Programme	B. Sc. Computer Science				
Course Code	CSC2MN102				
Course Title	Introduction to Data Science				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Python Programming 2. Linear Algebra				
Course Summary	This course provides a comprehensive overview of data science, covering the various types of data and their applications. The students will acquire a deep understanding of exploratory data analysis along with hands-on implementation skills. . The curriculum introduces both supervised and unsupervised and techniques of Machine learning. Additionally, the data pre-processing techniques are introduced Overall, the course provides a comprehensive understanding of the fundamental data science principles, guiding students through the data science process and illustrating practical applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the types of data and the applications of data science	U	C	Instructor-created exams / Quiz
CO2	Implement various data analysis and visualisation techniques.	Ap	P	Problem-solving assessments

CO3	Express and Gain insights on advanced data preprocessing techniques	U	P	Modelling Assignments	
CO4	Discuss various machine learning techniques and algorithms	U	P	Modelling Assignments/ / Case studies	
CO5	Create analysis and prediction models using Machine learning methodologies	C	M	Modelling Assignments/ / Case studies Instructor-created exams / Quiz	

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks (70)
I		**Introduction to Data Science**	10	10
	1	Introduction to Data: Types of Data – Structured Data, Semi-Structured Data, Unstructured Data and Data Streams, Statistical Data Types - Quantitative Data (Ratio and Interval Scale) and Qualitative Data (Nominal and ordinal)	2	
	2	Basic Methods of Data Analysis- Descriptive Data Analysis, Diagnostic Data Analysis or Exploratory Data Analysis, Inferential Data Analysis and Predictive Analysis.	1	
	3	Inferential Statistics: Statistical Inference, Population and Sample, Statistical Modeling, Probability Distributions – Normal, Uniform	3	
	4	Introduction to Data Science: Big Data and Data Science , Data Science Process	2	
	5	Applications of Data Science , Issues and challenges in Data Science	2	

II		**Exploratory Data Analysis**	14	10

	6	Exploratory Data Analysis (EDA) : Types of EDA - Univariate non-graphical, Multivariate non- graphical, Univariate graphical, and, Multivariate graphical. Methods of EDA – Descriptive Statistics and Data Visualization	5	
	7	Descriptive Statistics - Measures of Central Tendencies, Dispersion, Skewness and Kurtosis.	5	
	8	Data Visualization - Histograms , Box plots , Quantile-Quantile plots Scatter plots , Heat map, Bubble chart , Bar chart, Distribution plot , Pair plot , Line graph , Pie chart, Area chart	4	
III	**Data Preparation for Analysis**		**6**	**15**
	9	Data Cleaning: Handling Missing and Noisy Data, Removing outliers	2	
	10	Data Integration	1	
	11	Data Transformation: Standardization, Normalization	2	
	12	Data Reduction: Dimensionality Reduction - Principal Component Analysis	1	
1V	**Introduction to Machine Learning**		**15**	**15**
	13	Machine Learning Algorithms : Supervised Learning– Classification, Regression, Unsupervised Learning – Clustering, Dimensionality Reduction , Reinforcement Learning	3	
	14	Test /Train Split, Model Training, Bias and Variance, Overfitting and Underfitting	3	
	15	Evaluation	2	
	16	Linear Regression	1	
	17	k-Nearest Neighbors (k-NN)	1	
	18	k-means Clustering	1	
	19	Naive Bayes	1	
	20	Application of Naive Bayes - Spam Filtering	1	
	21	Singular Value Decomposition	1	
	22	Applications of Supervised, Unsupervised and Reinforcement	1	

		Learning		
V		**Hands-on Data Structures:**	30	20
		Practical Applications, Case Study and Course Project		
	1	Implementation of the concepts or the algorithms learned [Binary Classification, Linear Regression, k-NN, k-means clustering, Spam Filtering]	15	
	2	Case study: Perform exploratory data analysis on a real world dataset using Python. Using appropriate Python packages parse, clean and visualize the data .	5	
	3	Capstone/Course Project: Perform an end-to-end project of the data science process.		

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1							3	1	2	3	1	1	1
CO 2							3	1	2	3	3	2	3
CO 3							3	1	2	3	3	2	3
CO 4							3	1	2	3	3	2	3
CO 5							3	1	2	3	3	2	3

Correlation Levels:

Level	Correlation
-	Nil

1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam

- Programming Assignments (20%)

- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1		✓		✓
CO 2	✓	✓		✓
CO 3		✓		✓
CO 4	✓			✓
CO 5	✓		✓	✓

References

1. O'Neil, Cathy, and Rachel Schutt. *Doing data science: Straight talk from the frontline*. " O'Reilly Media, Inc.", 2013.

2. Han, Jiawei, et al. Data Mining: Concepts and Techniques. Netherlands, Elsevier Science, 2011.

3. Shah, Chirag. A Hands-On Introduction to Data Science. United Kingdom, Cambridge University Press, 2020.

4. Chopra, Rohan, et al. Data Science with Python: Combine Python with Machine Learning Principles to Discover Hidden Patterns in Raw Data. United Kingdom, Packt Publishing, 2019.

Programme	B. Sc. Computer Science				
Course Code	CSC2MN103				
Course Title	**Fundamentals of SPSS and R programming**				
Type of Course	**Minor**				
Semester	II				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic computer knowledge 2. Spreadsheet essentials				
Course Summary	This course offers SPSS basics including data management, transformation, visualization and statistical analysis techniques. Also inAtroduces fundamentals of R environment, focusing on data manipulation and visualization.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Summarize essential data input and manipulation activities within SPSS..	U	P	Instructor-created exams / Seminar Presentation/ Instructor-created exams/ Quiz
CO2	Apply descriptive statistics and conduct parametric and nonparametric tests in SPSS	Ap	P	Assignment / Instructor-created exams
CO3	Summarize overview of R Environment	U	P	Assignment / Instructor-created exams
CO4	Describe Parametric and Non Parametric testing of Statistical Hypothesis	U	P	Hands-on practical sessions

CO5	Create effective visualizations using SPSS and R.	C	P	

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

\# - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Introduction to SPSS**	12	19
	1	Features – Data View – Variable View – Output Viewer Window – Syntax Editor Window -	1	
	2	Open data file , Save , import from other data source ,data entry , labelling for dummy numbers	2	
	3	Recode in to same variable, Recode in to different variable, Transpose of data, Insert variables and cases	2	
	4	Merge variables and cases, Split, Select cases, Compute total scores	2	
	5	Table looks – Changing column - font style and sizes	2	
	6	Diagrammatic representation	2	
II		**Data Analysis Using SPSS**	10	18
	7	Estimation of mean, median and mode- Standard deviation and coefficient of variation.	2	
	8	Descriptive statistics, Parametric tests t-test (paired or unpaired), ANOVA (one-way- two way)	2	

	9	Pearson rank correlation, Linear regression	3	
	10	Non parametric tests: Mann Whitney U test, Wilcoxon signed rank test .	2	
	11	Kruskall Wallis test ,Chi- Square test	1	
III		**Overview of R Environment**	**11**	**18**
	12	R editor, Workspace	2	
	13	Data type – Importing and Exporting Data	2	
	14	Basic Computational Ideas – Merges in R. Matrix Determinant – Inverse – Transpose,Trace)	3	
	15	Eigen Values and Eigen Vectors	2	
	16	Construction of Bar, Pie, Histogram, Line Chart, Box Plot, Scatter Plot	2	
IV		**Parametric and Non Parametric testing of Statistical Hypothesis**	**12**	**15**
	17	One Sample t test, Two group t tests, Paired t test, one way ANOVA, two way ANOVA	3	
	18	Wilcoxon, Mann Witney, Kruskal Wallis Simple Correlation	3	
	19	Linear Regression, Multiple Linear Regression, Testing for overall significance of Model Coefficients – Testing for Individual Regression Coefficients.	2	
	20	Outliers Detection Control Charts, Variable Control Chart, x, R, S.	2	
	21	Attribute Control Chart - p, np, c, u. CUSUM Control Chart, EWMA Control Chart.	2	

	22	Process Capability Analysis, Process Capability Analysis		
V		**Hands-on Word Processor and Presentation Tool:** **Practical Applications, Case Study and Course Project**	**30**	
		SPSS 1. Descriptive Statistics 2. Paired –Samples T Test 3. One-Way ANOVA 4. Correlation & Linear Regression 5. Chi- Square Test **R PROGRAMMING** 6. Simple Correlation 7. Linear Regression 8. One- Way ANOVA 9. Paired T test 10. Plotting Bar Chart	20	
		Case study(Example): **SPSS and R** 1. **Case Study: Customer Satisfaction Analysis** Analyze factors influencing customer satisfaction using survey data. Employ SPSS for regression analysis to identify significant predictors such as product quality, pricing, and customer service. Use R programming to analyse data and make predictions.	10	

Reference Books:

1. Michael S. Louis – Beck (1995). Data analysis an introduction, Series: quantitative applications in the social sciences. Sage, Publications. London

2. Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications. London.

3. Sprankle , M., Problem Solving & Programming Concepts, Pearson India

4. Learning Statistics using R By Rndall E.Schumacker, Sage Publication

5. R for Everyone By Jared P.Lander, Pearson Education

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	-	-	-	-	-	-	1	1	3	3	1	1	1
CO 2	-	-	-	-	-	-	2	1	3	3	3	1	1
CO 3	-	-	-	-	-	-	1	1	3	3	3	1	1
CO 4	-	-	-	-	-	-	1	1	3	3	3	1	1
CO 5	-	-	-	-	-	-	1	2	3	3	3	1	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam

- Programming Assignments (20%)

- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓	✓	✓
CO 5	✓	✓	✓	✓

Programme	B. Sc. Computer Science				
Course Code	CSC2FM106				
Course Title	Digital Empowerment through Ethical Standards				
Type of Course	**MDC**				
Semester	II				
Academic Level	100 – 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic understanding of computers				
Course Summary	This course explores the evolution from pre-digital challenges to the current digital landscape, covering historical milestones, key technologies, and the vision of Digital India. It emphasizes the benefits and importance of digital revolution while addressing ethical and security considerations. Participants engage with digital tools for personal and professional growth and examine case studies on digital infrastructure, missions, and services to understand real-world applications.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Analyse the challenges of pre digital world and understand the importance of digitalization	An	F	Instructor-created exams / Quiz
CO2	Identifying the applications of Cloud Computing, IoT, AI and Blockchain	U	C	Instructor-created exams/ Home Assignments
CO3	Understanding digital india initiatives	U	C	Instructor-created exams
CO4	Enhance the digital literacy by using ideration l tools for online data sharing, online learning, and content creation with awareness of ethical and security considerations in the digital age.	Ap	P	Instructor-

	CO5	Analyze the real-world case studies of digital infrastructure and digital technologies.	An	C	Instructor-created exams

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)
Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs 36+9	Marks (50)
I		**Transition to Digital World**	**7**	**8**
	1	Challenges of Pre-Digital Age	1	
	2	Importance and Benefits of Digital Revolution	2	
	3	Key concepts: digitization, digitalization, digital transformation	1	
	4	Introduction to Key Digital Technologies: Cloud Computing, IoT, AI, Block Chain	3	

Module	Unit	Content	Hrs	Marks
II		**Perspective of Digital India & Digital Innovations in Kerala**	**11**	**15**
	5	Understanding Digital India: Concept, Objectives, and Evolution	1	
	6	Overview of Digital Infrastructure: Broadband Connectivity, Digital Literacy, and Access to Information	2	
	7	Vision of Digital India: DigiLocker, E-Hospitals, e-Pathshala, BHIM, , e-Health Campaigns	3	
	8	Kerala-Emergence as Digital Society : Internet & Mobile Penetration in Kerala, 4 Pillars of Digital Emergence in Kerala (Akshaya Project, IT@School Project, Digital Infrastructure Availability, State Data Centre & allied Applications),	2	
	9	Role of K-DISC in Digital Empowerment	1	
	10	Kerala State IT Mission: Core IT Infrastructure, e-Governance Applications, Service Delivery Platforms,	2	
III		**Digital Tools for Personal and Professional Growth**	**9**	**12**

	11	Digital Tools for Data Sharing: Google Drive, Google Sheets	2	
	12	Digital Tools for Data Sharing: Google Docs, Google Classroom	3	
	13	Online learning platforms and resources (e.g., Coursera, Khan Academy, MOOCs, Duolingo)	2	
	14	Networking Tools: LinkedIn	1	
	15	Content Creation and Management: Canva	1	
IV		**Ethical and Security Considerations in the Digital Age**	**9**	**15**
	16	Understanding privacy in the digital age	1	
	17	Legal and ethical considerations in data collection and processing: Intellectual Property Rights (IPR)	2	
	18	Key Terminologies: Cyber Security, Cyber Crime, Cyber Attack, Cyber Espionage, Cyber Warfare	2	
	19	Authentication, Authorisation	1	
	20	Cyber Crimes and Classification	2	
	21	Introduction to Cyber Laws in India	1	
V		**Open Ended Module: Case Study (One from each set)**	**9**	
	1	Case Study on Digital Infrastructure Projects: (Bharat Broadband Network (BBNL) , Submarine Cable Project, Google Data Center)	3	
	2	Case Study on Digital Mission:	3	

		(Digital Literacy Missions in Kerala, SmartDubai Project, China's Digital Silk Road)		
	3	Case Study on Digital Services: (MyGov.in , Moodle LMS, Digital Payment Services)	3	

References

1. "Digital India Importance Needs and Values" by S K Kaushal
2. "Cyber Security in India: Government, Law Enforcement and Corporate Sector" by Vipin M. Chaturvedi and Shivani Kapoor
3. "Information Security: Principles and Practices in Indian Context" by R.S. Pressman, G. Sharma, and G. Sridhar
4. "Introduction to Computer Security" by Michael Goodrich and Roberto Tamassia
5. https://kdisc.kerala.gov.in/
6. https://itmission.kerala.gov.in/

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Final Exam