendors; Big Data and Stream Analytics; and Applications of Stream Analytics.

Business Analytics (BA) – Emerging trends and Future Impacts: Location-Based Analytics for Organizations; Analytics Applications for Consumers; Recommendation Engines; Web 2.0 Revolution and Online Social Networking; Cloud Computing and BI; Impacts of Analytics in Organizations – An Overview; Issues of Legality, Privacy and Ethics; and an overview of Analytics Ecosystem.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

On completion of this course, the students will be able to,

CO1: Understanding of core business intelligence concepts and including data warehousing, data mining and reporting.

CO2: Apply the concept of Business Intelligence for the data visualization and data analytics

CO3: Analyze the need of Business Intelligence in various text, web and social media analytics.

CO4: Apply critical thinking skills to identify business problems and provide solutions.

CO5: Explore the Business Intelligence design principles and its need in Big data analytics.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Textbooks:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, etal, ,Business Intelligence: A Managerial Perspective on Analytics, 3rd Ed, Pearson India Education Inc, Indian Subcontinent Reprint 2018 (ISBN978-93-528-6271-9)

Reference Books:

1. Jiawei Han and Michelinekambe, Jian Pei, ,Data Mining: Concepts and Techniques, 3rded. The Morgan Kaufmann Publishers.
2. Michael Steinbach, Pang-Ning Tan, and Vipin Kumar, ,Introduction To Data Mining', Pearson International Edition,2006.
3. James Allen,' Natural Language Understanding', 2nd Ed., The Benjamin/Cummings Publishing Company Inc.
4. Daniel Jurafsky, James.H.Martin,, Speech and Language Processing', 2nd Edition, Pearson Education Inc.

CO PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	-	1	2	-	-	-	-	-	-	2	2	-
CO2	-	-	2	2	1	-	-	-	-	-	-	-	2	2	-
CO3	2	3	-	-	1	2	-	-	-	-	-	-	2	2	-
CO4	3	2	2	-	-	-	-	-	2	-	-	-	-	-	2
CO5	2	-	-	2	2	2	-	-	-	-	-	-	2	2	-
AVG	2.5	2.3	2.3	2	1.2	2	-	-	2	-	-	-	2	2	2

INTELLIGENT DATABASE MANAGEMENT SYSTEM

Course Code	**21CDT72**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**2:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Prerequisites: Python or Java, Database Management Systems.

Course Objective

1. Upon completion of this course, the student will be able to:
2. Grasp the basic concepts of knowledge and expert systems.
3. Illustrate information retrieval and multidimensional indexing.
4. Acquire the elements of data mining and knowledge discovery in databases.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, andanalyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic andencourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to IDBS

Informal definition of the domain - General characteristics of IDBSs - Data models and the relational data model –A taxonomy of intelligent database systems - Guidelines for using intelligent database systems.

08 Hours

Module - II

Semantic Data Models

Nested and semantic data models – Introduction - The nested relational model - Semantic models - Object-oriented approaches to semantic data modeling – Object oriented database systems - Basic concepts of a core object-oriented data model - Comparison with other data models - Query languages and query processing - Operational aspects – Systems - The ODMG standard - The object-relational data model - Java and databases – Conclusions

08 Hours

Module - III

Knowledge-Based Systems- AI Context

Characteristics and classification of the knowledge-based systems – Introduction - The resolution principle - Inference by inheritance – Conclusion - Deductive database systems - Basic concepts - DATALOG language - Deductive database systems and logic programming systems—differences - Architectural approaches - Research prototypes - Updates in deductive databases - Integration of deductive database and object database technologies - Constraint databases - Conclusions.

08 Hours

Module - IV

Advanced Knowledge-Based Systems

Introduction - Architectural solutions - The 'general bridge' solution - Extending a KBS with components proper to a DBMS - The 'tight coupling' approach – Conclusion.

08 Hours

Module - V

Applications in IDBS

Introduction -

Application of mediators to heterogeneous systems – Proposals - Multi- Agents systems - Main issues in designing a multi-agent system . Internet indexing and retrieval - Basic indexing methods - Search engines or meta-searchers - Internet spiders - Data mining - Data mining tasks - Data mining tools - Medical and legal information systems - Medical information systems - Legal information systems – Conclusions.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

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

CO1: Understand the concepts of Intelligent database.

CO2: Make study of the Database installation then create the database with user and apply SQL.

CO3: Understand the concepts of knowledge-based systems and apply with AI.

CO4: Design and create the small applications.

CO5: Analyze and Implement for various real-time applications in Intelligent Database System.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Textbooks:

1. Elisa Bertino, Barbara Catania, Gian Piero Zarri, ―Intelligent Database Systems‖, Collection ACM Press.

Reference Books:

1. Ngoc Thanh Nguyen, Radoslaw Katarzyniak, and Shyi-Ming Chen (Eds.), "Advances in Intelligent Information and Database Systems ", Springer, 2010.

E Books

https://www.eyrolles.com/Informatique/Livre/intelligent-database-systems-9780201877366/

MOOC

https://www.coursera.org/learn/database-management

CO PO Mapping:

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

FINANCIAL ANALYTICS

Course Code	**21CDT731**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Finance, Accounting, Economics

Course objectives:

- This course introduces a core set of modern analytical tools that specifically target finance applications.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

CORPORATE FINANCE ANALYSIS: Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model- Payback, NPV, IRR.

08 Hours

Module - II

FINANCIAL MARKET ANALYSIS: Estimation and prediction of risk and return (bond investment and stock investment) –Time series-examining nature of data, Value at risk, ARMA, ARCH and GARCH.

08 Hours

Module - III

PORTFOLIO ANALYSIS: Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

08 Hours

Module - IV

TECHNICAL ANALYSIS: Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

08 Hours

Module - V

CREDIT RISK ANALYSIS: Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:
On completion of this course, the students will be able to,

- The learners should be able to perform financial analysis for decision making using excel, Python and R.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books and Reference Books:

1. Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.
2. Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, 25 Oct 2013 by Pavel Ryzhov.
3. Quantitative Financial Analytics: The Path To Investment Profits Paperback – Import, 11 Sep 2017 by Edward E Williams (Author), John A Dobelman.
4. Python for Finance - Paperback – Import, 30 Jun 2017 by Yuxing Yan (Author).
5. Mastering Python for Finance Paperback – Import, 29 Apr 2015 by James Ma Weiming.

BLOCK CHAIN TECHNOLOGY

Course Code	**21CDT732**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Network Security and Information Security

Course Objectives:

1. Understand about Symmetric and Asymmetric Encryption, block chain and Bit coin concepts
2. Analyse the Working of Block Chain System.
3. Design, build, and deploy smart contracts and distributed applications
4. Evaluate security, privacy, and efficiency of a given block chain system.
5. Cognize about _digital‘ currency, Storage and Currency Exchange Services.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to Block chain: Back story of Block chain, what is Block chain? Centralized vs. Decentralized Systems, Layers of Block chain, why is Block Chain Important? Limitations of Centralized Systems, Block chain Adoption So Far, Block chain Uses and Use Cases How Block chain Works-1: Laying the Block Chain Foundation, Cryptography, Symmetric Key Cryptography, Cryptographic Hash Functions.

08 Hours

Module - II

Cryptography and Transactions: Asymmetric Key Cryptography, Diffie-Hellman Key Exchange, Symmetric vs. Asymmetric Key Cryptography, Merkle Trees, Putting It All Together, Properties of Block Chain Solutions, Block chain Transactions, Distributed Consensus Mechanisms, Block chain Applications, Scaling Block chain, Off-Chain Computation, Sharding Block Chain State.

08 Hours

Module - III

Bitcoin Works: The History of Money, Dawn of Bitcoin, What Is Bitcoin? Working with Bitcoins, The Bitcoin Block chain, Block Structure, The Genesis Block, The Bitcoin Network, Network Discovery for a New Node, Bitcoin Transactions, Consensus and Block Mining, Block Propagation, Bitcoin Scripts, Bitcoin Transactions Revisited, Scripts.

08 Hours

Module - IV

Ethereum and Crypto Currencies: Ethereum Introduction, Ethereum Block chain, Elements of Ethereum Block chain and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges**,** Cryptographic Hash Functions**,** Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Crypto currency.

08 Hours

Module - V

How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes

After the completion of this course, student will be able to

CO1: Gain Knowledge in Symmetric Encryption, Asymmetric Encryption, Block Chain System and Crypto currencies.

CO2: Analyze the working of Block Chain System, Ledger Transaction and Mining mechanism.

CO3: Design and Implement Ethereum block chain contract.

CO4: Pertain to ethical and legal usage of Block chain applications.

CO5: Use of Bitcoins, online wallets, Currency Exchanges and payment services.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Beginning Block chain: A Beginner's Guide to Building Block Chain Solutions by Bikramaditya Singhal, Gautam Dhameja and Priyansu Sekhar Panda.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bit coin and Crypto-currency Technologies: A Comprehensive Introduction, Princeton University Press (July 19,2016).

Reference Books:

1. Mastering Bit coin by Andreas M. Antonopoulos
2. Block chain Technology: Crypto-currency and Applications by S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, Oxford University Press 2019.
3. Imran Bashir, Mastering Block chain: Deeper Insights into Decentralization, Cryptography, Bitcoin, and Popular Block chain Frameworks, Packt Publishing, 1st Edition, 2017.

E-Resources:

1. NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/#
2. Udemy: https://www.udemy.com/course/build-your-blockchain-az/
3. EDUXLABS Online training://eduxlabs.com/courses/block chain technology- training/?tab=tab-curriculum

ARTIFICIAL INTELLIGENCE

Course Code	**21CDT733**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Statistics.

Course Objectives:

This course will enable students to:

1. Understand AI technique to a given concrete problem.
2. Study non-trivial AI techniques to handle complex problem.
3. Understand uncertainty and Problem-solving techniques.
4. Learn various symbolic knowledge representations to specify domains and reasoning tasks of a situated software agent.
5. Gain knowledge on logical systems for inference over formal domain.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction: What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem solving: Problem-solving agents; Example problems; Searching for solution; Uninformed search strategies.

08 Hours

Module - II

Informed Search, Exploration, Constraint Satisfaction, Adverbial Search: Informed search strategies; Heuristic functions; On-line search agents and unknown environment. Constraint satisfaction Problems; Backtracking search for CSPs. Adverbial search: Games; Optimal decisions in games; Alpha-Beta pruning

08 Hours

Module - III

Logical Agents: Knowledge-based agents; The wumpus world as an example world; Logic; propositional logic Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic.

08 Hours

Module - IV

First-Order Logic, Inference in First-OrderLogic-1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic. Propositional versus first-order inference; Unification and lifting.

08 Hours

Module - V

Inference in First-Order Logic-2: Forward chaining; backward chaining; Resolution..

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

On completion of this course, students will be able to:

CO1: Design intelligent agents for solving simple gaming problems.
CO2: Apply non-trivial AI techniques to handle complex problems.
CO3: Apply various symbolic knowledge representation to specific problems.
CO4: Design Knowledge-based agents.
CO5: Describe syntax and semantics of first-order logic.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Stuart Russel, Peter Norvig: –Artificial Intelligence A Modern Approach‖, 2nd Edition, Pearson Education, 2003, (Chapters 1.1, 2, 3.1 - 3.4, 4.1, 4.2, 4.5, 5.1, 5.2, 6.1- 6.3, 7, 8, 9, 10, 11.1, 11.2, 11.4, 11.5, 13.1, 13.4, 13.5, 13.6,) ISBN:0-13-103805-2.

Reference Books:

1. Elaine Rich, Kevin Knight: –Artificial Intelligence‖, 3rd Edition, Tata McGraw Hill, 2009, ISBN-10: 0070087709.
2. Nils J. Nilsson: ―Principles of Artificial Intelligence‖, Elsevier, 1980, ISBN: 978-3-540-11340-9

E-Resources:

1. http://stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence
2. http://www.getfreeebooks.com/16-sites-with-free-artificial-intelligence-ebook

COMPUTER VISION

Course Code	**21CDT734**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Computer graphics, drawing and animation Image processing techniques

Course Objectives:

Upon Completion of the course, the students will be able to:

1. Recall image processing techniques for computer vision
2. Do shape and region analysis
3. Elucidate Hough Transform and its applications to detect lines, circles, ellipse
4. Apply three-dimensional image analysis techniques
5. Exploit motion analysis
6. Study real world applications of computer vision algorithms

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Image Processing Foundations: Fundamentals of Image Processing Techniques – Classical Filtering Operations – Thresholding Techniques – Edge Detection Techniques – Corner and Interest Point Detection–Mathematical Morphology –Texture.

08 Hours

Module - II

Shapes and Regions: Binary Shape Analysis – Connectedness – Object Labeling and Counting – Size Filtering – Distance Functions – Skeletons and Thinning – Deformable Shape Analysis – Boundary Tracking Procedures – Active Contours – Shape Models and Shape Recognition – Centroidal Profiles – Handling Occlusion – Boundary Length Measures – Boundary Descriptors – Chain Codes – Fourier Descriptors – Region Descriptors – Moments.

08 Hours

Module - III

Hough Transform: Line Detection – Hough Transform (HT) For Line Detection – Foot-of-Normal Method – Line Localization – Line Fitting – RANSAC for Straight Line Detection – HTBased Circular Object Detection – Accurate Center Location – Speed Problem – Ellipse Detection – Case Study: Human Iris Location – Hole Detection – Generalized Hough Transform – Spatial Matched Filtering – GHT for Ellipse Detection – Object Location – GHT for Feature Collation. **08 Hours**

Module - IV

3D Vision and Motion: Methods for 3D Vision – Projection Schemes – Shape From Shading– Photometric Stereo –Shape from Texture – Shape from Focus – Active Range Finding – Surface Representations –Point-Based Representation – Volumetric Representations – 3D Object Recognition – 3D Reconstruction – Introduction to Motion – Triangulation – Bundle Adjustment – Translational Alignment – Parametric Motion – Spline-Based Motion – Optical Flow – Layered Motion.

08 Hours

Module - V

Applications: Application: Content Based Image Retrieval, Content Based Video Retrieval.

08 Hours

Case Study: Face Recognition, Gait Recognition.

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

On completion of this course, students will be able to:

CO1: Apply key image processing techniques to analyze and manipulate digital images.

CO2: Analyze and recognize shapes and regions using techniques like binary shape analysis, object labeling, distance functions, and shape descriptors.

CO3: Apply the Hough Transform and its variants for line, circle, and ellipse detection, object localization, and feature collation.

CO4: Explore 3D vision techniques and motion analysis, including 3D reconstruction, object recognition, motion estimation, and optical flow.

CO5: Apply content-based image and video retrieval techniques, with a focus on face and gait recognition.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. E. R. Davies, (2012), ‚Computer & Machine Vision', Fourth Edition, Academic Press.
2. R. Szeliski,(2011),Computer Vision: Algorithms and Applications', Springer 2011.
3. Simon J. D. Prince, (2012) ,Computer Vision: Models, Learning, and Inference', Cambridge University Press, 2012.
4. Mark Nixon and Alberto S. Aquado, (2012), Feature Extraction & Image Processing for Computer Vision',Third Edition, Academic Press.

Reference Books:

1. D.L.Baggioetal.,(2012),Mastering Open CV with Practical Computer Vision Projects', Packet Publishing.
2. Jan Erik Solem, (2012),Programming Computer Vision with Python: Tools and algorithms for analyzing images', O'Reilly Media.

CO PO Mapping:

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

TEXT ANALYTICS AND NATURAL LANGUAGE PROCESSING

Course Code	**21CDT741**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: AI, Python Programming.

Course Learning Objectives

1. Should have interest in text analytics and natural language processing.
2. Should be aware of deriving insights from big text data.
3. Should have a basic knowledge of programming skills.
4. Should be interested in learning new languages for analytics.
5. Students will be able to create customized word cloud.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

INTRODUCTION: Introduction to NLP, Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit distance, N gram Language Models, Evaluating Language Models

08 Hours

Module - II

SYNTACTIC ANALYSIS: English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Partof- Speech Tagging, Maximum Entropy Markov Models, Grammar Rules for English, Treebanks, Grammar Equivalence and Normal form, Lexicalized Grammar.

08 Hours

Module - III

SEMANTIC ANALYSIS: Representation of Sentence Meaning: Computational Desiderata for Representations, Model- Theoretic Semantics, First-Order Logic, Event and State Representations, Description Logics, Semantic roles, Semantic role labeling.

08 Hours

Module - IV

SEQUENCE PARSING WITH RECURRENT NETWORKS: Simple Recurrent Networks, Applications of RNNs, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Characters and Byte-Pairs.

08 Hours

Module - V

CASE STUDY: Sentiment Classification, Dialog Systems and Chatbots.

08 Hours

Teaching-Learning Process for all modules	Chalk and Talk, Power point presentation, flip teaching, YouTube videos

PRACTICAL COMPONENTS

Sl. No	Experiments
1	Convert the text into tokens
2	Find the word frequency
3	Demonstrate a bigram language model
4	Demonstrate a trigram language model
5	Generate regular expression for a given text
6	Perform Lemmatization
7	Perform Stemming
8	Identify parts-of Speech using Penn Treebank tag set.
9	Implement HMM for POS tagging
10	Build a Chunker

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Understand the basics of Natural language processing
CO2: Analyze the text syntactically
CO3: Analyze the text content Semantically
CO4: Implement recurrent network for language models
CO5: Implement a sentiment classification and chatbot systems

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft), 2019.

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, First Edition, O'reilly, 2009 2. Stefanie Molin,‖ Hands-On Data Analysis with Pandas‖, Packt Publishing Ltd,2019.
2. Yoav Goldberg, University of Toronto, Neural Network Methods for Natural language Processing, Morgan & Claypool, 2017
3. Christopher D. Manning, and Hinrich Schutze. Foundations of statistical natural language processing. First Edition, MIT press, 1999

E-Books:

1. https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf
2. https://www.nltk.org/book/
3. https://www.nltk.org/genindex.html

MOOC:

1. **https://www.coursera.org/learn/language-processing**

CO PO Mapping:

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

DIGITAL IMAGE PROCESSING

Course Code	**21CDT742**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Digital signal processing.

Course Objectives:

This course will enable students to:

1. Study the fundamental concepts of image representation and image processing system.
2. Evaluate techniques followed in image enhancements
3. Illustrate image segmentation and compression algorithms

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic andencourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to Image Processing: Digital Image Fundamentals Light, brightness adaption and discrimination, Human visual system, Image as a 2D data, Image representation Gray scale and Color images, Image sampling and quantization, Color Fundamentals, Color Models, Pseudo-color image processing.

08 Hours

Module - II

Image Enhancement In The Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

08 Hours

Module - III

Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.

08 Hours

Module - IV

Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

08 Hours

Module - V

Image Compression: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, run length coding.

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes (COs):

On completion of this course, students will be able to:

CO1: Explain fundamentals of image processing.
CO2: Compare transformation algorithms.
CO3: Contrast enhancement, segmentation and compression techniques.
CO4: Understand the rapid advances in Machine vision.
CO5: Understand the need for image transforms different types of image transforms and their properties.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods: –Digital Image Processing, 3rdEdition, Pearson Education, Pearson Education, 2014, ISBN-10: 9332518467, ISBN-13: 9789332518469,

Reference Books:

1. S Jayaraman, S Esakkirajan, T Veerakumar: –Digital Image Processing‖, Tata Mc- Graw Hill Publication.
2. S Sridhar: –Digital Image Processing‖, Oxford University Press, ISBN-10: 0199459355, ISBN-13:9780199459353.

E-Resources:

1. https://www.abebooks.com/9789332518469/Digital-Image-Processing-3rd-Edi-tion-9
2. www.synergy.ac.in/intranet/classnotes/introduction.pdf

ROBOTIC PROCESS AUTOMATION			
Course Code	**21CDT743**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Basic Programming Concepts, Electronic Circuits

Course Objectives:

1. To understand the RPA and the ability to differentiate it from other types of automation.
2. To model the sequences and the nesting of activities.
3. To make use of exception handling techniques to handle the log errors.
4. To carry out experiment with workflow in a manner to get the optimized output from a Bot.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternativeeffective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotescritical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic andencourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. **RPA BASICS:** History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

08 Hours

Module - II

RPA TOOL INTRODUCTION AND BASICS: Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity -

The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.

08 Hours

Module - III

ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

08 Hours

Module - IV

HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. **EXCEPTION HANDLING:** Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

08 Hours

Module - V

DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.

08 Hours

Teaching-Learning Process for allmodules	Chalk and board, Active Learning, PPT Based presentation, Video

COURSE OUTCOMES:

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

CO1: Describe RPA, where it can be applied and how it's implemented.

CO2: Describe the different types of variables, Control Flow and data manipulation techniques.

CO3: Identify and understand Image, Text and Data Tables Automation.

CO4: Describe how to handle the User Events and various types of Exceptions and strategies.

CO5: Understand the Deployment of the Robot and to maintain the connection

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Alok Mani Tripathi, –Learning Robotic Process Automation‖, Packt Publishing, 2018.

References:

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, –Introduction to Robotic Process Automation: a Primer‖, Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant‖, Independently Published, 1st Edition 2018.
3. Srikanth Merianda,‖Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation‖, Consulting Opportunity Holdings LLC, 1st Edition 2018.
4. Lim Mei Ying, –Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes‖, Packt Publishing, 1st Edition 2018.

Web References:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

CYBER SECURITY FOR DATA SCIENCE

Course Code	**21CDT744**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning Objectives

This course will enable students to:

1. Describe the importance of cyber security
2. Describe the security issues in programming, web, OS and network.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction: What Is Computer Security? Threats, Harm, Vulnerabilities, Controls, Conclusion, What's Next?

Toolbox: Authentication, Access Control, and Cryptography: Authentication, Access Control.

08 Hours

Module - II

Programs and Programming: Unintentional (Nonmalicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

08 Hours

Module - III

The Web—User Side: Browser **Attacks**, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks

08 Hours

Module - IV

Operating Systems: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

08 Hours

Module - V

Networks: Network concepts, War on Networks: Threats to Network Communications, Wireless Network Security, Denial of Service, and Distributed Denial-of-Service.

08 Hours

Teaching-Learning Process for all modules	Chalk and Talk, Power point presentation, flip teaching, YouTube videos

Course Outcomes

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

CO1: Understand fundamental aspects of cyber security

CO2: Describe the security issues in web, network, and Operating system.

CO3: Implement some of the solutions to mitigate the security attacks.

CO4: Analyse impact on the system when cyber-attacks and threats happens etc.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Suggested Learning Resources:

Textbooks:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, Pearson Education, 5th Ed, 2018.

Reference Books:

1. Sammons, John, and Michael Cross. The basics of cyber safety: computer and mobile device safety made easy. Elsevier, 2016.
2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons,2018.

R PROGRAMMING			
Course Code	**21CDO751**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Programming Knowledge, Statistics.

Course Objectives:

1. Explore and understand how R and R Studio interactive environment.
2. To learn and practice programming techniques using R programming.
3. Read Structured Data into R from various sources.
4. Understand the different data Structures, data types in R.
5. To develop small applications using R Programming

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Numeric, Arithmetic, Assignment, and Vectors: R for Basic Math, Arithmetic, Variables, Functions, Vectors, Expressions and assignments Logical expressions.

Textbook 1: Chapter 2(2.1 to 2.7)

08 Hours

Module - II

Matrices and Arrays: Defining a Matrix, Sub-setting, Matrix Operations, **Conditions and Looping:** if statements, looping with for, looping with while, vector based programming.

Textbook 1: Chapter 2- 2.8, chapter 3- 3.2 to 3.5.

08 Hours

Module - III

Lists and Data Frames: Data Frames, **Lists,** Special values, The apply family.

Textbook 1: Chapter 6- 6.2 to 6.4

08 Hours

Module - IV

Functions: Calling functions, scoping, Arguments matching, writing functions: The function command, Arguments, specialized function.

Textbook 1: Chapter 5- 5.1 to 5.6

08 Hours

Module - V

Pointers: packages, frames, de bugging, manipulation of code, compilation of the code.

Textbook 1: Chapter 8- 8.1 to 8.8

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, Demonstration, presentation, problem solving, MOOC

Course Outcomes (Course Skill Set):

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

CO1: To understand the fundamental syntax of R through readings, practice exercises.
CO2: To demonstrations, and writing R code.
CO3: To apply critical programming language concepts such as data types, iteration.
CO4: To understand control structures, functions, and Boolean operators by writing R programsand through examples.
CO5: To import a variety of data formats into R using R-Studio.

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Textbooks

1. Jones, O., Maillardet. R. and Robinson, A. (2014). Introduction to Scientific Programming and Simulation Using R. Chapman & Hall/CRC, The R Series.

References:

1. Michael J. Crawley, –Statistics: An Introduction using R‖, Second edition, Wiley,2015

Weblinks and Video Lectures (e-Resources):

1. Wickham, H. & Grolemund, G. (2018). for Data Science. O'Reilly: New York. Available for free athttp://r4ds.had.co.nz

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Demonstration of simple projects

SOCIAL NETWORK ANALYTICS

Course Code	**21CDO752**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Web Technology and Networks

Course Learning Objectives:

1. Compute and interpret metrics that describe individual nodes in a network.
2. Compute and interpret metrics that characterize various qualities of the network as a whole.
3. Compute and interpret partitioning networks into communities based on different criteria.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

SOCIAL NETWORK ANALYSIS: Network analysis- Development of Social network analysis- Key concepts and measures in network analysis -The global structure of networks - The macro-structure of social networks - Personal networks.

08 Hours

Module - II

WEB SEMANTICS IN SOCIAL NETWORK APPLICATIONS: Electronic sources for network analysis - Electronic discussion networks - Blogs and online communities - Web-based networks - Knowledge Representation on the Semantic Web - Ontologies and their role in the Semantic Web Ontology languages for the Semantic Web - The Resource Description Framework (RDF) and RDF Schema - The Web Ontology Language (OWL) - Comparison to the Unified Modelling Language (UML) - Comparison to the Entity/Relationship (E/R) model and the relational model - Comparison to the Extensible Markup Language (XML) and XML Schema.

08 Hours

Module - III

MODELLING AND AGGREGATING SOCIAL NETWORK DATA: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Representing identity - On the notion of equality - Determining equality - Reasoning with instance equality - Evaluating smashing.

08 Hours

Module - IV

DEVELOPING SOCIAL-SEMANTIC APPLICATIONS: Building Semantic Web applications with social network features - The generic architecture of Semantic Web applications -Sesame – Elmo – GraphUtil - The features of Flink - System design – open academia: distributed, semantic-based publication management - The features of open academia - System design.

08 Hours

Module - V

EVALUATION OF SOCIAL NETWORK ANALYSIS: Evaluation of web-based social network extraction - Data collection - Preparing the data – Optimizing goodness of fit - Comparison across methods and networks - Predicting the goodness of fit – Evaluation through analysis - Semantic-based Social Network Analysis in the sciences - Data acquisition - Representation, storage and reasoning- Visualization and Analysis – Results - Descriptive analysis - Structural and cognitive effects on scientific performance.

08 Hours

Teaching Learning Methodology: Chalk and Talk, Power point presentation, flip teaching,YouTube videos

PRACTICAL COMPONENTS

Sl. No	Experiments
1	To Searching for the keyword Paris using the geographic search of Flickr. **Suggested Readings:** Semantic Web
2	Identify the features in web pages that can be used for social network extraction. **Suggested Readings:** Web data and semantics
3	Add data to a Sesame repository using the web interface **Suggested Readings:** Sesame repository
4	Query data through the web interface of Sesame and display the results. **Suggested Readings:** Sesame repository
5	Creating and write out a FOAF profile Using Elmo. **Suggested Readings:** ELMO
6	Collect personal and social data using a custom-built online survey system which an online survey offers several advantages compared to a paper questionnaire **Suggested Readings:** Evaluation of Social network analysis
7	Draw the Histogram for the number of web pages per individual. **Suggested Readings:** Evaluation of Social network analysis

Course Outcomes:

After successful completion of this course, the students will be able to:

CO1: Understand a social network analysis
CO2: Understand the Web data and semantics in social network applications
CO3: Model and aggregate the social network data
CO4: Develop social–semantic applications
CO5: Evaluate the social network extraction with case studies

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Peter Mika , Social Networks and the Semantics Web‖,Springer, 2007

Reference Books:

1. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.

E-Books:

1. http://www.asecib.ase.ro/mps/Social%20Networks%20and%20the%20Semantic%20Web%20[2007].pdf

MOOC:

1. https://www.coursera.org/learn/social-network-analysis

DIGITAL MARKETING ANALYTICS

Course Code	**21CDO753**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: Data Analytics

Course Objectives:

This course will enable students to,

1. Gain an understanding of the motivations behind data collection and analysis methods used by marketing professionals
2. Understand frameworks and approaches to measuring consumers‘ digital actions
3. Learn to evaluate and choose appropriate web analytics tools and techniques
4. Earn familiarity with the unique measurement opportunities and challenges presented by New Media

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students‘ Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encouragethe students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

DIGITAL MEDIA AND ANALYTICS: Digital media types – Owned and earned social metrics – Paid searches and Organic Searches – Aligning Digital and Traditional Analytics – Identifying social media listening tools – Understanding social media engagement software – Social media engagement tools.

08 Hours

Module - II

TOOLS FOR DIGITAL ANALYTICS: Social Media Listening Tools - Evolution, Social analytics life cycle, Social media monitoring software: Sysomos, Radian6, Visible Technologies, Zoho social and others. Search Analytics Tools – Basics of search, Search analytics use cases, Search data, Google trends, YouTube trends, Google Adwords keyword, Yahoo clues, Collecting insights through search data. Audience Analysis Tools – Audience Analysis Use Cases, Audience analysis tool types – Audience analysis Techniques, Event Triggers.

Content Analysis Tools - Content Audits-Optimizing Content Distribution, Analysing Content Consumption. Engagement Analysis Tools – Social Media Engagement Software (SMES), using SMES, study of different SMES in the market.

08 Hours

Module - III

DIGITAL INFLUENCE AND LISTENING: Reality of Digital Influence - Media List - Klout, Peer Index - Online Versus Offline Influence - Using the Influencer List - Developing Social Media Listening Program - Using Listening Data for Program Planning - Implementing Listening Program - Conversation Audit - Online Influencers - Conducting Social brand benchmarking - Use of Online data for crisis anticipation - Identifying known issues - Crisis day monitoring and ongoing reporting - Corrections after crisis - Improving customer service – Social customer service conflict - Social customer service models.

08 Hours

Module - IV

RESEARCH PLAN AND SEARCH ANALYSIS: Launching new product – Product life cycle – Introduction Phase – Growth Phase – Maturity Phase. Formulating research plan – Developing source list – Research methods – Constructing reports – Delivering reports – Report use cases – Building central repository of information – Search analytics for digital strategy – Search analytics for content strategy and planning – Search analytics for paid advertising.

08 Hours

Module - V

ROI, MOBILE ANAYTICS AND BUSINESS INTELLIGENCE: Return on Investment (ROI) – Return on Engagement, Influence, Experience – Tracking ROI – Understanding measurement fundamentals – Measurement reporting cadence - Mobile Analytics – Mobile market landscape – Mobile marketing measurement – Marketing activities – Audience/visitor metric – Mobile app performance - Social CRM – Social CRM initiative – Social CRM Initiative – Future of Digital Data – Business Intelligence

08 Hours

Teaching Learning Methodology: Chalk and board, Active Learning, PPT Based presentation, Video

Course Outcomes:

On completion of this course, the students will be able to,

CO1: Relate to digital media marketing and the need for analytics on the data captured.
CO2: Choose the appropriate tools for performing different digital analytics on the digital marketing data.
CO3: Analyze and appraise the outcomes of digital influence and listening.
CO4: Formulate a research plan and perform search analysis on the digital marketing data.
CO5: Summarize the strategies for Mobile analytics and Business Intelligence

Assessment Details (both CIE and SEE)

Component		Weightage (%)	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Chuck Hemann and Ken Burbary, ‑Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World‖, Que Publishing, 1 edition, ISBN-13: 978-0789750303, 2013.

References:

1. Simon Kingsnorth, ―Digital Marketing Strategy: An Integrated Approach to Online Marketing‖, Kogan Page Publisher, First edition, ISBN-13: 978-0749474706, 2016.
2. Dave Chaffey, Fiona Ellis-Chadwick, ―Digital Marketing – Strategy, Implementation and Practice‖, Pearson Education, Sixth edition, ISBN-13: 978-1292077611, 2016.

E-Books:

1. Eric Enge, Andy Crestodina, Larry Kim, Steve Rayson and Chad White, ―How the Pros Turn Marketing Analytics Into Effective Marketing Strategies‖, Alexa, An Amazon Company. https://blog.alexa.com/wp-content/uploads/2016/12/How-to-Pros-Turn-Marketing- Analytics-into-Effective-Marketing-Strategies-ebook.pdf

MOOC:

1. **https://www.coursera.org/learn/marketing-analytic**

DATA SCIENCE AND VISUALIZATION

Course Code	**21CDO754**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P: S)	**3:0:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Prerequisite: This course introduces students to data analysis and visualization in the field of exploratory data science using Python.

Course Objective:

1. To introduce the fundamental concepts of data science.
2. To Learn different approaches in the design of data visualization systems
3. To analysis and solve problems of data visualization systems.
4. To evaluate the effectiveness of visualizations for specific data, task, and user types.
5. To use the existing visualization paradigms, techniques, and tools

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction: Introduction to Data Science, Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook.

Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels

08 Hours

Module - II

Getting Started with Pandas: Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics. Data Loading, Storage and File Formats. Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases Data Cleaning and Preparation. Handling Missing Data, Data Transformation, String Manipulation**.**

08 Hours

Module - III

Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting.

Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools.

08 Hours

Module - IV

Data Aggregation and Group operations: Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation.

Time Series Data Analysis: Date and Time Data Types and Tools, Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling, Periods and Periods Arithmetic, Resampling and Frequency conversion, Moving Window Functions.

08 Hours

Module - V

Advanced Pandas: Categorical Data, Advanced Group By Use, Techniques for Method Chaining

08 Hours

Teaching-Learning Process for all modules	Chalk and board, Active Learning, PPT Based presentation, Video

Course outcomes:

On successful completion of the course, the students will be able to :

CO1: Use data analysis tools in the pandas library.
CO2: Load, clean, transform, merge and reshape data.
CO3: Create informative visualization and summarize data sets.
CO4: Analyze and manipulate time series data.
CO5: Solve real world data analysis problems.

Assessment Details (both CIE and SEE)

Component		**Weightage (%)**	
CIE's	CIE 1 5th week	20	60
	CIE 2 10th week	20	
	CIE 3 15th week	20	
AAT's	AAT-1 10th week	10	
	AAT-2	10	
	AAT-3	20	
Continuous Internal Evaluation Total Marks: 100. Reduced to 50 Marks			
Semester End Examination (SEE) Total Marks: 100. Reduced to 50 Marks			

Text Books:

1. Bart Baesens, Analytics in a Big Data World, Wiley publications, 2014.
2. Gareth James, Daniela Witten, Trevor Hatie, Roberst Tibhirani , An Introduction to Statistical Learning-with Applications in R, Springer series in statistics, 2017.
3. Jared P. Lander, R for Everyone, Addison Wesley Data & Analytics Series, Pearson, 2014.

Reference Books:

1. McKinney, W. (2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.
2. O'Neil, C, & Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media.