DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT

CURRICULUM

Scheme and Syllabus V to VI Semester

Outcome Based Education

(Academic Year 2025-2026)

Department of CSE in Data Science

5th & 6th Semester B.E

ABOUT THE INSTITUTE

Dayananda Sagar Academy of Technology and Management- DSATM was established in 2011 with 5 UG Programmes and 1 PG Program, currently there are 10UG courses, BArch course, and 2 PG courses the programmes are approved by All India Council for Technical Education (AICTE) New Delhi, Affiliated to Visvesvaraya Technological University (VTU), Belagavi and DSATM is an autonomous institute from 2023-2024, (10 years), with NAAC A+ Grade,5 courses NBA Accredited.

The Dayananda Sagar Institutions is one of pioneer institutions in India and abroad with six decades of excellence in Academic and Research. The newer campuses were necessary to accommodate the growing need of the technology and innovation.

DSATM nurtures the students in academic, research, sports, cultural and extracurricular activities.

- Creating an academic environment to nurture and develop competent entrepreneurs, leaders and professionals who are socially sensitive and environmentally conscious.
- Integration of Outcome Based Education and cognitive teaching and learning strategies to enhance learning effectiveness.
- Developing necessary infrastructure to cater to the changing needs of Business and Society.
- Optimum utilization of the infrastructure and resources to achieve excellence in all areas of relevance.
- Adopting learning beyond curriculum through outbound activities and creative assignments.
- Imparting contemporary and emerging techno-managerial skills to keep pace with the changing global trends.
- Facilitating greater Industry-Institute Interaction for skill development and employability enhancement.
- Establishing systems and processes to facilitate research, innovation and entrepreneurship for holistic development of students.
- Implementation of Quality Assurance System in all Institutional processes.

VISION OF THE INSTITUTE

To strive at creating the institution a centre of highest calibre of learning, so as to create an overall intellectual atmosphere with each deriving strength from the other to be the best of engineers, scientists with management & design skills.

MISSION OF THE INSTITUTE

- To serve its region, state, the nation and globally by preparing students to make meaningful contributions in an increasing complex global society challenge.
- To encourage, reflection on and evaluation of emerging needs and priorities with state-of-the-art infrastructure at institution.
- To support research and services establishing enhancements in technical, economic, human and cultural development.
- To establish interdisciplinary centre of excellence, supporting/ promoting student's implementation.
- To increase the number of Doctorate holders to promote research culture on campus.
- To establish IIPC, IPR, EDC, innovation cells with functional MOU's supporting student's quality growth.

QUALITY POLICY

Dayananda Sagar Academy of Technology and Management aims at achieving academic excellence through continuous improvement in all spheres of Technical and Management education. In pursuit of excellence cutting - edge and contemporary skills are imparted to the utmost satisfaction of the students and the concerned stakeholders.

ABOUT THE DEPARTMENT

Year of Establishment: 2022
Intake of the Department = 120
Brief Details about CSE in Data Science:

- Data Science is the extraction of actionable Information from raw data
- Data science is the practice of designing and building systems for collecting, Storing and analyzing data at scale.
- Data engineering is a Vital aspect of company growth, Network interactions and predicting future trends.
- Data Science is the field of study that combines domain expertise, programming skills and knowledge of mathematics and statics to exact meaningful insights from data.

VISION OF THE DEPARTMENT

"To create an academic environment which trains the students as next generation data scientist solving grand challenges innovating through global research opportunities."

MISSION OF THE DEPARTMENT

- To ensure the responsible use of data to benefit society.
- To ensure broader community in the translation of data into information to support and improve decision making.
- To develop skilled professionals in data science field.
- To establish industry conducive environment with State-of-Art data driven infrastructure
- To facilitate high quality data science education, industry collaboration with research orientation.
- To maximize the power of data benefiting the social needs through science and engineering.
  PEO's

PROGRAM EDUCATION OBJECTIVES (PEO'S):

- PEO1: Graduates shall have robust knowledge of data handling, analytics platform.
- PEO2: Graduates will be skilled professionals with global competence.
- PEO3: Graduates shall have successful carrier as data science engineers with leadership and management skills.

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex 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.
4. 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.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. 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 engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex 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.

11. 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 projects and in multidisciplinary environments.

12. 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 OUTCOMES (PSO's)

- PSO 1: Produce quality data science professionals with robust development knowledge
- PSO 2: Develop global competency student quality to meet data science changes

PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

Sl. No.	Semester	No. of Credits
1	1st Semester	20
2	2nd Semester	20
3	3rd Semester	21
4	4th Semester	21
5	5th Semester	22
6	6th Semester	22
7	7th Semester	20
8	8th Semester	14
	Total	**160**

PROPOSED UG SCHEME

Sl. No	Course Category	BOS	TD	Teaching Hours/Week					Credits
				Lecture	Tutorial	Practical	Project	Total (Hrs/week)	
				L	T	P	S		
1	IPCC-1	CSE	CSET	3	0	2	0	5	5
2	IPCC-2	CSE	CSE	3	0	2	0	5	5
3	PCC-1	CSE	CSE	3	0	0	0	3	3
4	PEC-1	CSE	CSE	3	0	0	0	3	3
5	MPR	CSE	CSE	0	0	0	2	2	3
6	PBL	CSE	CSE	0	0	0	2	4	2
7	AEC	CSE	CSE	0	0	2	0	2	1
8	HSMS	CSE	CSE	1	0	0	0	1	0
9	NCMC	NSS / YOGA / PED							
10	AICTE Activity Points								
								Total	**22**

Percentage of Mapping– Theory & Practical - Scheme & Syllabus- 5th & 6th Sem

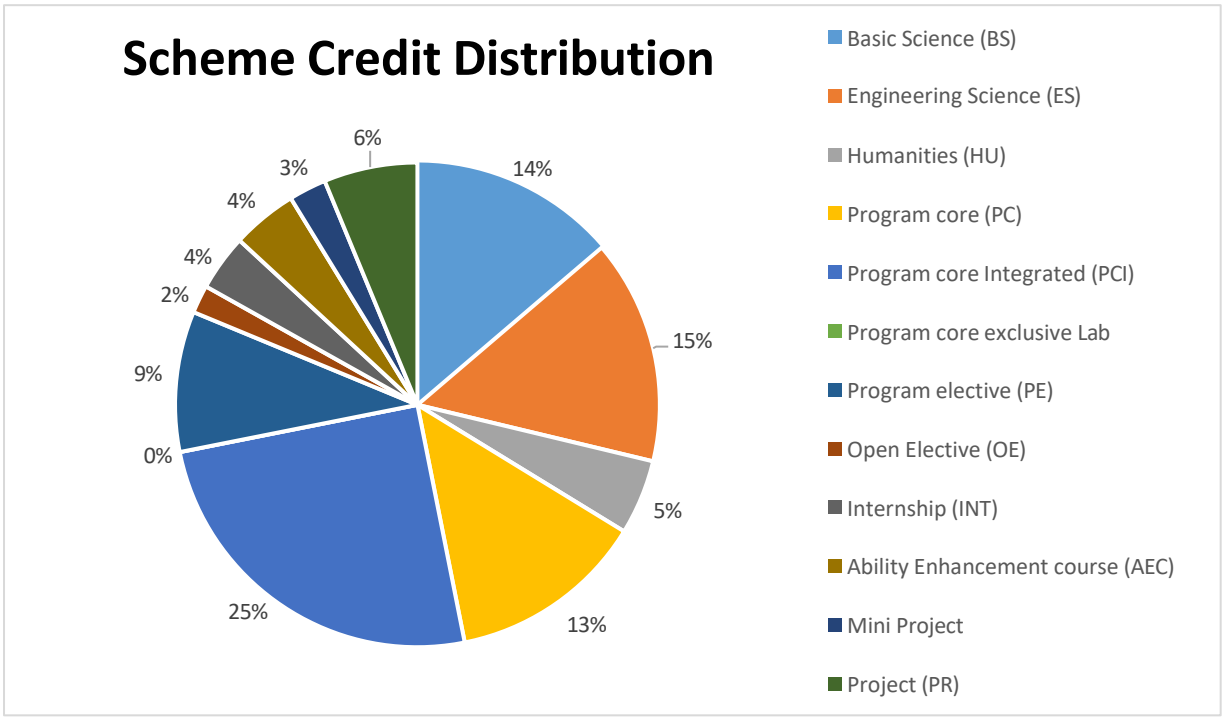
5th Sem & 6th Sem

Sl. No	Course Category	Component			
		Theory	Practical	Outreach	YOGA/SPORTS
1	IPCC-1	60%	40%	--	--
2	IPCC-2	60%	40%	--	--
3	PCC-1	100%	--	--	--
4	PEC-1	100%	--	--	--
5	PR	--	100%	--	--
6	PBL	--	100%	--	--
7	AEC	--	100%	--	--
8	HSMS	--	--	100%	--
9	NCMC	--	--	--	100%
Total Percentage		**36%**	**42%**	**11%**	**11%**

Scheme Distribution

Department of CSE in Data Science

Course Component	Credits	% of Credits
Basic Science (BS)	22	14
Engineering Science (ES)	24	15
Humanities (HU)	8	5
Program core (PC)	21	13
Program core Integrated (PCI)	40	25
Program core exclusive Lab	0	0
Program elective (PE)	15	9
Open Elective (OE)	3	2
Internship (INT)	6	4
Ability Enhancement course (AEC)	7	4
Mini Project (MPR)	4	3
Project (PR)	10	6
Total	**160**	**100**



SEMESTER WISE CREDIT BREAKDOWN FOR B.E. DEGREE CURRICULUM

BATCH 2023-2027

Course Category	Semester								Total Credits
	1st	2nd	3rd	4th	5th	6th	7th	8th	
Basic Sciences (BSC)			3	3	---	---			6
Engineering Sciences (ESC)			---	---	---	---			---
Humanities, Social Sciences and Management (HSMC)			---	---	2	---			---
Ability Enhancement Course (AEC)			1	1	1	1			5
Universal Human Values (UHV)			---	1	---	---			1
Professional Core Courses (PCC)			6	6	3	3			18
Professional Core Courses Lab (PCCL)			---	---	2	---			
Integrated Professional core Course (IPCC)			8	8	8	8			31
Professional Elective Course (PEC)			---	---	3	3			6
Institutional Open Elective Courses (IOE)			---	---	---	3			3
Internship (INT)			---	---	---	---			4
Mini Project / Project Work (PW)			2	2	3	4			13
Social Connect & Responsibility (SCR)			1	---	---	---			1
Non-credit Mandatory Courses (NCMC)			---	---	---	---			---
Total Credits			**21**	**21**	**22**	**22**			**86**

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Affiliated to VTU
Approved by AICTE
Accredited by NAAC with A+ Grade
6 Programs Accredited by NBA
(CSE, ISE, ECE, EEE, MECH, CIVIL)

Scheme of Teaching and Examinations – 2025-26
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2025-26)

5th SEMESTER: Computer Science Engineering in Data Science

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BCD501	Artificial Intelligence & Machine Learning	IPCC	CSE-DS	CSE-DS	3	0	2	0	5	4	03	50	50	100
2	BCD502	Data Warehousing and Data Mining	IPCC	CSE-DS	CSE-DS	3	0	2	0	5	4	03	50	50	100
3	BCD503	Modern Software Engineering	PCC	CSE-DS	CSE-DS	3	0	0	0	3	3	03	50	50	100
4	BCD504X	Professional Elective	PEC-1	CSE-DS	CSE-DS	3	0	0	0	3	3	03	50	50	100
5	BCD505	Artificial Intelligence	PBL	CSE-DS	CSE-DS	0	0	0	3	3	3	03	50	50	100
6	BCDL506	SAS Programming lab	PCCL	CSE-DS	CSE-DS	0	0	2	0	2	2	02	50	50	100
7	BCD517 BCDL527	- Research Methodology and IPR - Pandas with NumPy, SciPy & SCIKIT lab	AEC	CSE-DS	CSE-DS	0	0	2	0	2	1	02	50	50	100
8	BESK508	Environmental Science	HSMS	CSE-DS	CSE-DS	2	0	0	0	2	2	02	50	50	100
9	BNSK509 BPEK509 BYOK509	National Service Scheme Physical Education Yoga	NCMC			1	0	0	0	0	0	---	100	---	100
AICTE Activity Points Mandatory					**Total**						**22**	**21**	**500**	**400**	**900**

Professional Elective	
Information Retrieval	BCD504A
Advance Database	BCD504B

6th SEMESTER: Computer Science Engineering in Data Science

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BCD601	Deep Learning	IPCC	CSE-DS	CSE-DS	3	0	2	0	5	4	03	50	50	100
2	BCD602	Data Visualization and Interpretation	IPCC	CSE-DS	CSE-DS	3	0	2	0	5	4	03	50	50	100
3	BCD603	Data Engineering	PCC	CSE-DS	CSE-DS	3	0	0	0	3	3	03	50	50	100
4	BCD604X	Professional Elective	PEC-2	CSE-DS	CSE-DS	3	0	0	0	3	3	03	50	50	100
5	BCD6XX	Open Elective	OEC-1	CSE-DS	CSE-DS	3	0	0	0	3	3	03	50	50	100
6	BCD606	Project Phase -1	PR	CSE-DS	CSE-DS	0	0	0	2	2	2	02	100	0	100
7	BCD607	Big Data Analytics	PBL	CSE-DS	CSE-DS	0	0	0	2	2	2	02	50	50	100
8	BCDL618 BCDL628	PyTorch Lab Generative AI Lab	AEC	CSE-DS	CSE-DS	0	0	2	0	2	1	02	50	50	100
9	BNSK609 BPEK609 BYOK609	National Service Scheme Physical Education Yoga	NCMC			0	0	0	0	0	---	0	100	0	100
AICTE Activity Points Mandatory					**Total**						**22**	**21**	**550**	**350**	**900**

Professional Elective	
Natural Language Processing	BCD604A
Computer Vision	BCD604B

IPCC: Integrated Professional Core Course,

PCC: Professional Core Course

PBL: Project Based Learning

AEC: Ability Enhancement Course,

NCMC: Non-Credit Mandatory Course

L: Lecture,

T: Tutorial,

P: Practical

S= SDA: Skill Development Activity,

CIE: Continuous Internal Evaluation,

SEE: Semester End Evaluation.

Integrated Professional Core Course (IPCC): Refers to Integrated Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Non-Credit Mandatory Course (NCMC) - National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Newly introduced subjects in the syllabus

		5th Semester	6th Semester
1.	List of Existing Elective Courses		
2.	List of New Existing Elective Courses		
3.	List of New Industry Aligned Course		

Percentage of Change in the Syllabus

5th Semester						
Sl. No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BCD501	Artificial Intelligence & Machine Learning	**Module-5:** Genetic AI, Advanced Topics and Ethical AI: Generative AI: GANs, VAEs, diffusion models		10%	
2	BCD502	Data Warehousing and Data Mining	**Module-3:** prediction concept **Module-5:** Mining Object, Spatial, Multimedia, Text and Web Data		15 %	To fill the gap in DWDM and to achieve full coverage
3	BCD503	Modern Software Engineering	**Module-5:** Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models **Module2-:** Extreme Programming		15 %	To fill the gap in Modern SE and to achieve full coverage
4	BCD504A	Information Retrieval	**Module-5:** Sentence transformer	Genetic Algorithms; Fuzzy Set Retrieval.	5%	
5	BCD504B	Advance Database	**New Course**			

6th Semester						
Sl. No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BCD601	Deep Learning	**Module-2:** Neural Network, Architecture of CNN **Module-3:** Supervised Deep Learning Architectures: LetNet-5		15%	To fill the gap in Deep learning and to achieve full coverage
2	BCD602	Data Visualization and Interpretation	**Module-5:** Seaborn, Bokeh		5%	
3	BCD603	Data Engineering	**Module-4:** Machine Learning Algorithms for Big Data Analytics	**Module-3:** MongoDB concepts (complete module content)	10%	

			Module-5: Programming examples in analytics and Machine Learning using Hadoop, Spark and Python			
4	BCD604A	Natural Language processing	**Module-5:** Brief mention of Transformers & Large Language Models (Text-to-Text Models)		5%	
5	BCD604B	Computer Vision				

5th SEMESTER

INTEGRATED PROFESSIONAL CORE COURSE (IPCC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Artificial Intelligence & Machine Learning**				
Course Code	:	**BCD501**				
Course Type (Theory/Practical/Project/Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L: T:P:S)	:	**3-0-2-0**		**SEE**	:	**50**
Total Hours	:	**40 hours Theory + 20 hours Practical**		**SEE Duration**	:	**3 hours**
Credits	:	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the foundations and evolution of AI and ML, including modern applications.
2	Apply problem-solving techniques using search algorithms and knowledge representation
3	Develop and evaluate machine learning models for classification, regression, and clustering.
4	Build and optimize deep learning models for real-world tasks.
5	Explore ethical considerations and deployment strategies for AI systems

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to AI and Foundations:** What is AI? current trends (generative AI, Agentic/autonomous systems). Foundations: Intelligent agents, rationality, environments. Problem-solving: State-space search, uninformed search (BFS, DFS).	8 Hours
Pedagogy	Quiz	
2	**Machine Learning Fundamentals:** Intro to ML: Supervised, unsupervised, reinforcement learning. ML process: Data preprocessing, feature engineering, model evaluation (accuracy, precision, recall, F1). Understanding Data: Types, stats, visualization.	8 Hours
Pedagogy	Quiz	
3	**Supervised Learning:** Regression, Linear regression, Logistic Regression, Decision Trees, K-Nearest Neighbors (KNN) **Unsupervised Learning:** Clustering algorithms, K-means, PCA	8 Hours
Pedagogy	Demonstration	
4	Deep Learning and Neural Networks: Intro to Neural Networks: Perceptron. MLPs: Backpropagation, activation functions.	8 Hours
Pedagogy	Demonstration	
5	**Advanced Topics and Ethical AI:** Generative AI: GANs, VAEs, diffusion models, Genetic AI **CASE STUDY: Artificial General Intelligence:** Definitions, Impact on society, economy, jobs and individuals **CASE STUDY: Artificial Super Intelligence:** Definitions, Impact on society, economy, future of humanity.	8 Hours
Pedagogy	Case Studies	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

List of Programs:

Sl. No.	Experiments/Programs	COs
1	**DFS:** Implement and Demonstrate Depth First Search Algorithm	CO2
2	**BFS:** Implement and Demonstrate Best First Search Algorithm	CO2
3	**conditional probability:** Load the Titanic CSV (columns: Gender, Pclass, Survived) into Pomegranate and construct a three-node Bayesian network (Gender → Pclass → Survived). **Fit** the network to the data, then compute **marginal** probabilities for each variable and **conditional** queries such as P (Survived | Gender="female", Pclass=3).	CO2
4	**Linear Regression**: Load the built-in Scikit-learn diabetes dataset (datasets.load_diabetes(return_X_y=True)) and fit a Linear Regression model to predict disease progression from a single feature. Split into train/test sets (80/20), train the model, plot predicted vs. actual values.	CO3
5	Use scikit-learn to train a decision tree on the Titanic dataset to predict Survived using features like Gender, Pclass, and Age. evaluate its accuracy.	CO3
6	**Naïve Bayes**: Use iris dataset and implement a GaussianNB classifier in scikit -learn. Split into train/test (70/30), train the model, and report accuracy, precision, recall, and F_1-score.	CO3
7	**KNN Clustering:** Load wine dataset in python. split data into train/test (75/25), and train a KNeighborsClassifier with n_neighbors=5. Evaluate model accuracy and show classification report	CO3
8	**K-Means Clustering on Iris Dataset** Load the Iris data, standardize features using StandardScaler, and apply KMeans(n_clusters=3). Compute cluster centers and assign each sample to a cluster	CO4
	Open ended Programs	
1	**MLP Classification**: Using the original 64-dimensional digits.data, split into train/test (80/20) and train an MLPClassifier (hidden_layer_sizes= (64, 32), max_iter=300). Report test set accuracy and plot the learning curve (loss vs. epochs).	CO4
2	Load keras. datasets.mnist, build a small ConvNet with two Conv2D + pooling layers followed by a dense softmax output, train for 5 epochs, and report test accuracy. Visualize a few learned filters from the first convolutional layer.	CO4
3	**Handling Missing Data in a Bayesian Network** Take the original three-node network (Gender → Pclass → Survived) but first introduce missing values by randomly blanking out 20% of the Pclass entries in your CSV. Fit the network using Pomegranate's expectation-maximization (EM) routine to handle the missing Pclass values. After training, impute the missing entries via the network's posterior predictions and measure imputation accuracy against the true hidden values.	CO2

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Pearson Education, 2015.
2	Kevin Patrick Murphy "Probabilistic Machine Learning: An Introduction", MIT Press, March 2022.
Reference Books	
1	Elaine Rich, Kevin Knight, *Artificial Intelligence*, 3rd Edition, Tata McGraw Hill, 2009.
2	"Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the foundations and evolution of AI and ML, including modern applications.	Understand	**L2**
CO2	Apply problem-solving techniques using search algorithms and knowledge representation.	Apply	**L3**
CO3	Develop and evaluate machine learning models for classification, regression, and clustering.	Apply	**L3**
CO4	Build and optimize deep learning models for real-world tasks.	Apply	**L3**
CO5	Explore ethical considerations and deployment strategies for AI systems	Understand	**L2**

Mapping of Course Outcomes to Program Outcomes (without Pedagogy):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**2**													
CO2	**3**	**2**	**3**	**1**	**2**										
CO3			**3**	**2**	**2**	**1**									
CO4	**2**	**2**	**3**												
CO5				**1**		**3**	**1**	**3**				**3**			

Weblinks and Video Lectures (e-Resources)	
1	https://www.coursera.org/learn/ai-for-everyone
2	Intro to ML: Supervised, Unsupervised, Reinforcement Learning - Machine Learning by Andrew Ng (Coursera) Intro to Machine Learning - YouTube
3	3Blue1Brown Neural Networks: https://www.youtube.com/playlist?list=PLZHQObOWTQDNU6R1_67000Dx_ZCJB-3pi
4	https://www.youtube.com/user/joshstarmer
5	edX - Artificial Intelligence (AI) by Columbia University: https://www.edx.org/course/artificial-intelligence-ai

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Data Warehousing and Data Mining**				
Course Code	:	**BCD502**				
Course Type (Theory/Practical/Project/Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L: T:P:S)	:	**3-0-2-0**		**SEE**	:	**50**
Total Hours	:	**40 hours Theory + 20 hours Practical**		**SEE Duration**	:	**3 hours**
Credits	:	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To understand the principles of Data warehousing and Data Mining.
2	To be familiar with the Data warehouse architecture and its Implementation.
3	To know the Architecture of a Data Mining system.
4	To understand the various Data preprocessing Methods.
5	To perform classification and prediction of data.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Data Warehousing and Business Analysis:** Introduction to Data Ware House, Differences between operational data base systems and data Ware House - Building a Data warehouse - Data Ware House Architecture and its components - DBMS Schemas for Decision Support - Data Extraction, Cleanup, and Transformation Tools - Metadata - reporting - Online Analytical Processing (OLAP) - OLAP Server Architecture-ROLAP, MOLAP and HOLAP.	**8 Hours**
Pedagogy	**Demonstration**	
2	**Data Cube:** A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models - **Data Mining:** What is Data Mining, Definition, Data Mining Functionalities, data mining versus knowledge discovery in databases - Data Preprocessing - Data Cleaning - Data Integration and Transformation - Data Reduction - Data Discretization and Concept Hierarchy Generation- Architecture of a Typical Data Mining Systems	**8 Hours**
Pedagogy	**Problem Solving**	
3	**Association Rule Mining:** Efficient and Scalable Frequent Item set Mining Methods - Mining Various Kinds of Association Rules - Association Mining to Correlation Analysis - Constraint-Based Association Mining. **Classification and Prediction:** Issues Regarding Classification and Prediction - Classification by Decision Tree Introduction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines.	**8 Hours**
Pedagogy	**Case study Assignment**	
4	**Cluster Analysis:** - Types of Data in Cluster Analysis - A Categorization of Major Clustering Methods - Partitioning Methods - Hierarchical methods - Density-Based Methods - Grid-Based Methods - Model-Based Clustering Methods - Clustering High-Dimensional Data - Constraint-Based Cluster Analysis - Outlier Analysis.	**8 Hours**
Pedagogy	**Poster Presentation**	
5	**Mining Object, Spatial, Multimedia, Text and Web Data:** Multidimensional Analysis and Descriptive Mining of Complex Data Objects - Spatial Data Mining - Multimedia Data Mining - Text Mining - Mining the World Wide Web, Graph Mining - Social Network Analysis.	**8 Hours**
Pedagogy	**Case studies**	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another	

- **Problem Solving**: encourages cognitive thinking and enables creative problem solving
- **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.
- **Case studies:** maps different domains in real time applications
- **Demonstration:** exhibits the implementation process

List of Programs:

Sl. No.	Experiments/Programs	COs
	Installation of R and Julia software	
1	List all the categorical (or nominal) attributes and the real-valued attributes separately.	**CO5**
2	What attributes do you think might be crucial in making the credit assessment? Come up with some simple rules in plain English using your selected attributes.	**CO5**
3	One type of model that you can create is a Decision Tree -train a Decision Tree using the complete dataset as the training data. Report the model obtained after training.	**CO5**
4	Suppose you use your above model trained on the complete dataset, and classify credit good/bad for each of the examples in the dataset. What % of examples can you classify correctly? (This is also called testing on the training set) Why do you think you cannot get 100 % training accuracy?	**CO5**
5	Is testing on the training set as you did above a good idea? Why or why not?	**CO5**
6	One approach for solving the problem encountered in the previous question is using cross-validation? Describe what is cross -validation briefly. Train a Decision Tree again using cross -validation and report your results. Does your accuracy increase/decrease? Why?	**CO5**
7	Check to see if the data shows a bias against "foreign workers" (attribute 20), or "personal -status" (attribute 9). One way to do this (perhaps rather simple minded) is to remove these attributes from the dataset and see if the decision tree created in those cases is significantly different from the full dataset case which you have already done. To remove an attribute, you can use the preprocess tab in Weka's GUI Explorer. Did removing these attributes have any significant effect? Discuss.	**CO5**
8	Another question might be, do you really need to input so many attributes to get good results? Maybe only a few would do. For example, you could try just having attributes 2, 3, 5, 7, 10, 17 (and 21, the class attribute (naturally)). Try out some combinations. (Removed two attributes in problem 7. Remember to reload the arff data file to get all the attributes initially before you start selecting the ones.	**CO5**
9	Sometimes, the cost of rejecting an applicant who actually has a good credit (case 1) might be higher than accepting an applicant who has bad credit (case 2). Instead of counting the misclassifications equally in both cases, give a higher cost to the first case (say cost 5) and lower cost to the second case. You can do this by using a cost matrix in Weka. Train your Decision Tree again and report the Decision Tree and cross -validation results. Are they significantly different from results obtained in problem 6 (using equal cost)?	**CO5**
10	Do you think it is a good idea to prefer simple decision trees instead of having long complex decision trees? How does the complexity of a Decision Tree relate to the bias of the model?	**CO5**

Open ended Programs		
1	You can make your Decision Trees simpler by pruning the nodes. one approach is to use Reduced Error Pruning -Explain this idea briefly. Try reduced error pruning for training your Decision Trees using cross -validation (you can do this in Weka) and report the Decision Tree you obtain? Also, report your accuracy using the pruned model. Does your accuracy increase?	**CO5**
2	(Extra Credit): How can you convert a Decision Trees into "if -then -else rules". Make up your own small Decision Tree consisting of 2 - 3 levels and convert it into a set of rules. There also exist different classifiers that output the model in the form of rules -one such classifier in Weka is rules. PART, train this model and report the set of rules obtained. Sometimes just one attribute can be good enough in making the decision, yes, just one! Can you predict what attribute that might be in this dataset? OneR classifier uses a single attribute to make decisions (it chooses the attribute based on minimum error). Report the rule obtained by training a one R classifier. Rank the performance of j48, PART and oneR.	**CO5**
3	Load a dataset into Weka and run simple k-means clustering algorithm with different values of k(number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights.	**CO5**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Jiawei Han, Micheline Kamber and Jian Pei "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.
2	Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw - Hill Edition, Tenth Reprint 2007.
Reference Books	
1	K.P. Soman, Shyam Diwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
2	G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
3	Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the basic concepts of Data Warehousing and Business Analysis techniques.	U, R	Level1 & Level2
CO2	Apply the Data Warehousing and Data mining techniques to design multidimensional Data models.	A	Level3
CO3	Analyze the business growth using Association rule mining and classification techniques.	An	Level4
CO4	Investigate the complex problems to cluster the patterns from time series data and its application in real world.	An	Level4
CO5	Design and develop data mining techniques to identifying the computing framework for Big Data and extend the Graph mining algorithms to Web mining.	E	Level5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2		**3**													
CO3			**3**												
CO4		**3**													
CO5			**3**		**3**				**2**			**3**			

Weblinks and Video Lectures (e-Resources)	
1	https://www.javatpoint.com/data-warehouse
2	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/ https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
3	https://www.btechguru.com/training--it--database-management-systems--file-structures--introduction-to-data-

PROFESSIONAL CORE COURSE (PCC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Modern Software Engineering**				
Course Code	:	**BCD503**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PCC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3-0-0-0**		**SEE**	:	**50**
Total Hours	:	**40 Hours**		**SEE Duration**	:	**3 hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Differentiate process models to judge which process model has to be adopted for the given scenarios.
2	Derive both functional and nonfunctional requirements from the case study.
3	Analyze the importance of various software testing methods and agile methodology
4	Illustrate the role of project planning and quality management in software development.
5	Identify appropriate techniques to enhance software quality.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

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Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Software and Software Engineering: The nature of Software, The unique nature of WebApps, Software Engineering, The software Process, Software Engineering Practice, Software Myths. Process Models: A generic process model, Process assessment and improvement, Prescriptive process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Specialized process models. Unified Process, Personal and Team process models	8 Hours
Pedagogy	**Think Pair and Share (Blended Learning)**	
2	Understanding Requirements: Requirements Engineering, Establishing the ground work, Eliciting Requirements, developing use cases, Building the requirements model, Negotiating Requirements, Validating Requirements. Requirements Modeling Scenarios, Information and Analysis classes: Requirement Analysis, Scenario based modeling, UML models that supplement the Use Case, Data modeling Concepts, Class-Based Modeling.	8 Hours
Pedagogy	**Problem Solving**	
3	Agile Development: What is Agility? Agility and the cost of change. What is an agile Process? Extreme Programming (XP) and Scrum, Other Agile Process Models, A tool set for Agile process. Principles that guide practice: Software Engineering Knowledge, Core principles, Principles that guide each framework activity.	8 Hours
Pedagogy	**Quiz**	
4	Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices. Project Evaluation: Evaluation of Individual projects, Cost-benefit Evaluation Techniques, Risk Evaluation.	8 Hours
Pedagogy	**Poster Presentation**	
5	Software Quality: Introduction, the place of software quality in project planning, Importance of software quality, Defining software quality, Software quality models, product versus process quality management. Software Project Estimation: Observations on Estimation, Decomposition Techniques, Empirical Estimation Models.	8 Hours
Pedagogy	**Demonstration**	
	Pedagogical Initiatives (Not limited to):	

	• **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2	Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
Reference Books	
1	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.
2	"Software Engineering: Principles and Practice", Hans van Vliet, Wiley India, 3rd Edition, 2010

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Differentiate process models to judge which process model has to be adopted for the given scenarios.	R/U	L2
CO2	Derive both functional and nonfunctional requirements from the case study.	R/U	L2
CO3	Analyze the importance of various software testing methods and agile methodology.	An	L4
CO4	Illustrate the role of project planning and quality management in software development.	A	L3
CO5	Identify appropriate techniques to enhance software quality.	A	L3

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2	3														
CO3		3		2											
CO4	3	2		2											
CO5	3	2			2										

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in
2	https://onlinecourses.nptel.ac.in

PROFESSIONAL ELECTIVE COURSE (PEC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Information Retrieval**				
Course Code	:	**BCD504A**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PEC-1**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Students will describe the fundamental components of text retrieval systems, including Boolean models and indexing techniques.
2	Students will explain and implement vector space models with TF-IDF weighting and evaluate their effectiveness in information retrieval.
3	Students will apply probabilistic retrieval models like Okapi/BM25 and Language Models for document ranking.
4	Students will implement and evaluate machine learning algorithms for text classification and document clustering.
5	Students will explain web search fundamentals, including crawling and link analysis, and identify key IR applications.

Teaching-Learning Process

Pedagogical Initiatives: Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
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COURSE CURRICULUM

Module No.	Topics	Hours
1	**Overview of text retrieval systems:** Boolean retrieval, the term vocabulary and postings lists, Dictionaries and tolerant retrieval, Index construction and compression	8
Pedagogy	**Quiz**	
2	**Retrieval models and implementation:** Vector Space Models: Vector Space Model, TF-IDF Weight, Computing scores in a complete search system, Evaluation in information retrieval, Relevance feedback.	8
Pedagogy	**Quiz**	
3	**Probabilistic models;** Okapi/BM2, Language models **Text Classification:** The text classification problem, Naive Bayes text classification, k-nearest neighbors, Support vector Machines	8
Pedagogy	**Demonstration**	
4	Support vector machines, machine learning on documents, Flat clustering, Hierarchical clustering.	8
Pedagogy	**Demonstration**	
5	**Web search basics, crawling, indexes, Link analysis:** Web Characteristic, Crawling, Web As a graph, Page Rank, Hubs and Authorities **IR applications:** Information extraction, Question answering, Opinion summarization, Social Network, Sentence transformer	8
Pedagogy	**Case Studies**	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Introduction to Information Retrieval, Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008.
2	Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, 2nd edition, KLUWER ACADEMIC PUBLISHERS
Reference Books	
1	Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamentals of information retrieval, including Boolean retrieval, indexing, and dictionary techniques.	Understand	**L2**
CO2	Apply retrieval models and evaluation measures to assess the performance of information retrieval systems.	Apply	**L3**
CO3	Analyze probabilistic retrieval models, language models, and text classification techniques in information retrieval.	Analyze	**L4**
CO4	Investigate machine learning techniques like support vector machines and clustering techniques to solve real world problems using information retrieval.	Apply	**L3**
CO5	Apply Information Retrieval techniques to develop applications like web search, crawling, indexing, and link analysis.	Apply	**L3**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2	3														
CO3		3		2											
CO4	3	2		2											
CO5	3	2			2										

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=Q72hzU1Z6aQ
2	Direct Link to MIT OpenCourseware: https://ocw.mit.edu/

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Advance Database**				
Course Code	:	**BCD504B**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PEC1**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To provide in-depth knowledge of advanced database models such as object-oriented, temporal, spatial, and distributed databases, enhancing the learner's understanding beyond relational systems.
2	To develop the ability to write efficient and complex queries using advanced SQL features, including views, triggers, stored procedures, indexing, and query optimization.
3	To introduce and analyze transaction management and concurrency control techniques, enabling students to manage multi-user environments and ensure database integrity.
4	To expose students to non-relational (NoSQL) databases and big data technologies, helping them understand when and how to use alternatives to traditional RDBMS for modern applications.
5	To impart knowledge of database system architecture, query processing, and performance tuning techniques for building scalable, high-performance systems.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
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COURSE CURRICULUM

Module No.	Topics	Hours
1	**INTRODUCTION TO ADVANCED DATABASE MANAGEMENT SYSTEM** Concepts & Architecture, Spatial data management, Web based systems Overview of client server architecture, Databases and web architecture, N-tier Architecture, Business logic - SOAP, Multimedia databases, Mobile database	8
Pedagogy	**Quiz**	
2	**PARALLEL AND DISTRIBUTED DATABASES** Database System Architectures: Centralized and Client-Server Architectures - Server System Architectures - Parallel Systems- Distributed Systems - Parallel Databases: I/O Parallelism - Inter and Intra Query Parallelism - Inter and Intra operation Parallelism - Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control - Distributed Query Processing - Case Studies	8
Pedagogy	**Demonstration**	
3	**INTELLIGENT DATABASES** Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) - Taxonomy – Applications - Design Principles for Active Rules - Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases - Recursive Queries in SQL - Spatial Databases- Spatial Data Types - Spatial Relationships - Spatial Data Structures - Spatial Access Methods - Spatial DB Implementation.	8
Pedagogy	**Problem Solving**	
4	**OBJECT AND XML DATABASES** Concepts for Object Databases: Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance. XML Databases: XML - Related Technologies - XML Schema - XML Query Languages - Storing XML in Databases - XML and SQL.	8
Pedagogy	**Poster Presentation**	
5	**EMERGING TECHNOLOGIES** Web Databases - Geographic Information Systems - Biological Data Management - Cloud Based Databases: Data Storage Systems on the Cloud - Cloud Storage Architectures - Cloud Data Models Query Languages - Introduction to Big Data-Storage - Analysis.	8
	Case Studies	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another	

	• **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Database system concepts', 5th Edition -Abraham Silberschatz, Henry Korth, S, Sudarshan, (McGraw Hill International)
2	R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2007.
Reference Books	
1	Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.
2	C.J. Date, A. Kannan and S. Swamynathan," An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3	Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2004.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the advanced database models and architectures including distributed, object-oriented, and NoSQL databases.	U	L2
CO2	Apply query optimization techniques and indexing strategies to improve database performance.	A	L3
CO3	Analyze transaction management, concurrency control, and recovery mechanisms in advanced database environments.	An	L4
CO4	Design and implement distributed and parallel databases for real-time applications.	A	L5
CO5	Demonstrate the use of emerging database technologies such as data warehousing, big data storage, and cloud-based database services.	A	L3

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1												
CO2	3	3	2	2											
CO3	3	3	3	3	2										
CO4	3	2	3	3	2										
CO5	3	2	3	2	3										

Weblinks and Video Lectures (e-Resources)	
1	https://www.geeksforgeeks.org/dbms/
2	https://online.stanford.edu/courses/sohs-ydatabases-databases
3	https://db-engines.com/en/

PROJECT BASED LEARNING (PBL)

Subject Identified for Project Based Learning

Semester	5
Subject Identified for PBL	Artificial Intelligence
Prerequisite	Theoretical Foundations (Linear Algebra, Probability & Statistics, Logic and Reasoning) Programming Skills (Python/ R / Java / C++) Machine Learning Concepts Data Handling & Preprocessing Tools and Frameworks
Justification for the selected subject	Gain **practical experience** in building and deploying AI solutions using tools such as **Python, TensorFlow, Keras, and Scikit-learn**. Understand the **end-to-end AI lifecycle**, including data acquisition, model training, performance evaluation, optimization, and deployment.
List of possible projects	AI in Industry / Domain-Specific Applications like 1. Disease Prediction System (e.g., Diabetes/Heart Disease) 2. Customer Churn Prediction for Telecom/Banking. 3. AI-powered Crop Recommendation System 4. Smart Attendance System using Face Recognition 5. Product Demand Forecasting using Time Series

Signature of the Guide **Signature of HOD**

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Artificial Intelligence**				
Course Code	:	**BCD506**				
Course Type (Theory/Practical/Project/Integrated)	:	**Project**				
Category	:	**PBL**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**0:0:0:2**		**SEE**	:	**50**
Total Hours	:	**30 hours – Theory + Project**		**SEE Duration**	:	**2 Hours**
Credits	:	**2**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Explain ML paradigms and the role of preprocessing and feature engineering.
2	Implement supervised learning algorithms using Scikit-learn.
3	Apply feature engineering techniques for data transformation and preparation.
4	Evaluate ML models using metrics like accuracy, precision, recall, F1-score, and AUC.
5	Use MLP models in Scikit-learn and explain key neural network parameters.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

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Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

Topics to implement project

Intro to AI& ML: Supervised, unsupervised, reinforcement learning. ML process: Data preprocessing, feature engineering

Supervised Learning using Scikit-Learn:

1. sklearn. linear_model.LinearRegression
2. sklearn.linear_model.LogisticRegression
3. sklearn.tree.DecisionTreeClassifier / DecisionTreeRegressor
4. sklearn.neighbors.KNeighborsClassifier / KNeighborsRegressor

Feature Engineering in detail using Scikit-learn (from sklearn.preprocessing, sklearn.feature_extraction, sklearn.feature_selection**)**

- Handling missing values (sklearn.impute.SimpleImputer, sklearn.impute.KNNImputer)
- Scaling and normalization (Standard Scaler, MinMax Scaler,)
- Encoding categorical variables (One Hot Encoder, Ordinal Encoder,)
- Generating polynomial features (Polynomial Features)

model evaluation metrics

- Classification metrics (sklearn.metrics)
- Regression metrics (sklearn.metrics)
- Confusion matrix (confusion_matrix)
- Precision, Recall, F1-score (precision_score, recall_score, f1_score)
- ROC curve and AUC (roc_curve, roc_auc_score)

Intro to Neural Networks (from sklearn.neural_network)

- Basic neural network concepts (activation, layers, weights) *(conceptual)*
- Multilayer Perceptron for classification (MLPClassifier)
- Multilayer Perceptron for regression (MLPRegressor)
- Activation functions (activation='relu', 'logistic', 'tanh')
- Learning rate strategies (learning_rate='constant', 'adaptive')

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" 3rd Edition
Reference Books	
1	Stuart Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson Education, 2015.
2	Elaine Rich, Kevin Knight, *Artificial Intelligence*, 3rd Edition, Tata McGraw Hill, 2009.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the fundamental concepts, history, and various domains of Artificial Intelligence.	R, U	L1 & L2
CO2	Apply knowledge representation techniques and search algorithms to solve real-world problems.	A	L3
CO3	Analyze different machine learning paradigms and evaluate their suitability for specific tasks.	An	L4
CO4	Develop intelligent agents and systems using rule-based, probabilistic, and logic-based approaches.	E	L5
CO5	Demonstrate practical knowledge of AI tools and platforms in solving classification, prediction, and decision-making problems.	A	L3
CO6	Design AI-driven applications integrating techniques like natural language processing, computer vision, and reinforcement learning.	C	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1												
CO2	3														
CO3		3		1											
CO4	3		2	1											
CO5	3	2	2	2					2	2					
CO6	2		2		3				2	2		2			

Weblinks and Video Lectures (e-Resources)	
1	Intro to ML: Supervised, Unsupervised, Reinforcement Learning - Machine Learning by Andrew Ng (Coursera) Intro to Machine Learning - YouTube
2	Supervised Learning with Scikit-learn - Scikit-learn Documentation Scikit-learn Supervised Learning Tutorial
3	Feature Engineering in Scikit-learn - Feature Engineering in Machine Learning Feature Engineering - YouTube
4	Model Evaluation Metrics - Evaluation Metrics in Machine Learning Evaluation Metrics - YouTube
5	Intro to Neural Networks - Introduction to Neural Networks - GeeksforGeeks Neural Networks Basics - YouTube

PROFESSIONAL CORE COURSE LABORATORY (PCCL)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**5th Semester**				
Course Title	**:**	**SAS Programming lab**				
Course Code	**:**	**BCDL506**				
Course Type (Theory/Practical/Project/ Integrated)	**:**	**Practical**				
Category	**:**	**PCCL**				
Stream	**:**	**CSE-DS**		**CIE**	**:**	**50**
Teaching hours/ week (L:T:P:S)	**:**	**0:0:2:0**		**SEE**	**:**	**50**
Total Hours	**:**	**15 Hours**		**SEE Duration**	**:**	**2 Hours**
Credits	**:**	**02**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the importance of data preprocessing in the ML pipeline.
2	Apply supervised learning for regression problems.
3	Understand unsupervised learning and clustering techniques.
4	Learn dimensionality reduction for visualization and preprocessing.
5	Apply time series models in predictive analytics.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in MATLAB.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Data Preprocessing (Handling Missing Values), Exploratory Data Analysis (EDA) **Lab Component:** 1. Load a dataset (e.g., fisheriris or any CSV dataset) and perform data cleaning and preprocessing such as handling missing values, normalization, and categorical encoding. 2. Perform basic EDA on a dataset using summary statistics, histograms, boxplots, and correlation matrices.	**3 Hours**
2	Linear Regression, Classification using Decision Tree **Lab Component:** 3. Build a linear regression model to predict house prices based on features like area, bedrooms, etc. Evaluate the model using RMSE and R-squared. 4. Use the fitctree function to train a decision tree classifier on the fisheriris dataset. Visualize the tree and test model accuracy.	**3 Hours**
3	K-Means Clustering, Principal Component Analysis (PCA) **Lab Component:** 5. Apply K-Means clustering on a customer dataset (e.g., mall customers) to group customers based on annual income and spending score. 6. Reduce the dimensionality of a high-dimensional dataset using PCA and plot the first two principal components.	**3 Hours**
4	Logistic Regression for Binary Classification, Support Vector Machine (SVM) **Lab Component:** 7. Use logistic regression to classify whether a student gets admission or not based on exam scores. 8. Train an SVM model on a binary classification dataset and compare the results with logistic regression.	**3 Hours**
5	Time Series Forecasting using ARIMA, Image Classification using Deep Learning (CNN) **Lab Component:** 9. Analyze a stock price dataset or temperature data using ARIMA for forecasting future values. 10. Use a pre-trained CNN (like alexnet or googlenet) to classify images into categories. Use SAS Deep Learning Toolbox.	**3 Hours**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Stormy Attaway, Matlab: A Practical Introduction to Programming and Problem-Solving 3rd Edition, Butterworth-Heinemann, July 1, 2013.
2	Stephen J. Chapman, MATLAB Programming for Engineers, 5th Edition, Cengage Learning publisher, May 14, 2015.
Reference Books	
1.	Holly Moore, MATLAB for Engineers (4th Edition) 4th Edition, Pearson publishers, January 7, 2014.
2.	Daniel T. Valentine, Brian H. Hahn, Essential MATLAB for Engineers and Scientists 7th Edition, Academic Press publishers, April 26, 2019.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the basics of MATLAB programs for data preprocessing	U	Level2
CO2	Apply MATLAP concepts to find the results for regression and AQI values	A	Level3
CO3	Analyze the process of clustering and market analysis	An	Level4
CO4	Apply classification technique to process the medical data analysis and find the solution	A	Level3
CO5	Investigate and demonstrate the real time series data analysis	E	Level5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2		3			3				3			3			
CO3			3		3		1		3			3			
CO4		3			3		1		3			3			
CO5				3	3		1		3			3			

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=7f50sQYjNRA
2	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013842981026668544279 00_shared/overview
3	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_014222742286950400 1496/overview
4	https://www.coursera.org/specializations/matlab-programming-engineers-scientists

ABILITY ENHANCEMENT COURSE (AEC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Research Methodology and Intellectual Property Right**				
Course Code	:	**BCD517**				
Course Type (Theory/Practical/Project/Integrated)	:	**Experiential Learning**				
Category	:	**AEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**0:0:2:0**		**SEE**	:	**50**
Total Hours	:	**15 hours**		**SEE Duration**	:	**2 Hours**
Credits	:	**01**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the knowledge on basics of research and its types.
2	Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3	Learn Ethics in Engineering Research.
4	Discuss the concepts of Intellectual Property Rights in engineering

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
6. Discuss various case studies to map with real-world scenarios and improve the understanding.
7. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

EXPIRENTIAL LEARNING CURRICULUM

Module No.	Topics	Hours
1	**Introduction**: Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship. **Tools:** Undermind, Litmaps, Bohrium, Perplexity.	**3 Hours**
Pedagogy	**Think-Pair-Share**	
2	**Literature Review and Technical Reading**, New and Existing Knowledge, Analysis and **Literature Review and Technical Reading**, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading. **Tools:** Google Scholar, IEEE Xplore, ACM Digital Library, PubMed, Scopus, Web of Science, arXiv, bioRxiv, Semantic Scholar, Connected Papers / Research Rabbit	**3 Hours**
Pedagogy	**Literature Review Paper Writing and Demo of the same**	
3	**Paper Writing:** Identification of research problem, Paper writing as per IEEE format, Introduction to LaTeX, Plagiarism Checking **Attributions and Citations:** Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations. **Tools:** Grammarly, QuillBot,LaTeX , Jenni.AI, Turnitin, Mendeley, Zotero, Scite.ai, PubMed, ResearchRabbit, Scispace, Speechify.	**3 Hours**
Pedagogy	**Case study, Patent Proposal Writing**	
4	**Introduction to Intellectual Property:** IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents:** Rights Associated with Patents, Enforcement of Patent Rights, Inventions Eligible for Patenting, Non-Patentable Matters, Patent Infringements, Avoid Public Disclosure of an Invention before Patenting. Process of Patenting, Prior Art Search. Choice of Application to be Filed. Patent Application Forms, Jurisdiction of Filing Patent Application, Publication, Pre-grant Opposition, Examination. Grant of a Patent, Validity of Patent Protection, Post-grant Opposition, Commercialization of a Patent, Need for a Patent Attorney/Agent. **Tools:** PatentPal, WIPO Lex/GPT-based querying, Google Patents, IPfolio/TurboPatent,WIPO, TrademarkNow Advisor, DesignSearch.ai, DesignShelf, Legal Robot	**3 Hours**
5	**Copyrights and Related Rights:** Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement **Trademarks:** Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India, Process for Trademarks Registration, Case Study: Coca-Cola Company vs. Bisleri International Pvt. Ltd.	**3 Hours**

	Tools: WIPO Lex, Google Scholar (Case Law), HeinOnline, LexisNexis / Westlaw, SCOPUS / Web of Science, Plagscan / Turnitin, WIPO Copyright Registration Tools, Scholarcy, Elicit	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Research Methodology and Intellectual Property Rights, Dr. Santosh M Nejakar, Dr. Harish Bendigeri, ISBN 978-93-5987-928-4, Edition: 2023-24.
Reference Books	
1.	Research Methods for Engineers, David V. Thiel, Cambridge University Press, 978-1-107-03488-4
2.	Intellectual Property Rights, N.K. Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9
3.	Research Methodology - Methods and Techniques., C. R Kothari, Gourav Garg, New Age International Publishers.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Acquire the knowledge of research and conduct a literature review.	Understand	L2
CO2	Apply the knowledge of research design, Citations, and the concepts of research methodology to a problem.	Apply	L3
CO3	Write an effective research paper for a given problem statement and Analyze data collection methods.	Analyze	L4
CO4	Choose Indian patent applications, Patent laws, Gain the requirements about registration and infringements related to trademarks, & copyrights.	Evaluate	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	-	-	3	-	3	-	3	2	-	-
CO2	-	-	-	2	2	-	-	3	-	3	-	3	-	-	-
CO3	-	-	-	2	3	-	-	3	-	2	-	3	-	-	-
CO4	-	-	-	-	2	-	-	3	-	3	-	3	-	2	2

Weblinks and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc24_ge21/preview
2	https://archive.nptel.ac.in/content/syllabus_pdf/121106007.pdf
3	https://onlinecourses.nptel.ac.in/noc21_hs08/preview

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Pandas with NumPy, SciPy & SCIKIT lab**				
Course Code	:	**BCDL527**				
Course Type (Theory/Practical/Project/Integrated)	:	**Practical - Experiential Learning**				
Category	:	**AEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**0:0:2:0**		**SEE**	:	**50**
Total Hours	:	**15 hours**		**SEE Duration**	:	**2 Hours**
Credits	:	**01**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Apply NumPy for array creation, indexing, reshaping, and basic computations.
2	Perform statistical analysis and solve linear equations using NumPy.
3	Create and manipulate Data Frames using Pandas operations.
4	Clean and reshape data, handling missing values effectively.
5	Analyze structured and time-series data using Pandas I/O and transformation tools.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in Pandas with NumPy.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

EXPIRENTIAL LEARNING CURRICULUM

Module No.	Topics	Hours
1	Basic Array Operations, Statistical Computations **Lab Component:** a. Create a 1D NumPy array; perform slicing and indexing operations b. Create a 4×3 2D NumPy array; reshape it to a 3×4 array c. Create a NumPy array d. Compute mean, median, standard deviation, variance, min, and max of the NumPy array.	**3 Hours**
2	Solving Linear Equations, Handling Missing Data in NumPy Arrays **Lab Component:** 1. Solve the following system of linear equations using numpy.linalg.solve(): 2x + 3y − z = 5 −x + 7y + 2z = 3 4x − 5y + z = −2 2. Demonstrate detection and imputation of missing values a. Detect missing values in a NumPy array using np.isnan() b. Impute missing values with the array's mean using np.nanmean() (and np.nan_to_num())	**3 Hours**

3	Array Stacking, Splitting & Concatenation, Basic DataFrame Creation and Manipulation.
	Lab Component:
	3. Combine and partition arrays using np.stack, np.concatenate, np.vstack/hstack, and np.split/hsplit.
	a. Define two 2D arrays of shape 2X3.
	b. Vertically and horizontally stack arrays with np.vstack() and np.hstack()
	c. Concatenate multiple arrays with np.concatenate() and partition them with np.split()
	4. data = {
	'Name': ['Alice', 'Bob', 'Charlie', 'David'],
	'Age': [25, 30, 35, 40],
	'Department': ['HR', 'IT', 'Finance', 'Marketing'],
	'Salary': [50000, 60000, 70000, 80000]
	}
	a. Add a new column Bonus with values [5000, 6000, 7000, 8000]
	b. Remove the Department column
	c. Filter and display employees with Salary > 60000
	d. Sort the DataFrame by Age in descending order
		3 Hours

4	I/O Operations, Handling Missing Data in Pandas **Lab Component:** 1. Show how to read/write CSV and SQL sources (read_csv, read HTML). Save this data as data.csv Name, Age, Department, Salary Alice,25, HR,50000 Bob,30, IT,60000	**3 Hours**

	Charlie,35, Finance,70000 David,40, Marketing,80000 a. Read the above data from a csv file b. Save the data as pandas DataFrame c. Write the data frame as excel 2. Use isnull(), fillna(), and dropna() to clean datasets with missing values. Data: Name, Age, Department, Salary, Bonus Alice,25, HR,50000,5000 Bob, IT,60000, Charlie, 35,70000,7000 David,40, Marketing,8000 Eve,30, Finance,65000, Frank, Operations,55000,6000 Grace,28, HR, a. Identify and drop missing values with. isnull() and. dropna() b. Fill missing data via .fillna() using mean/median or custom values	
5	Reshaping & Pivoting **Lab Component:** a. DATA: Employee, Department, Month, Salary Alice, HR, Jan,50000 Alice, HR, Feb,52000 Alice, HR, Mar,53000 Bob, IT, Jan,60000 Bob, IT, Feb,62000 Bob, IT, Mar,61000 Charlie, Finance, Jan,55000 Charlie, Finance, Feb,56000 Charlie, Finance, Mar,57000 Given a dataset in long format containing employee department-wise monthly salary records (with columns: Employee, Department, Month, and Salary), transform the data to wide format using pivot_table() where months are columns and employees are rows. Display average salary per month for each employee. b. DATA: Date, Temperature 2023-01-01,30 2023-01-02,32 2023-01-03,31 2023-01-15,28 2023-02-01,29 2023-02-12,30 2023-03-01,33 2023-03-15,35 2023-03-30,34 2023-04-01,36 2023-04-15,37 2023-05-01,38 2023-05-15,40 2023-06-01,42 2023-06-15,43	**3 Hours**

	Convert a 'Date' column in a dataset to datetime format using pd.to_datetime(). Set it as the index, then resample the data to calculate monthly and yearly summaries (e.g., mean temperature)	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	*Python for Data Analysis* by Wes McKinney, O'Reilly Media, Incorporated, 2013
2	*Data Science from Scratch* by Joel Grus, O'Reilly Media, Inc., 2019

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Demonstrate proficiency in creating, transforming, and manipulating multi-dimensional data structures using NumPy	Apply	L3
CO2	Apply statistical computations, linear algebra routines, and random-sampling methods in NumPy for exploratory data analysis and simple simulations.	Apply	L3
CO3	Ingest, inspect, and manipulate tabular data using Pandas, including I/O from/into CSV, Excel, JSON, HTML, and SQL sources	Apply	L3
CO4	Clean, reshape, pivot, and merge datasets in Pandas, handling missing and categorical data effectively	Apply	L3
CO5	Perform basic time-series indexing, resampling, and rolling-window operations to analyze temporal datasets.	Apply	L3

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3										
CO2	3	3	2	2	3										
CO3	3	3	2	2	3										
CO4	3	3	3	2	3										
CO5	3	3	2	3	3										

Weblinks and Video Lectures (e-Resources)	
1	https://numpy.org/doc/
2	https://pandas.pydata.org/docs/
3	https://www.youtube.com/playlist?list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
4	https://www.youtube.com/watch?v=QUT1VHiLmmI

Humanities, Social Sciences and Management (HSMS)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th Semester**				
Course Title	:	**Environmental Science**				
Course Code	:	**BESK508**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**HSMS**				
Stream	:	**CSE-DS**		**CIE**	:	**100**
Teaching hours/ week (L:T:P:S)	:	**2:0:0:0**		**SEE**	:	**---**
Total Hours	:	**15 Hours**		**SEE Duration**	:	**1.5 Hours**
Credits	:	**2**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**To introduce** students to the fundamental concepts of the environment, ecosystems, and biodiversity, emphasizing their interdependence and significance in sustaining life.
2	To identify the causes, effects, control measures major challenges of pollution of environmental problems and e-waste management.
3	To provide guidance on developing skills, and demonstrate socio-economic skills for Environmental protection e-waste management.

Teaching-Learning Process

General Instructions - Pedagogy:

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

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
- State the need for activities and its present relevance in the society and Provide real-life examples.
- Support and guide the students for self-planned activities.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Environment and Sustainability**: **Environment & Ecosystem:** Components of the environment, Ecosystems: Structure and Function, Types: Forest, Wetlands, River, Oceanic and Lake ecosystem. **Sustainability**: 17SDG targets and possible actions. Self-Study Component (SSC): Biodiversity: Types, Values, and Conservation of biodiversity.	**3 Hours**
Pedagogy		
2	**Natural resources and Energy:** Natural Resources: Water resources - Availability & Quality aspects, Water borne diseases & Fluoride problem in drinking water. Energy: Different types of energy, Wind Energy, Hydrogen as an alternative energy. Self-Study Component (SSC): Conventional sources & non-conventional sources of Energy, Solar energy	**3 Hours**
Pedagogy		
3	**Environmental Pollution and Global Environmental Issues** Environmental Pollution: Water Pollution, Noise pollution, Air pollution (Sources, Impacts, Preventive measures, Case studies, Relevant Environmental Acts) Global Environmental Issues: Acid Rain, Ozone Depletion, Global warming and Ground water depletion. Self-Study Component (SSC): Case studies of air pollution episodes.	**3 Hours**
Pedagogy		
4	**Waste management & Environmental Legislation:** Waste management: Solid Waste Management, types and sources, Biomedical Waste Management - Sources, Characteristics, Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984 Solid Waste Management Rules,2016, Biomedical Waste Management Rules, 2016. Self-Study Component (SSC): Case studies on waste management options	**3 Hours**
Pedagogy		

5	**E - Waste Management** E- waste: Composition and generation, Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment. Component of E waste management. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications. Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024	**3 Hours**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	S M Prakash - Environmental Studies,3rd Edition Elite Publishers, Mangalore, 2018.
2	Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.
3	Benny Joseph- Environmental studies, Tata McGraw-Hill 2nd edition 2012.
Reference Books	
1	R Geetha Balakrishna & K G Lakasminarayana Bhatta- Environmental Studies, S M Publications, 2006-2007.
2	M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3	Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
4	Dr. B.S Chauhan- Environmental studies, university of science press 1st edition
5	M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	To understand the principles of ecology and environmental issues that apply to air, land and water issues along with e-waste management on a global scale.	Understand/ Remember	L1
CO2	To evaluate the societal complex issues related to environment and e-waste management.	Design	L4
CO3	To develop sustainable solution for environmental issues and e-waste management issues	Create	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1													2		
CO2									2	2				2	1
CO3								3		3					

Weblinks and Video Lectures (e-Resources)	
1	https://youtu.be/I_bnGkviWOUhttps://youtu.be/Ar04qG1P8Es
2	https://sdgs.un.org/goals
3	https://kspcb.karnataka.gov.in/waste-management/biomedical-waste
4	https://archive.nptel.ac.in/courses/109/105/109105190/
5	https://youtu.be/I_bnGkviWOUhttps://youtu.be/Ar04qG1P8Es

Course - Skills Mapping Table

5th Semester					
Sl. No	**Name of the Course**	**Course Code**	**Course Type**	**Course Category**	**Skills attained by the students**
1	Artificial Intelligence & Machine Learning	BCD501	Integrated	IPCC	➢ Machine Learning Algorithms ➢ Model Evaluation & Tuning ➢ Computer Vision Technologies
2	Data Warehousing & Data Mining	BCD502	Integrated	IPCC	➢ Data Warehouse Architecture ➢ Data Integration and Cleaning ➢ Data Mining Algorithms
3	Artificial Intelligence	BCD505	Project	PBL	➢ AI Framework Proficiency ➢ Model Training & Evaluation ➢ Algorithm Selection & Customization
4	SAS Programming	BCD506	Practical	PCCL	➢ SAS Programming Proficiency ➢ Real-World Data Handling ➢ Problem-Solving & Debugging
5	RMIPR Pandas using NumPy, SciPy & SCIKIT	BCD516 BCD527	Practical Experiential learning	AEC	➢ Literature Review & Gap Analysis ➢ Research Ethics & Integrity ➢ Understanding of IPR Concepts ➢ NumPy Fundamentals ➢ Pandas Data Structures ➢ Real-World Data Analysis

6th SEMESTER

INTEGRATED PROFESSIONAL CORE COURSE (IPCC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**Deep Learning**				
Course Code	:	**BCD601**				
Course Type (Theory/Practical/Project/Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3:0:2:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours of Theory + 20 Hours of Practical**		**SEE Duration**	:	**3 Hours**
Credits	:	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the fundamentals of deep learning.
2	Know the theory behind Convolutional Neural Networks, RNN.
3	Illustrate the strength and weaknesses of many popular deep learning approaches.
4	Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to Deep Learning:** Introduction, why to use Deep Learning, How Deep Learning Works, Deep Learning Challenges, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basics of Supervised Deep Learning Introduction.	8
Pedagogy	**Demonstration**	
2	Convolution Neural Network, Evolution of Convolution Neural Network, Architecture of CNN, Convolution Operation, Training Supervised Deep Learning Networks, Training Convolution Neural Networks, Gradient Descent-Based Optimization Techniques, Challenges in Training Deep Networks.	8
Pedagogy	**Problem Solving**	
3	Recurrent and Recursive Neural Networks Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNNs, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory (LSTM), Gated RNNs.	8
Pedagogy	**Case study Assignment**	
4	**Introduction to Transformer:** Introduction, Architecture, Operations, Types and Applications of Transformers.	8
Pedagogy	**Poster Presentation**	
5	Deep Reinforcement Learning: Introduction, Stateless Algorithms: Multi-Armed Bandits, The Basic Framework of Reinforcement Learning, Ensample learning, case studies.	8
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

List of Programs:

Sl. No.	Experiments/Programs	COs
1	Design and implement a neural network for generating word embedding for words in a document corpus	
2	Write a program to demonstrate the working of a deep neural network for classification task.	
3	Desing and implement a Convolutional Neural Network (CNN) for classification of image dataset	
4	Build and demonstrate an autoencoder network using neural layers for data compression on image dataset	
5	Desing and implement a RNN network for classification of textual documents.	
6	Design and implement a deep learning network for forecasting time series data.	
7	Write a program to enable pre-train models to classify a given image dataset	
8	Simple Grid World Problem: Design a custom 2D grid world where the agent navigates from a start position to a goal, avoiding obstacles. Environment: Custom grid (easily implemented in Python)	
Open ended Programs		
1	Design and implement RNN for sentiment analysis to find the status of a person using word corpus.	
2	Design and implement a Convolutional Neural Network (CNN) for classification of image dataset	
3	Design and implement a deep learning network for classification of textual documents.	

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Simon J.D. Prince, "Understanding Deep Learning", MIT Press, 2023.
2	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
3	Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer, 2018.

Reference Books	
1	Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009
2	N.D. Lewis, “Deep Learning Made Easy with R: A Gentle Introduction for Data Science”, January 2016
3	Nikhil Buduma, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O’Reilly publications
4	M. Arif Wani Farooq Ahmad Bhat Saduf Afzal Asif Iqbal Khan, Advances in Deep Learning, Springer, 2020

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand the basic concepts of deep learning techniques	U	L2
CO2	Examine various CNN technique for solving the real-world image analysis.	A	L3
CO3	Analyze the concepts of AlexNet and Optimization techniques	An	L4
CO4	Investigate the complex problems of research-oriented scenario using RNN with LSTM techniques.	A	L3
CO5	Design and demonstrate the implementation of deep learning techniques	E	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3													
CO3			3												
CO4		3													
CO5	2		2		3				3			3			

Weblinks and Video Lectures (e-Resources)	
1	Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/
2	A. Levitin “Introduction to the Design & Analysis of Algorithms,” 3rd ed., Ch. 3 ©2012 Pearson Education, Inc. Upper Saddle River, NJ. All Rights Reserved. - ppt download (slideplayer.com)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**6th Semester**				
Course Title	**:**	**Data Visualization and Interpretation**				
Course Code	**:**	**BCD602**				
Course Type (Theory/Practical/Project/Integrated)	**:**	**Integrated**				
Category	**:**	**IPCC**				
Stream	**:**	**CSE-DS**		**CIE**	**:**	**50**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50**
Total Hours	**:**	**40 Hours of Theory + 20 Hours of Practical**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**4**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the foundations of data visualization and the principles of visual perception.
2	Apply problem-solving techniques to choose the most effective visual representations for data.
3	Develop and evaluate interactive dashboards using industry-standard tools like Tableau.
4	Build and customize a wide range of data visualizations using Python libraries.
5	Explore storytelling techniques and ethical considerations in data presentation

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	History and importance of data visualization. Principles of visual perception (Gestalt, color theory, pre-attentive attributes). Taxonomy of chart types (comparison, distribution, composition, relationship). Storytelling with data: context, narrative structure, and audience. Avoiding clutter and misleading visuals.	**8 Hours**
Pedagogy	**Quiz**	
2	Introduction to the Tableau interface. Connecting to data sources (Excel, CSV, SQL databases). Building basic and advanced charts. Creating calculated fields and parameters. Assembling interactive dashboards with filters, actions, and tooltips. Introduction to Tableau Stories for narrative presentation	**8 Hours**
Pedagogy	**Demonstration**	
3	Dashboard planning and layout principles (Z-pattern, grids). Key Performance Indicator (KPI) design and tracking. User-centric design and usability testing for dashboards. Advanced chart types: heatmaps, treemaps, and sankey diagrams. Performance optimization for large datasets	**8 Hours**
Pedagogy	**Demonstration**	
4	Introduction to the Matplotlib library. The anatomy of a Matplotlib plot (Figure, Axes, Artist). Creating fundamental plots: line, bar, scatter, and histograms. Customizing plots: labels, titles, colors, line styles, and legends. Working with subplots to create multi-chart layouts. Saving visualizations to files	**8 Hours**
Pedagogy	**Demonstration**	
5	Seaborn: High-level interface for statistical graphics. Creating complex statistical plots (box plots, violin plots, pair plots, heatmaps) with minimal code. Integration with Pandas DataFrames. Bokeh: Introduction to interactive plotting for web browsers. Basic glyphs, tools (pan, zoom, hover), and layouts. Building simple interactive applications and linked plots.	**8 Hours**
	Case Studies	

Pedagogical Initiatives (Not limited to):

- **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another
- **Problem Solving**: encourages cognitive thinking and enables creative problem solving
- **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.
- **Case studies:** maps different domains in real time applications
- **Demonstration:** exhibits the implementation process

List of Programs:

Sl. No.	Experiments/Programs	COs
1	**Lab 1: Seasonal Sales Calculations** **Scenario:** A retail chain asks you to pinpoint their most volatile products and understand seasonal trends in order to optimize inventory. **Dataset:** "Retail Sales Forecasting" (Kaggle: https://www.kaggle.com/c/competitive-data-science-predict-future-sales) or a cleaned monthly sales CSV • **Problem:** Compute quarterly totals and growth rates for top 3 products. Choose and sketch the chart type that best shows quarter-over-quarter percentage change. • **Tasks:** 1. Calculate total sales per quarter for Product A, B, and C. 2. Compute QoQ growth (%) for each. Select chart (e.g., line with percent axis) and justify in ≤50 words	
2	**Lab 2: Error Rate Diagnostics** **Scenario:** Your company's web service suffered unexplained downtime spikes; you must uncover when and why error rates surged. **Dataset:** "Server Logs" (Kaggle: https://www.kaggle.com/seznam/edd-server-logs) • **Problem:** Identify time periods with unusual error spikes. • **Tasks:** 1. Calculate hourly error rates (errors ÷ total requests). 2. Find top 5 hours with highest rates. Sketch improved visualization (e.g., bar chart with clear axis) and list 2 calculation-based improvements.	
3	**Time & Category Analysis** **Scenario:** The VP of Sales needs quick insights on YoY performance and category contributions to guide next quarter's targets. **Dataset:** Tableau's built-in "Sample - Superstore" • **Problem:** Compute year-over-year sales change and category share percentages. • **Tasks:** 1. Calculate YOY % change in total sales for last 3 years. 2. Compute each category's share of total sales for the most recent year. Build three views: YOY trend, category share pie (with % labels), and profit map.	
4	**Regional Drill-Down Metrics** **Scenario:** Regional managers want to self-serve on their average order values and best-selling categories without relying on IT. **Dataset:** "Global Superstore" (Kaggle: https://www.kaggle.com/teertha/us-superstore) • **Problem:** Determine region-wise average order value and top-selling category. • **Tasks:** 1. Calculate average order value per region. 2. Identify top category by sales in each region. Build dashboard with a region filter and category drill-through action	
5	**KPI Wallboard Calculations** **Scenario:** The CEO's office needs a large-screen wallboard showing instant health metrics for their e-commerce business. **Dataset:** "E-Commerce Data" (Kaggle: https://www.kaggle.com/carrie1/ecommerce-data) • **Problem:** Compute monthly Total Sales, Profit Margin (%), and Avg Discount. • **Tasks:** 1. Derive Profit Margin = (Profit ÷ Sales) × 100 for each month. 2. Compute average discount per order. Display Big Ass Numbers (BANs) with sparklines for the last 12 months.	

6	**Profit Leak Detection** **Scenario:** The Product Director suspects some sub-categories drain profits but wants a visual summary to confirm. **Dataset:** "Superstore Sales" (Kaggle) • **Problem:** Quantify profit ratio (Profit ÷ Sales) by sub-category. • **Tasks:** 1. Calculate profit ratio for each sub-category. 2. Identify the bottom 5 sub-categories by ratio. Build a treemap; annotate calculations in dashboard notes.	
7	**Programmatic Visualization with Matplotlib** **Lab 7: Climate Data Trends** **Scenario:** The municipal climate office requires clear trends on temperature rises and rainfall changes to inform policy. **Dataset:** "Global Land Temperatures" (Kaggle: https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data) • **Problem:** Compute annual average temperature and total annual rainfall. • **Tasks:** 1. Aggregate monthly data to yearly averages and rainfall sums. 2. Plot a line (temperature) and a bar chart (rainfall) with titles and axis labels. Save both as PNGs; include calculation code comments.	
8	**Combined Climate Summary** **Scenario:** Stakeholders need a single figure to compare temperature vs. rainfall over the last two decades. **Dataset:** Same as Lab 7 • **Problem:** Present side-by-side yearly temperature vs. rainfall for the last 20 years. • **Tasks:** 1. Prepare arrays for the last 20 years. 2. Create a 1×2 subplot figure with proper titles and labels. Embed an overall title listing mean values.	
Open ended Programs		
1	**Advanced Python Visuals** **Lab 9: Iris Data Statistics** **Scenario:** A botany research team wants concrete measures of variation to decide on species sampling methods. **Dataset:** Seaborn's built-in Iris • **Problem:** Calculate mean, median, and IQR of petal length per species. • **Tasks:** 1. Compute these statistics for each species. 2. Generate a pairplot & boxplot annotated with statistic lines. Summarize findings in ≤5 bullet points.	
2	**Auto MPG Explorations** **Scenario:** An automotive blog plans an interactive feature showing how horsepower impacts fuel efficiency. **Dataset:** "Auto MPG" (UCI/Kaggle: https://www.kaggle.com/uciml/autompg-dataset) • **Problem:** Compute correlation coefficient between horsepower and MPG. • **Tasks:** 1. Calculate Pearson's r. 2. Build a Bokeh scatter plot with r displayed in the title or annotation. 3. Enable hover showing MPG and HP; include pan/zoom tools.	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic, October 7, 2015, Wiley Publishers
2	Information Dashboard Design: The Effective Visual Communication of Data by Stephen Few, O'Reilly Publishers, 2006
Reference Books	
1	Python for Data Analysis by Wes McKinney.
2	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron (for Matplotlib sections).

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the foundations of data visualization and its applications in modern industries.	Understand	**L2**
CO2	Apply design principles and storytelling to create compelling data narratives.	Apply	**L3**
CO3	Develop and evaluate interactive dashboards for diverse datasets using Tableau.	Apply	**L3**
CO4	Build and customize a wide variety of static and interactive plots using Python.	Apply	**L3**
CO5	Analyze ethical challenges in data representation and deploy visualizations responsibly	Understand	**L2**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2	3	1	2										
CO3			3	2	2	1									

CO4	2	2	3												
CO5				1		3	1	3				3			

Weblinks and Video Lectures (e-Resources)	
1	Official documentation for Tableau, Matplotlib, Seaborn, and Bokeh.
2	Kaggle for datasets and practical examples.
3	Online courses on platforms like Coursera and Udemy.

PROFESSIONAL CORE COURSE (PCC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**Data Engineering**				
Course Code	:	**BCD603**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PCC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3.:0:0:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours of Theory**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To Understand the basic concepts of big data analytics
2	To implement MapReduce programs for processing big data.
3	To realize storage and processing of big data using Pig, Hive and Spark.
4	To analyze big data using machine learning techniques.
5	To analyze Text, web content and link using machine learning techniques with Pyspark.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

1. Adopt different teaching methods to attain the course outcomes.
2. Include videos to demonstrate various concepts.
3. Encourage collaborative (Group) Learning to encourage team building.
4. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
5. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
6. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
7. Discuss various case studies to map with real-world scenarios and improve the understanding.
8. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	Classification of data, Characteristics, Evolution and definition of Big data, What is Big data, Why Big data, Traditional Business Intelligence Vs Big Data, Typical data warehouse and Hadoop environment. **Big Data Analytics:** What is Big data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies used in Big data Environments, Few Top Analytical Tools, NoSQL, Hadoop.	**8 hrs**
Pedagogy	**Demonstration**	
2	**Introduction to Hadoop:** Introducing Hadoop, Why Hadoop, Why not RDBMS, RDBMS Vs Hadoop, History of Hadoop, Hadoop overview, Use case of Hadoop, HDFS (Hadoop Distributed File System), Processing data with Hadoop, Managing resources and applications with Hadoop YARN (Yet Another Resource Negotiator). Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression.	**8 hrs**
Pedagogy	**Problem Solving**	
3	**Introduction to Hive:** What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF). **Introduction to Pig:** What is Pig, Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use case for Pig, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.	**8 hrs**
Pedagogy	**Case Study Assignment**	
4	**Spark and Big Data Analytics:** Spark, Introduction to Data Analysis with Spark. **Machine Learning Algorithms for Big Data Analytics:** Estimating the Relationships, Outliers, Variances, Probability distributions and correlations - Recommendation system.	**8 hrs**
Pedagogy	**Poster Presentation**	
5	**Text, Web Content and Link Analytics:** Introduction, Text Mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and Analyzing a Web Graph - **Programming examples in analytics and Machine Learning using Hadoop, Spark and Python:** Installation steps for Hadoop and Spark, Programming steps using Hive and pyspark , Data Visualization using python plotting library.	**8hrs**
Pedagogy	**Case studies**	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving	

	• **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Seema Acharya and Subhashini Chellappan "Big data and Analytics" Wiley India Publishers, 2nd Edition, 2019.
2	Rajkamal and Preeti Saxena, "Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Publication, 2019.
Reference Books	
1	Adam Shook and Donald Mine, "MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2	Tom White, "Hadoop: The Definitive Guide" 4th Edition, O'reilly Media, 2015.
3	Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Identify and list various Big Data concepts, tools and applications.	U,R	Level1 & Level2
CO2	Develop programs using HADOOP framework.	A	Level3
CO3	Make use of Hadoop Cluster to deploy Map Reduce jobs, PIG, HIVE and Spark programs.	An	Level4
CO4	Analyze the given data set and identify deep insights from the data set.	An	Level4
CO5	Demonstrate Text, Web Content and Link Analytics.	E	Level5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2		3													
CO3			3												
CO4		3													
CO5				3								3			
CO6					3				3			3			

Weblinks and Video Lectures (e-Resources)	
1	https://www.kaggle.com/datasets/grouplens/movielens-20m-dataset
2	https://www.youtube.com/watch?v=bAyrObI7TYE&list=PLEiEAq2VkUUJqp1k-g5W1mo37urJQOdCZ
3	https://www.youtube.com/watch?v=VmO0QgPCbZY&list=PLEiEAq2VkUUJqp1kg5W1mo37urJQOdCZ&index=4
4	https://www.youtube.com/watch?v=GG-VRm6XnNk https://www.youtube.com/watch?v=JglO2Nv_92A

PROFESSIONAL ELECTIVE COURSE (PEC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**Natural Language Processing**				
Course Code	:	**BCD604A**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To learn the fundamental concepts and techniques of natural language processing (NLP) including Language Models, Word Embedding, Part pf speech Tagging, Parsing
2	To learn computational properties of natural languages and the commonly used algorithms for processing linguistic information
3	To introduce basic mathematical models and methods used in NLP applications to formulate computational solutions
4	To introduce students research and development work in Natural language Processing

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

DSATM

Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction to NLP & Basic Text Processing:** What is NLP? History and Levels of NLP, Applications of NLP, Challenges in NLP, Text Preprocessing: Tokenization, stop word removal, Stemming and Lemmatization, Regular Expressions for text processing.	**8 Hours**
Pedagogy	**Short examples for preprocessing. Quiz on definitions and basic techniques.**	
2	**Language Modeling:** Introduction to Language Modeling, N-gram Models: Unigrams, Bigrams, Trigrams, Calculating N-gram Probabilities, The Challenge of Sparsity: Smoothing (Add-one/Laplace smoothing), Evaluating Language Models: Perplexity (Conceptual).	**8 Hours**
Pedagogy	**Problem solving (N-gram probability calculation)**	
3	**Words and Their Meanings: Lexical Semantics & Embeddings:** Lexical Semantics: Word Senses and Relations, WordNet: A Lexical Database (Overview), **Vector Semantics:** Representing words as vectors., TF-IDF (Term Frequency-Inverse Document Frequency). **Introduction to Word Embeddings, Word2Vec:** Skip-gram and CBOW (Conceptual understanding), Visualizing Embeddings (Conceptual).	**8 Hours**
Pedagogy	**Demonstration/Visualization of vector space**	
4	**Syntactic Analysis: Part-of-Speech Tagging & Basic Parsing:** Part-of-Speech (POS) Tagging: Definition and Importance, English Word Classes and Tagsets, Rule-based vs. Stochastic POS Taggers, Hidden Markov Models (HMM) for POS Tagging (Conceptual Overview).	**8 Hours**
Pedagogy	**Demonstration**	
5	**NLP Applications & Advanced Concepts Overview:** Text Classification: e.g., Sentiment Analysis, Spam Detection, Information Retrieval; Text Summarization (Extractive vs. Abstractive), Question Answering Systems (Overview), Introduction to Sequence-to-Sequence Models. Brief mention of Transformers & Large Language Models (Text to Text Models)	**8 Hours**
	Case Studies	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving	

	• **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Daniel Jurafsky and James H. Martin, SPEECH and LANGUAGE PROCESSING: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, McGraw Hill, 3rd edition, 2025
2	Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, MIT Press. Cambridge, MA
Reference Books	
1	Allen James, Natural Language Understanding
2	Neural Machine Translation by Philipp Koehn

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the fundamental concepts, levels of analysis, and key challenges in Natural Language Processing.	Understand	**L2**
CO2	Apply text pre-processing techniques and build simple N-gram language models.	Apply	**L3**
CO3	Analyze different approaches for representing word meaning and the utility of Part-of-Speech tagging. | L4 | Analyze, Differentiate	Analyze	**L4**
CO4	Evaluate basic syntactic parsing techniques and their role in understanding sentence structure.	Analyze	**L4**
CO5	Analyze common NLP applications and formulate high-level approaches to solve simple NLP tasks, considering ethical implications	Analyze	**L4**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2		3													
CO3			3												
CO4				3											
CO5			3												

Weblinks and Video Lectures (e-Resources)	
1	**Book/Tutorial:** https://www.nltk.org/book/
2	**Spacy Documentation:** https://spacy.io/usage
3	**Stanford CS224N: NLP with Deep Learning (Official Playlist - Winter 2023 or latest available)** https://www.youtube.com/playlist?list=PLoROMvodv4rOSH4v6133s9LFPRHjEmbmJ
4	**Dan Jurafsky - Speech and Language Processing (Lectures based on the textbook)** https://www.youtube.com/playlist?list=PL6397E4B26D60E0C5

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**Computer Vision**				
Course Code	:	**BCD604B**				
Course Type (Theory/Practical/Project/Integrated)	:	**Theory**				
Category	:	**PEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50**
Total Hours	:	**40 Hours**		**SEE Duration**	:	**3 Hours**
Credits	:	**3**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To understand the fundamentals of computer vision and digital image processing
2	To introduce the processes involved image enhancement and restoration.
3	To facilitate the students to gain understanding color image processing and morphology.
4	To impart the knowledge of image segmentation and object recognition techniques.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

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COURSE CURRICULUM

Module No.	Topics	Hours
1	**Introduction:** What is computer vision? A brief history. **Image Formation:** Photometric image formation, The digital camera. **Image processing**: Point operators, Linear filtering.	8
Pedagogy	**Quiz**	
2	**Image processing**: More neighborhood operators, Fourier transforms, Pyramids and wavelets, and Geometric transformations.	8
Pedagogy	**Problem Solving**	
3	**Image Restoration and Reconstruction:** A model of Image degradation/restoration process, restoration in the presence of noise only, periodic noise reduction by frequency domain filtering. **Image Segmentation:** Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only), Segmentation by region growing & region splitting & merging.	8
Pedagogy	**Demonstration**	
4	**Color Image Processing:** Color fundamentals, color models, Pseudocolor image processing, full color image processing, color transformations, color image smoothing and sharpening, Using color in image segmentation, Noise in color images.	8
Pedagogy	**Poster Presentation**	
5	**Morphological Image Processing:** Preliminaries, Erosion and Dilation, opening and closing, Hit-ormiss transform, some basic morphological algorithms. **Feature Extraction:** Background, Boundary preprocessing (Boundary following & Chain codes only). **Image pattern Classification:** Background, Patterns and classes, Pattern classification by prototype matching (Minimum distance classifier only).	8
	Case Study	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily.	

	• **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2nd Edition, 2022, Springer.
2	Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Pearson, 4th edition, 2019.
Reference Books	
1	David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.
2	Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Explain the fundamentals of computer vision and its applications.	**U**	**L2**
CO2	Apply the image enhancement techniques for smoothing and sharpening of images.	**A**	**L3**
CO3	Analyze the different image restoration and segmentation techniques.	**An**	**L4**
CO4	Demonstrate the smoothing and sharpening techniques for color images.	**An**	**L4**
CO5	Explain morphological, feature extraction, and pattern classification techniques for object recognition.	**A**	**L3**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2	3														
CO3		3		2								3			
CO4		3	3		3				2			3			
CO5	3				3				2			3			

Weblinks and Video Lectures (e-Resources)	
1	Virtual Labs: https://cse19-iiith.vlabs.ac.in/
2	https://onlinecourses.nptel.ac.in/noc21_ee78/preview
3	Introduction to Machine Vision: https://www.youtube.com/watch?v=tY2gczObpfU
4	https://coral.ise.lehigh.edu/optml/files/2019/10/OptML_CV_tutorial_1_compressed.pdf

PROJECT BASED LEARNING (PBL)

Subject Identified for Project Based Learning

Semester	6
Subject Identified for PBL	Big Data Analytics
Prerequisite	Big Data Tools & Technologies Programming Skills (Python/ Java / Scala / R and SQL) Statistics & Probability, Mathematics for Data Science
Justification for the selected subject	Applying foundational knowledge in statistics, data mining, and programming to real-world datasets. Gain proficiency in industry-relevant platforms such as Hadoop, Spark, Hive, and Kafka, preparing them for roles in data engineering and analytics.
List of possible projects	1. Real-Time Data Processing Projects 2. Data Warehousing & ETL-Based Projects 3. Machine Learning with Big Data 4. NoSQL & Semi-Structured Data Projects 5. Public Datasets & Government/Open Data Projects 6. Domain-Specific Applications 7. Text and Web Analytics Projects

Signature of the Guide **Signature of HOD**

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**Big Data Analytics**				
Course Code	:	**BCD607**				
Course Type (Theory/Practical/Project/Integrated)	:	**Project**				
Category	:	**PBL**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L: T:P:S)	:	**0:0:2:2**		**SEE**	:	**50**
Total Hours	:	**30 Hours Theory + Project**		**SEE Duration**	:	**2 Hours**
Credits	:	**2**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To learn primitive constructs of Hadoop and MapReduce for Big Data Analysis.
2	To understand the knowledge of Hive and Pig script.
3	To gain knowledge on Python for big data processing and visualization using Pyspark and Power BI.
4	To learn primitive concepts of Informatica and Talent for Big data analysis.
5	To implement applications using Integrated MapReduce, Hive, Pig jobs and Functional programming.

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in Data Science.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

- Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Introduce Topics in manifold representations.
- 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.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding

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Topics to implement project
Hadoop 3.x & HDFS: Set up a Hadoop cluster (Pseudo-distributed and fully-distributed), Ingest and store log data from multiple sources into HDFS, Data replication and compression demo **MapReduce:** Understand key-value processing, Implement custom map and reduce functions, Word Count Program (Basic).
Pig: Use Pig Latin for ETL tasks, Load, transform, and analyze data, Pig Latin Overview, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Analyze e-commerce data (customer trends, product views). **Hive:** SQL-like querying on big data, Partitioning, bucketing, UDFs, What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF), Build a data warehouse using Hive.
PySpark: Use Python for big data processing, perform transformations and actions using DataFrames and RDDs, Real-time sentiment analysis using Twitter stream. **Power BI:** Connect, model, and visualize data, Publish and share dashboards, Sales Dashboard using Excel/CSV files as sources.
Informatica: ETL concepts using Informatica PowerCenter, Data mapping, transformation, workflow design, Build an end-to-end ETL pipeline (source to target), Data cleansing and standardization workflows, Real-time data integration using Informatica Cloud. **Talend:** Open-source ETL using Talend Open Studio, Data integration and job design, Extract, transform, and load financial data into MySQL, Build data quality reports (nulls, duplicates), API-based data ingestion and transformation.
Databricks: Unified analytics with Apache Spark, Collaborative notebooks and ML, Data lake analytics on Azure/AWS using Databricks, Notebook-based fraud detection model, Streaming data pipeline and dashboarding. **Oozie:** Workflow scheduling for Hadoop jobs, Integrate MapReduce, Hive, Pig jobs, Schedule a daily ETL pipeline with dependency rules. **Scala:** Functional programming and Spark integration, Data pipelines using Scala with Spark, Implement ETL using Scala and Spark.

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Seema Acharya and Subhashini Chellappan “Big data and Analytics” Wiley India Publishers, 2nd Edition, 2019.
2	Rajkamal and Preeti Saxena, “Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning”, McGraw Hill Publication, 2019.
Reference Books	
1	Adam Shook and Donald Mine, “MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems” - O'Reilly 2012
2	Tom White, “Hadoop: The Definitive Guide” 4th Edition, O’reilly Media, 2015.

3	Thomas Erl, Wajid Khattak, and Paul Buhler, Big Data Fundamentals: Concepts, Drivers & Techniques, Pearson India Education Service Pvt. Ltd., 1st Edition, 2016
4	John D. Kelleher, Brian Mac Namee, Aoife D'Arcy -Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, MIT Press 2020, 2nd Edition

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Remember and understand the basic constructions of Hadoop and MapReduce for Big Data Analysis.	R,U	Level1 & Level2
CO2	Apply the knowledge of pig and Hive to Load, transform, analyze, Partitioning, bucketing the Big data.	A	Level3
CO3	Analyse the concept of Pyspark and powerBI to solve complex problem and visualize, Publish and share dashboards in Big data.	An	Level4
CO4	Apply the concepts of Informatica and Talent to do Data mapping, transformation, workflow, Data integration and job design.	A	Level3
CO5	Investigate the concept of Unified analytics, Workflow scheduling and Data pipelines using Oozie, Scala with Spark.	E	Level5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3						
CO2		3			3				3						
CO3			3		3				3						
CO4		3			3				3						
CO5				3	3				3			3			

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=1vbXmCrkT3Y
2	https://www.youtube.com/watch?v=94w6hPk7nkM
3	https://www.youtube.com/watch?v=qXHRmkObG8c
4	https://www.youtube.com/watch?v=7pee6_Sq3VY
5	https://www.youtube.com/watch?v=PzQ3DBrHW-U

ABILITY ENHANCEMENT COURSE (AEC)

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th Semester**				
Course Title	:	**PyTorch Lab**				
Course Code	:	**BCDL618**				
Course Type (Theory/ Practical/ Integrated/ Project)	:	**Practical - Experiential Learning**				
Category	:	**AEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**0-0-2-0**		**SEE**	:	**50**
Total Hours	:	**15 Hours**		**SEE Duration**	:	**2 hours**
Credits	:	**1**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**Understand the fundamental concepts of deep learning**, including neural networks, activation functions, loss functions, backpropagation, and optimization algorithms.
2	**Gain practical experience using PyTorch**, a leading deep learning framework, to implement, train, evaluate, and deploy machine learning models.
3	**Build and train deep learning architectures** such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and Transformers for real-world tasks.
4	**Handle data pipelines** using PyTorch's Dataset and Data Loader classes, and perform efficient preprocessing and augmentation.
5	**Apply deep learning techniques to solve tasks** in computer vision, natural language processing, and time-series analysis.

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

ii. Adopt different teaching methods to attain the course outcomes.
iii. Include videos to demonstrate various concepts in C.
iv. Encourage collaborative (Group) Learning to encourage team building.
v. Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
vi. Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
vii. Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
viii. Discuss various case studies to map with real-world scenarios and improve the understanding.
ix. Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

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COURSE CURRICULUM

Module No.	Topics	Hours
1	Understand basic PyTorch operations and tensor manipulation. **Topics:** • Installing PyTorch and setting up (CPU/GPU) • Tensors: creation, indexing, slicing, reshaping • Basic operations (addition, multiplication, etc.) • Autograd: understanding gradients Excersices: **Recreate basic tensor arithmetic manually and with PyTorch Gradient descent for a linear function**	**3 Hours**
2	**Neural Network Fundamentals** • Create a custom neural network with nn.Module • Use nn.Linear, nn.ReLU, nn.Sigmoid • Forward pass implementation • Lab Exercise: XOR classifier using a simple 2-layer MLP **Training a Model** • Use Data Loader for batching • Define a loss function (MSELoss, CrossEntropyLoss) • Use an optimizer (SGD, Adam) • Manual training loop: Forward, backward, update Lab Exercise: Train a model on a synthetic classification dataset	**3 Hours**
3	**Image Classification with CNN** • Convolution, pooling layers, and flattening • Build a CNN for MNIST or CIFAR-10 • Lab Exercise: Classify MNIST using a CNN with 2 conv layers **Custom Datasets and Data Augmentation** • Define a custom dataset using torch.utils.data.Dataset • Apply torch vision. transforms • Lab Exercise: Load and transform images from a custom folder	**3 Hours**
4	**RNNs and LSTMs** • Implement a character-level RNN • Use nn.RNN or nn.LSTM • Sequence handling with pack_padded_sequence • Lab Exercise: Text classification or name generation **Transfer Learning** • Load pretrained models (resnet18, vgg16, etc.) • Freeze/unfreeze layers • Replace classifier head for new task • Lab Exercise: Fine-tune ResNet18 on a small image dataset	**3 Hours**

5	**Model Saving and Loading** • Save/load models with torch.save and torch. load • Save entire model vs state_dict • Lab Exercise: Save a trained model and use it for inference **Custom Layers and Loss Functions** • Implement a custom layer • Write a custom loss function using autograd • Lab Exercise: Build a model with a custom loss (e.g., Huber loss)	**3 Hours**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Deep Learning with PyTorch by Eli Stevens, Luca Antiga, and Thomas Viehmann, Manning Publisher, 2020
2	Deep Learning for Coders with fastai and PyTorch by Jeremy Howard and Sylvain Gugger, O'Reilly Media, 2020

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Understand and apply fundamental tensor operations using PyTorch.	Apply	**L3**
CO2	Design and implement simple neural networks using PyTorch modules.	Apply	**L3**
CO3	Build and train convolutional neural networks for image classification tasks.	Apply	**L3**
CO4	Implement data preprocessing and augmentation using PyTorch Datasets and Data Loaders.	Apply	**L3**
CO5	Develop sequence models using RNNs and LSTMs for natural language or time-series tasks.	Apply	**L3**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**								**2**						
CO2			**3**						**2**			**2**			
CO3			**3**						**2**			**2**			
CO4			**3**						**2**			**2**			

CO5			**3**						**2**			**2**			

Weblinks and Video Lectures (e-Resources)	
1	https://numpy.org/doc/
2	https://pandas.pydata.org/docs/
3	https://www.youtube.com/playlist?list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
4	https://www.youtube.com/watch?v=QUT1VHiLmmI

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Semester	:	**6th Semester**				
Course Title	:	**Generative AI Lab**				
Course Code	:	**BCDL628**				
Course Type (Theory/Practical/Project/Integrated)	:	**Practical - Experiential Learning**				
Category	:	**AEC**				
Stream	:	**CSE-DS**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**0-0-2-0**		**SEE**	:	**50**
Total Hours	:	**15 Hours**		**SEE Duration**	:	**2 hours**
Credits	:	**1**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	Understand the principles and concepts behind generative AI models
2	Explain the knowledge gained to implement generative models using Prompt design frameworks
3	Apply various Generative AI applications for increasing productivity
4	Develop Large Language Model-based Apps

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- **x.** Adopt different teaching methods to attain the course outcomes.
- **xi.** Include videos to demonstrate various concepts.
- **xii.** Encourage collaborative (Group) Learning to encourage team building.
- **xiii.** Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- **xiv.** Adopt **Problem-Based Learning (PBL),** which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- **xv.** Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- **xvi.** Discuss various case studies to map with real-world scenarios and improve the understanding.
- **xvii.** Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

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COURSE CURRICULUM

Module No.	Topics	Hours
1	1. Explore pre-trained word vectors. Explore word relationships using vector arithmetic. Perform arithmetic operations and analyse results. 2. Use dimensionality reduction (e.g., PCA or t-SNE) to visualize word embeddings for Q 1. Select 10 words from a specific domain (e.g., sports, technology) and visualize their embeddings. Analyze clusters and relationships.	**3 Hours**
2	**1.** Train a custom Word2Vec model on a small dataset. Train embeddings on a domain-specific corpus (e.g., legal, medical) and analyze how embeddings capture domain-specific semantics. **2.** Use word embeddings to improve prompts for Generative AI model. Retrieve similar words using word embeddings. Use the similar words to enrich a GenAI prompt. Use the AI model to generate responses for the original and enriched prompts. Compare the outputs in terms of detail and relevance.	**3 Hours**
3	8. Write a program that: Takes a seed word. Generates similar words. Constructs a short paragraph using these words. 9. Use a pre-trained Hugging Face model to analyze sentiment in text. Analyze the sentiment by giving sentences to input.	**3 Hours**
4	1. Summarize long texts using a pre-trained summarization model from Hugging face. Take a passage as input and obtain the summarized text. 2. Install langchain, langchain-community, and transformers. Load a text document from your **local machine**. Use a Hugging Face pre-trained language model to extract key information from the document. Create a prompt template using LangChain to format and display the output in a specific manner.	**3 Hours**
5	**1.** Institution name as input. Use Pydantic to define the schema for the desired output and create a custom output parser. Invoke the Chain and Fetch Results. Extract the below Institution related details from Wikipedia: **The founder of the Institution. When it was founded. The current branches in the institution. How many employees are working in it. A brief 4-line summary of the institution.** **2.** Build a chatbot for the Indian Penal Code. We'll start by downloading the official Indian Penal Code document, and then we'll create a chatbot that can interact with it. Users will be able to ask questions about the Indian Penal Code and have a conversation with it.	**3 Hours**

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	**Modern Generative AI with ChatGPT and OpenAI Models**: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4, by Valentina Alto, Packt Publishing Ltd, 2023.
2	**Generative AI for Cloud Solutions**: Architect modern AI LLMs in secure, scalable, and ethical cloud environments, by Paul Singh, Anurag Karuparti ,Packt Publishing Ltd, 2024.

Course Outcomes: At the end of the course, the student will be able to:

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	Develop the ability to explore and analyze word embeddings, perform vector arithmetic to investigate word relationships, visualize embeddings using dimensionality reduction techniques	Apply	**L3**
CO2	Apply prompt engineering skills to real-world scenarios, such as information retrieval, text generation.	Apply	**L3**
CO3	Utilize pre-trained Hugging Face models for real-world applications, including sentiment analysis and text summarization.	Apply	**L3**
CO4	Apply different architectures used in large language models, such as transformers, and understand their advantages and limitations.	Apply	**L3**

Weblinks and Video Lectures (e-Resources)	
1	https://numpy.org/doc/
2	https://pandas.pydata.org/docs/
3	https://www.youtube.com/playlist?list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
4	https://www.youtube.com/watch?v=QUT1VHiLmmI

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3						2						
CO2			3						2						
CO3			3						2						
CO4			3						2						

Course - Skills Mapping Table

6th Semester

Sl. No.	Name of the Course	Course Code	Course Type	Course Category	Skills attained by the students
1	Deep Learning	BCD601	Integrated	IPCC	➢ Neural Network Design ➢ Framework Proficiency ➢ Autoencoders & Generative Models
2	Data Visualization and Interpretation	BCD602	Integrated	IPCC	➢ Visualization Tools Proficiency ➢ Chart & Graph Design ➢ Ethical Representation of Data
3	Big Data Analytics	BCD607	Project	PBL	➢ Big Data Frameworks & Tools ➢ Data Storage & Management ➢ Data Quality & Validation
4	Project Phase -1	BCD606	Project	PR	➢ Literature survey for project title finalization ➢ Software tool for project implementation ➢ Software Engineering concepts ➢ Survey paper publications
5	PyTorch	BCD618	Practical Experiential learning	AEC	➢ Proficiency in PyTorch Framework ➢ Tensor Operations ➢ Custom Dataset Creation
	Generative AI	BCD628			➢ Understanding Generative Models ➢ Model Architecture & Training ➢ Data Augmentation