॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदवी तृतीय वर्षाचा अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६—२७ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्यापरिषद बैठकीतील विषय क्र.०८/६४—२०२६ च्या ठरावानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील राष्ट्रीय शैक्षणिक धोरण—२०२० नुसार पदवी तृतीय वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२६—२७ पासून लागू करण्यास मा.विद्यापरिषदेने मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील बी.एस्सी. तृतीय वर्षाचे खालील विषयाचे अभ्यासक्रम (Syllabus) उपपरिसर लातूर येथे शैक्षणिक वर्ष २०२६—२७ पासून लागू करण्यात येत आहे.

01	B.Sc. III Year Computer Science (with data Science Specialization)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड — ४३१ ६०६.
जा.क्र.:शै—१/परिपत्रक/पदवी/बीएस्सी/२०२६—२७/ 120
दिनांक : २८.०७.२०२६

उपकुलसचिव
शैक्षणिक (१—अभ्यासमंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :—
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
४) मा. संचालक, परिक्षा व मुल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

SWAMI RAMANAND TEERTH

MARATHWADA UNIVERSITY, NANDED - 431 606

(Structure and Syllabus of Four Years Degree Program with Multiple Entry and Exit Option)

FOUR YEAR BACHELOR OF SCIENCE

COMPUTER SCIENCE

(With Data Science Specialization)

School of Technology, Sub-Campus, Latur

B.Sc. III year Computer Science (with Data Science Specialization) syllabus

Under the Faculty of
Science and Technology

Effective from Academic year **2025– 2026**

From the Desk of the Dean, Faculty of Science and Technology

Swami RamanandTeerthMarathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power",***is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve the **3Es, the *equity, the efficiency and the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the *cumulative grade point average* (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the *Choice Based Credit System* (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high caliber graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science-based to the discipline-specific-based curriculum. All the recommendations of the ***SukanuSamiti*** given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship*** program for science background students is praise worthy and certainly help the students to imbibe first-hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Dr. M. K. Patil, ***Dean,*** *Faculty of Science and Technology*

Swami RamanandTeerthMarathwada University, Nanded

Faculty of Science & Technology

Structure for Four Year Multidisciplinary Degree Program with Multiple Entry and Exit

Subject: COMPUTER SCIENCE

Year & Level	Semester	Subject-1 Major (DSC/DSE) 8 Credits	Subject-2 Minor (DSM) (Basket 1) 4 Credits	Generic Elective (GE) (Basket 2) *(Select one each from Group A and B of Basket 2, differentfrom DSC / DSM)* 2 Credits	Vocational & Skill Enhancement Course (V/SEC) *(Related to DSC)* 2 Credits	Ability Enhancement Course (AEC) (Basket 3 for L2) Value Education Courses (VEC) / Indian Knowledge System (IKS) *(Common across faculty)* 04 credits	Field Work / Project/ Internship/ OJT/ Apprenticeship / Case Study Or Co-curricular Courses (CC) (Basket 4 for CC) *(Common across faculty)* 2 Credits	Credits	Total Credits
1	2	3	4	5	6	7	8	9	10
3 (5.5)	V	SCSCCT 6101(3-Credits) SCSCCT6102(3-Credits) SCSCCT6103(2-Credits) SCSCCP 6104(2-Credits) SCSCCP 6105(2-Credits) (12 Credits)	SCSCET 6106 (3-Credits) SCSCEP 6107 (1-Credits) (04 Credits)	-	-	SCSCAE 6108 (04 Credits)	SCSCFP 6109 (2-Credits)	22	44
	VI	SCSCCT 6501(3-Credits) SCSCCT6502(3-Credits) SCSCCT6503(2-Credits) SCSCCP 6504(2-Credits) SCSCCP 6505(2-Credits) (12 Credits)	SCSCET 6506 (3-Credits) SCSCEP 6507 (1-Credits) (04 Credits)	-	-	SCSCAE 6508 (04 Credits)	SCSCFP 6509 (2-Credits)	22	
Exit option: UG Certificate in Major DSC on completion of 44 credits and additional 4 credits from NSQF / Internship									

B. Sc. CS Third Year Semester V*(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SCSCCT 6101	Data Visualization and Modeling	03	--	**03**	03	--
	SCSCCP 6102	Data Analytics using Python	03	--	**03**	03	--
	SCSCCT 6103	Software Engineering	02	--	**02**	02	--
	SCSCCP 6104	Lab 11:DVM	--	02	**02**	--	04
	SCSCCP 6105	Lab 12: DAUP	--	02	**02**	--	04
Minor	SCSCCT 6106	Data Mining Techniques	03	--	**03**	02	--
	SCSCCP 6107	Lab 13: DMT	-	01	**01**	--	02
Skill Enhanced Course	SCSCSE6108	Social Media Analytics	04	--	**04**	04	--
Ability Enhancement Course	SCSCAE 6109	Mini Project	--	02	**02**	--	02
Total Credits			**15**	**07**	**22**	**14**	**12**

. B. Sc. CS Third Year Semester VI *(Level 5.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SCSCCT 6501	AI and Machine Learning	03	--	**03**	03	--
	SCSCCP 6502	Digital Signal and Image Processing	03	--	**03**	03	--
	SCSCCT 6503	Software Project Management	02	--	**02**	02	--
	SCSCCP 6504	Lab 14: AI&ML	--	02	**02**	--	04
	SCSCCP 6505	Lab 15: DSIP	--	02	**02**	--	04
Minor	SCSCCT 6506	Natural Language Processing	03	--	**03**	02	--
	SCSCCP 6507	Lab16: NLP	-	01	**01**	--	02
Ability Enhancement Course	SCSCSE6508	Data analysis using SPSS	04	--	**04**	04	--
Project	SCSCFP6509	Major Project	--	02	**02**	--	02
Total Credits			**15**	**07**	**22**	**14**	**12**

B. Sc. CS Third Year Semester V*(Level 5.5)*

B.Sc. Computer Science (Specialization with Data Science) Course Structure

[40% Continuous Assessment (***CA***) and 60% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7)/ Col (8+9) (10)
			Continuous Assessment(CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SCSCCT 6101	Data Visualization and Modeling	30	30	30	45	--	--	75 (3 Credits)
	SCSCCP 6102	Data Analytics using Python	30	30	30	45	--	--	75 (3 Credits)
	SCSCCT 6103	Software Engineering	20	20	20	30	--	--	50 (2 Credits)
	SCSCCP 6104	Lab 11:DVM	--	--	--	--	20	30	50 (2 Credits)
	SCSCCP 6105	Lab 12: DAUP	--	--	--	--	20	30	50 (2 Credits)
Minor	SCSCCT 6106	Data Mining Techniques	30	30	30	45	--	--	75 (3 Credits)
	SCSCCP 6107	Lab 13:DMT	--	--	--	--	10	15	25 (1 Credits)
Skill Enhancement Course	SCSCSE6108	Social Media Analytics	--	--	--	--	40	60	100 (4 Credits)
Ability Enhancement Course	SCSCAE 6109	Mini Project	--	--	--	--	--	50	50 (2 Credits)
Total Credits 22									

B. Sc. CS Third Year SemesterVI*(Level 5.5)*

[40% Continuous Assessment (***CA***) and 60% End Semester Assessment (***ESA***)]

(For illustration we have considered a paper of 02 credits, 50 marks, need to be modified depending on credits assigned to individual paper)

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7)/ Col (8+9) (10)
			Continuous Assessment(CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Major	SCSCCT 6501	AI and Machine Learning	30	30	30	45	--	--	75 (3 Credits)
	SCSCCP 6502	Digital Signal and Image Processing	30	30	30	45	--	--	75 (3 Credits)
	SCSCCT 6503	Software Project Management	20	20	20	30	--	--	50 (2 Credits)
	SCSCCP 6504	Lab 14: AI&ML	--	--	--	--	20	30	50 (2 Credits)
	SCSCCP 6505	Lab 15: DSIP	--	--	--	--	20	30	50 (2 Credits)
Minor	SCSCCT6506	Natural Language Processing	30	30	30	45	--	--	75 (3 Credits)
	SCSCCP 6507	Lab16: NLP	--	--	--	--	10	15	25 (1 Credits)
Ability Enhancement Course	SCSCVC 6508	Data analysis using SPSS	--	--	--	--	40	60	100 (4 Credits)
Project	SCSCAE 6509	Major Project	--	--	--	--	--	50	50 (2 Credits)
Total Credits 22									

Guidelines for Course Assessment:

A. Continuous Assessment (CA) (40% of the Maximum Marks):

This will form 40% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (**Test I** on 40% curriculum and **Test II** remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper and one assignment will make his **CA** score (col 6).

B. End Semester Assessment (60% of the Maximum Marks):

(For illustration we have considered a paper of 02 credits, 50 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper will consists of 6 questions, each of 10 marks.**
2. **Students are required to solve a total of 3 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY TWO**of the remaining Five Questions (Q.2 to Q.6) andshall be based on entire syllabus.

C. Assessment of Co-Curricular courses (CC):

a. Continuous Assessment (CA) of the CC course shall be done by the respective course coordinator depending on the regularity, performance of a student and his participation in the international, national, state, university, college level events or camps, wherever applicable.

b. End Semester Assessment (ESA) shall be done on the basis of the write-up and presentation by the student on the activities that he has carried out throughout the semester.

c. Students have freedom to take more than one CC courses, however, score of the best performing CES shall be considered for final assessment.

D. Syllabi, Teaching Scheme and Examination Scheme for the courses in Column 7 and Column 8 (AEC, VEC, IKS, CI, EVS, CCs, etc.) shall be common for all the students from different faculties.

Note: Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45lectures.

%%%%%

Semester Fifth

Course Code	Course Title	Credits
SCSCCT 6101	**Data Visualization and Modeling**	**03**
Course Objectives	1. Understand the fundamentals of visualization concepts and its importance. 2. Understand essential design principles to design and develop effective visualizations. 3. Understand planning and visual analytics through advanced visualization techniques.	
Course Outcomes	1. Understand foundational visualization concepts 2. Demonstrate visualizations principles to enhance data visualization 3. Analyze and apply essential design principles to data exploration and visualization 4. Design appropriate charts, tables, maps and dashboards	
Unit I	**Introduction**	
	Introduction to data visualization-Need for data visualization and its definition-Tools for Visualizing Data-Methods of visualizing data-Overview of modern visualization tools - working with various data formats - Basic chart types.	
Unit II	**Data Visualization for Human Perception**	
	The Human Brain and Data Visualization-Cognitive vs Perceptual Design Distinction Introduction of Effective and Ineffective Visuals-Types of Visualizations and its examples Practicing Good Ethics in Data Visualization-Ineffective Visuals and improvements-Visual Perception and Cognitive Principles- Strategic Use of Pre-Attentive Attributes - De-Cluttering	
Unit III	**Design and Exploratory Analysis**	
	Introduction-Exploratory and Explanatory Analysis -Identifying Outliers-Constructing a Control Chart-Design For Purpose-Data, Relationships, and Design-Static Versus Interactive Visualizations-Multiple, Connected View, Language, Labelling, and Scales-Visual Lies and Cognitive Bias- Case Study	
Unit IV	**Visual Analytics and Planning**	
	Basics of Visual Analytics -Charts- Colours, Shapes, and Sizes-Dual Line Charts-Bar Charts, Line Graphs, Pie Charts-Scatter Plots, Gantt Charts, Bubble Charts-Histograms, Bullet Charts, Heat Maps and Highlight Tables-Dates-Discrete vs. Continuous Dates-Basics of table calculations Maps. Introduction to Planning and Preproduction for Visualizations	
Suggested Readings	1. Colin Ware and Kaufman M,, Visual thinking for design‖, Morgan Kaufmann Publishers, 2008 2. Ben Fry, " Visualizing data", O'Reily,2007 3. Chakrabarti, S, ―Mining the web: Discovering knowledge from hypertext data ―,Morgan Kaufman Publishers, 2003.	

Course Code	Course Title	Credits
SCSCCP-6102	**Data Analytics using Python**	03
Course Objectives	1. To understand the students to basics of the python programming for real word data analytics problems. 2. To make use of the statistics to get a deterministic view of data, and interpreting results in the field of exploratory data science using Python. 3. To understand the effective use of python libraries and make use of it for "Data Science" pathway.	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Understand the python programming facilities for real word data analytics problems. 2. Make use of the statistics to get a deterministic view of data, and interpreting results in the field of exploratory data science using Python. 3. Understand the effective use of python libraries and make use of it for "Data Science" pathway.	
Unit I	**Basics of Python and Data analysis**:	
	Fundamentals of Python programming, List, tuple, dictionary and its operations in python, Python Libraries for data handling: NumPy, Pandas, SciketLearn, Matplotlib, Seaborn with examples,introduction of Data Analysis, Statistical foundations for Data Analysis, Types of data, Descriptive Statistics, Correlation and covariance.	
Unit II	**Array manipulation using Numpy:**	
	Numpy array: Creating Numpy arrays; various data types of Numpy arrays, indexing and slicing, swapping axes, transposing and reshaping arrays, data processing using Numpy arrays, Vectorization, Array Manipulation.	
Unit III	**Data Manipulation using Pandas**	
	Introduction to Pandas, Loading and displaying data of pandas data frame, Working with DataFrames, Arithmetics, Indexing, Filtering, Handling missing data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping, Selecting Columns from a dataframe, Selecting Rows from a dataframe, Adding new data in a dataframe, Deleting data from a dataframe.	
Unit IV	**Plotting and Visualization of Data**	
	Exploratory Data Analysis (EDA), Using Matplotlib to plot data: figures, subplots, markings, color and line styles, labels and legends, Plotting functions in Pandas: Line, bar, Scatter plots, histograms, Pie chart, Heatmap.	
Suggested Readings	1. Molin S. Hands-On Data Analysis with Pandas, Packt Publishing, 2019 2. Gupta S.C., Kapoor V.K. Fundamentals of Mathematical Statistics,12 th edition, Sultan Chand & Sons, 2020. 3. Chen D. Y. Pandas for Everyone: Python Data Analysis, First edition, Pearson Education, 2018 4. Data science and machine learning using python By Dr.Reema Thareja 5. Python for Data Analysis by Wes McKinney 6. Python data science handbook by Jake Vanderplas	

Course Code	Course Title	Credits
SCSCCT-6103	**Software Engineering**	**02**
Course Objectives	1. To aware the software Engineering principles 2. To understand the software development and testing process, verification and validation of software product	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Students are able to develop software using software engineering principles 2. Students are able to test the software as well as quality of software product	
Unit I	**Introduction**	
	Introduction: Software, Software Characteristics, Software Applications, Software Myths, Software Engineering, Generic View of Software, Software Paradigms: Linear Sequential Model or Classic Life Cycle, Prototyping, Evolutionary Software Process Model, 4 GT, RAD	
Unit II	**Software process and project metrics**	
	Measures, metric and indicators, Software Measurement, Reconciling different metric approaches, Metrics for software quality, Integrating metrics within the software Engineering process.	
Unit III	**Design Engineering and User Interface Design**	
	Design process and design quality, design concepts, design models, The Golden rules, User interface analysis and design, interface design activities.	
Unit IV	**Software Testing**	
	Testing objectives, Testing principles, White box testing : features, types of white box testing, Black box testing: features, Equivalence partitioning, Boundary Value Analysis,	
Suggested Readings	1. Software Engineering a Practitioner's Approach Roger S. Pressman 8e 2. Software Engineering Richard Fairley Tata McGraw Hill. 3. Software Engineering David Gustafson 4. Practical Guide in Structured System Design Meilier Page 5. Software Project Management - Jalote	

Course Code	Course Title	Credits
SCSCCT-6106	**Data Mining Techniques**	**03**
Course Objectives	1. To make more effective use of data stored in huge databases and create a clean, consistent repository of data within a data warehouse. 2. To discover hidden patterns and knowledge that is embedded in the data using different data mining techniques. 3. To use different data mining techniques for taking business decisions and designing policies.	
Course Outcomes	**After successful learning of this course students will be able to:** 1. make more effective use of data stored in huge databases and create a clean, consistent repository of data within a data warehouse. 2. Find out the hidden patterns, trend and knowledge from huge data using different data mining algorithms and techniques. 3. Use different data mining techniques for interpreting results and taking business decisions and designing policies.	
Unit I	**Data Warehouse and OLAP Technology**	
	Introduction to Data Warehouse, Data Warehouse Features, Data Warehouse Architecture, Data Warehouse Implementation, OLAP and OLTP, Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization, Data Marts Vs Data warehouse.	
Unit II	**Introduction to Data Mining Technique**	
	Data mining definition, Fundamentals of data mining, Data Mining Functionalities, Application of data mining, Classification of Data Mining systems, Data Mining Tasks (Classification, Regression, Association, Time Series analysis etc), KDDs, Data Mining Vs KDD's, Major issues in Data Mining.	
Unit III	**Classification and Clustering tasks**	
	Introduction of Classification, Examples of classification, Classification algorithms: Decision Tree, Naïve Bayes, Support Vector Machines (SVM), KNN algorithms, Introduction to clustering, types of clustering, K-means clustering algorithm with example	
Unit IV	**Association rule mining and web mining**	
	Mining Frequent Patterns, Frequent Itemset, Associations and Correlations: Basic Concepts, Mining various kinds of Association Rules, Apriori Algorithm for association rule with examples, Introduction to Web Mining, web Content Mining, Web Structure Mining, Web Usage Mining, Examples of web mining and applications.	
Suggested Readings	1. M.H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education. 2. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3. Pieter Adriaans, Dolf Zantinge , "Data Mining", Pearson Education Asia 4. M Berry and G. Linoff, "Mastering Data Mining", John Wiley. 5. Arun K Pujari, Data Mining Techniques, 2nd edition, Universities Press. 6. Sam Aanhory & Dennis Murray, Data Warehousing in the Real World, Pearson Edn Asia	

Course Code	Course Title	Credits
SCSCCT-6108	**Social Media Analytics**	**03**
Course Objectives	1. Understand the fundamentals of social media analytics and its relevance in today's digital landscape. 2. Learn different types of social media analytics and their applications, including customer profiling, location analytics, action analytics, mobile/app analytics, and Google Analytics. 3. Gain knowledge of social network analysis, including network structure, egocentric networks, network metrics, and clustering techniques. 4. Explore text analytics techniques used in social media, including data types, deployment models, and text mining algorithms. 5. Develop practical skills in building recommender systems in social media using techniques such as association rule mining, collaborative filtering, and similarity measures	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Students are able to understand how to analyze the social media data. 2. Students are able to use tools for social media analytics 3. Students are able to understand the social media network	
Unit I	**Introduction to Social Media**	
Unit I	Social Media Data, Social Media Intelligence & Listening, Social Media Monitoring Metrics, Types of Social Media tools, Theories in Media Research, Long Tail, electronic word-of-mouth (eWOM), Power Law& Popularity.	
Unit II	**Types of Social Media Analytics**	
	Knowing your customers –Seven layer Approach, Location Analytics, Action Analytics, Mobile/App Analytics, Google Analytics .	
Unit III	**Social Network Analysis**	
	Introduction to Networks, Common network terms, Network structure, Types of Networks, Egocentric Networks, Network analysis metrics, Strong and Weak Ties, Clustering and Grouping.	
Unit IV	**Text Analytics in Social Media**	
	Text Analytics data types, Deployment models, Purpose of text analytics, Text analytics value creation cycle, Text Mining algorithms**.**	
Suggested Readings	1. David Easley and Jon Kleinberg "Networks, Crowds, and Markets: Reasoning about a Highly Connected World" , Cambridge University Press 3rd Edition, 3rd Edition 2. Derek Hansen Ben Shneiderman Marc Smith ItaiHimelboim, Morgan Kaufmann "Analysing Social Media Networks with Node XL" , 2nd Edition 3. Huan Liu, Mohammad Ali Abbasi, and Reza Zafarani "Social Media Mining: An Introduction" , Cambridge University Press. 1st Edition	

Practical Course

Course Code:	**SCSCCP 6104**	Lab 11:DVM	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6105**	Lab 12:DAUP	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6107**	Lab 13:DMT	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6109**	Mini Project	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Project	As per the choice and need of current era topic of the project will be selected. 1. Every project group contains minimum 1 and maximum 3 students 2. Project should be implemented in the lab on given computer. 3. Every group should give at least one presentation before final examination on their project topics.		

Sixth Semester

Course Code	Course Title	Credits
SCSCCT-6501	**Introduction to AI and ML**	**03**
Course Objectives	1. To understand the Concept of AI and its application 2. To understand the basics of Machine Learning and its applications 3. To apply AI techniques and algorithms for different application	
Course Outcomes	1. Students are able to understand the applications of AI in different fields 2. Students are able to understand the applications of machine learning in different field. 3. Students are able to understand and apply different AI techniques on different problems in society.	
Unit I	**Introduction to AI**	
	Definition, History – Evolution of AI, Overview of AI problems, types of AI (Narrow/Weak vs. General/Strong), applications of AI, Intelligent Agents: Structure, environment, types, and agent behaviours, Turing Test in AI	
Unit II	**Knowledge Representation and problem solving approach using AI**	
	Knowledge-Based Agent in AI: Architecture, Approaches to designing a knowledge-based agent, knowledge representation: Techniques of knowledge representation, Propositional logic, Rules of Inference, Search Algorithms in AI: Terminologies, Properties of search Algorithms, Types of search algorithms (BFS, DFS, properties of A* algorithm), Hill climbing approach	
Unit III	**Introduction to Machine Learning (ML) Fundamentals**	
	Introduction to Machine Learning: History of ML, Examples of ML, Applications of ML, Types of Learning in ML: Supervised, Unsupervised Semi-Supervised and reinforcement Learning with examples, ML Life cycle, Data Pre-processing, Training versus Testing, Positive and Negative Class, Confusion matrix with positive and negative classes.	
Unit IV	**Machine Learning Algorithms and Model Evaluation**	
	Supervised Learning: Basics of Binary Classification, Multiclass classification, Classification algorithms:Logistic Regression, Decision Trees, Support Vector Machines (SVM), and Random Forests. Unsupervised Learning: Basics of Clustering, Types of clustering, K-Means clustering algorithm with example, Dimensionality Reduction using PCA. Model Evaluation: Train/Test split, cross-validation, accuracy, precision, recall, and F1-score.	
Suggested Readings	1. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011. 2. Ric, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGraw Hill. 3. Data science and machine learning using python by Dr. Reema Thareja, MCGraw Hill Publisher, 2023 4. Alpaydin, E. 2010. Introduction to Machine Learning. 2nd edition, MIT. 5. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.	

Course Code	Course Title	Credits
SCSCCP 6502	**Digital Signal and Image Processing**	**03**
Course Objectives	1. Fundamentals of digital image processing. 2. Study of Image Enhancement Techniques 3. Various image transforms, image restoration techniques, morphology and segmentation used in digital image processing.	
Course Outcomes	1. Describe the roles of image processing systems in a variety of applications; 2. Write programs to read/write and manipulate images: enhancement, segmentation, and compression, spatial filtering. 3. Develop image processing using mathematical morphology. 4. Evaluate the methodologies for image segmentation.	
Unit I	**Introduction**	
	Elements of Visual Perception- Structure of the human eye, Image formation in the eye, brightness adaptation and discrimination; light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, basic relationships between pixels, linear and nonlinear operations.	
Unit II	**Image Enhancement**	
	Point processing: Contrast stretching, power-law and gamma transformation. Histogram processing: histogram equalization and matching.	
Unit III	**Filtering and Restoration**	
	Degradation function and Noise Models, Spatial Domain Filtering: Correlation and Convolution, Smoothing Linear and Nonlinear Filters: Mean and Median Filters, Adaptive Filtering, Sharpening Linear and Nonlinear Filters: Derivative, Laplacian, Unsharp Masking, High-boost Filtering. Frequency Domain Filtering	
Unit IV	**Morphology and Segmentation**	
	Basic concept of set theory, logic operation involving binary images, dilation and erosion, opening and closing, and hit-or-miss transformation. Detection of discontinuities – Point detection, line detection, edge detection – gradient operators, compass operators, Laplace operators and zero crossing, stochastic gradients, performance of edge detector operators.	
Suggested Readings	1. A. K. Jain, Fundamentals of Digital Image Processing, Pearson Education India, 2015. 2. Rafael Gonzalez, Richard Woods, Digital Image Processing, Pearson Education India, 2017. 3. R. H. Vollmerhausen, R.G. Driggers, Analysis of Sampled Imaging Systems, SPIE Press, 2001. 4. Chanda, D. D. Majumder, Digital Image Processing and Analysis, PHI, 2011. 5. A. C. Bovik, Handbook of Image and Video Processing (Communications, Networking & Multimedia). Academic Press, 2005. 6. J. S. Lim, Two Dimensional Signal and Image Processing, Prentice-Hall, Englewood Cliffs, New Jersey, 1989.	

Course Code	Course Title	Credits
SCSCCT 6503	**Software Project Management**	02
Course Objectives	1. To understand the basics of software project and its management activities 2. To understand and highlights an importance of software project management 3. To understand the software project planning and evaluation techniques.	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Understand Project Management principles while developing the software project. 2. Apply extensive knowledge of basic project management concepts, framework, and process models while developing the software. 3. Implement a project to manage project schedule, project progress, expenses and resources with the application of suitable project management tools.	
Unit I	**Introduction of Software Project Management**	
	Fundamentals of Software Project Management (SPM), Need Identification, Vision and Scope, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework.	
Unit II	**Software Project Planning**	
	Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure of a Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.	
Unit III	**Project Organization and Scheduling**	
	Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts.	
Unit IV	**Introduction of Project Monitoring and Control**	
	Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators: 23 Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance.	
Suggested Readings	1. Project Management: The Managerial Process with MS By Clifford F. Gray and Erik W. Larson, McGraw Hill 2. Project Management and Tools & Technologies – An overview, By Shailesh Mehta SPD Publications 3. Software Project Management – M. Cotterell, Tata McGraw-Hill Publication. 4. Software Project Management – Royce, Pearson Education 5. Software Project Management – S. A. Kelkar, PHI Publication.	

Course Code	Course Title	Credits
SCSCCT 6506	**Natural Language Processing**	03
Course Objectives	1. Introduce to some of the problems and solutions of NLP and their relation to linguistics and statistics. 2. To understand linguistic phenomena and learn to model them with formal grammars. 3. To estimate parameters using supervised and unsupervised training methods. 4. To design, implement, and analyze NLP algorithms. Able to design different language modeling Techniques.	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Students are able to solve NLP problems 2. Students are able to develop models for NLP	
Unit I	**Introduction**	
	Applications or Use cases of NLP, Components of NLP, Steps in NLP, Finding the Structure of Words: Words and Their Components, Lexemes, Morphemes, Morphology, Typology, Morphological Typology. **Natural Language Processing with python NLTK package (Text Preprocessing Tasks)** Word Tokenization, Sentence Tokenization, Filtering Stop words, Stemming, Tagging Parts of Speech, Lemmatization, Chunking, Chinking, Named Entity Recognition, Term Frequency and Inverse Document Frequency (TF-IDF).	
Unit II	**Syntax Analysis**	
	Parsing Natural Language, Tree banks: A Data-Driven Approach to Syntax, **Representation of Syntactic Structure:** Syntax Analysis using Dependency Graph, Syntax Analysis using Phrase Structure Trees, **Parsing Algorithms:** Shift Reduce Parsing,**Models for ambiguity Resolution in Parsing**: Probabilistic Context Free Grammar, Generative Models, Discriminative models for Parsing.	
Unit III	**Language Modeling**	
	Introduction, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems.	
Unit IV	**Semantic Parsing**	
	Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.	
Suggested Readings	1. Multilingual natural Language Processing Applications: From Theory to Practice–Daniel 2. M.Bikel and Imed Zitouni, Pearson Publication. Speech and Natural Language Processing-Daniel Jurafsky & James H Martin, Pearson .	

Course Code	Course Title	Credits
SCSCCT 6508	Data Analysis using SPSS	04
Course Objectives	1. To be familiar with basic tools of SPSS and data analytic techniques. 2. To apply the tools for real-life data analysis projects and reporting.	
Course Outcomes	**After successful learning of this course students will be able to:** 1. Students are expected to develop a clear understanding of the fundamental concepts of Data Analytics. 2. Students will also learn SPSS tools, handling various types of data and their graphical representation. 3. Students are expected to apply different data analytic tools in real life problems.	
Unit I	**Introduction**	
	Starting SPSS, Working with data file, Different data types, Scale of measurements, Dialogue boxes. Preparing the Data file, Creating data file, Entering data, Variable types in SPSS, Defining the variables, Modifying data file, and Import data. Screening and cleaning data, Manipulation of data.	
Unit II	**Data Pre-processing**	
	Creating new variables, Recoding, Labelling variables and their values,- Missing values and Outliers	
Unit III	**Descriptive Statistics**	
	Graphs- Creating and editing, graphs and charts, Categorical variables, continuous variables, Frequencies, Descriptive, Explore, Cross Tabulation, Checking normality, Outliers checking, Correlation: Pearson product moment correlation, Spearman rank correlation, Partial correlation, Simple linear regression, Multiple regression analysis.	
Unit IV	**Principle Component Analysis**	
	Description of Data, Principal Component and Factor Analysis, Principal Component Analysis, Factor Analysis, Factor Analysis and Principal Components Compared, Analysis Using SPSS	
Suggested Readings	1. Performing Data Analysis using IBM SPSS, Lawrence S. Meyers, Glenn C. Gamst, A. J.,Guarino, Wiley Publication 2. SPSS for Windows Step by Step A Simple Guide and Reference, Darren George and Paul Malley. 3. SPSS in Simple Steps, Kiran Pandya, Smruti Bulsari, Sanjay Sinha, Dreamtech Press.	

Practical Course

Course Code:	**SCSCCP 6504**	Lab 14: AI and ML	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6505**	Lab 15:DSIP	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6507**	Lab 16:NLP	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Experiments:	As per the Lab Manual circulated to students by the concerned Teacher		

Course Code:	**SCSCCP 6509**	Major Project	**Credit : 02**
Course Objective	As per the Lab Manual circulated to students by the concerned Teacher		
Course Outcome	As per the Lab Manual circulated to students by the concerned Teacher		
Project	As per the choice and need of current era topic of the project will be selected. 1. Every project group contains minimum 1 and maximum 3 students 2. Project should be implemented in the lab on given computer. 3. Every group should give at least one presentation before final examination on their project topics.		