Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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–: પરિપત્ર :–

યુનિવર્સિટી સંલગ્ન તમામ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭થી અમલમાં આવનાર T.Y.B.Sc. (Data Science and Analytics) Honours Sem.-5 & 6 નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસ સમિતિની તા.૨૫/૦૩/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૧૦ થી મંજૂર કરી કોમ્પ્યુટર સાયન્સ ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ ફેકલ્ટીની તા.૨૯/૦૪/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૭ થી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૭/૦૫/૨૦૨૬ ની સભાનાં ઠરાવ ક્રમાંકઃ૫૦ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/૧૦૦૫૦/૨૦૨૬
તા.૧૨/૦૫/૨૦૨૬

કુલસચિવ (ઇ.ચા.)

પ્રતિ,

૧) યુનિવર્સિટી સંલગ્ન તમામ કોમ્પ્યુટર સાયન્સ કોલેજોના આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકો/વિદ્યાર્થીને જાણ કરી અમલ કરવા સારૂ.

૨) ઈ.ચા.ડીનશ્રી, કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.

૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

Veer Narmad South Gujarat University, Surat

Computer Science and Information Technology Faculty

Syllabus for T.Y. B.SC.(DATA SCIENCE AND ANALYTICS) (HONOURS)

(Semester-V and Semester-VI)

as per the NEP-2020

To be implemented from

Academic Year: June, 2026-2027

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT B.Sc.(Data Science and Analytics) Semester-5 and Semester-6	
Name of Program	**Bachelor of Computer Science in Data Science and Analytics**
Program Abbreviation	**B.Sc.(Data Science and Analytics)**
Duration	Four-year Integrated Program with Multi-Level Entry and Exit option
Eligibility Criteria	As per University Criteria
Pre-requisite	Second Year of B.Sc.(Data Science and Analytics)
Medium of Instruction	English
Objective of Program	The B.Sc.(Data Science and Analytics) program aims to provide strong foundations in data science, statistics, and computing. It develops analytical and problem-solving skills to address real-world data-driven challenges. The program equips students with programming and technical skills required for data analysis and model implementation. It emphasizes transforming data into meaningful insights through visualization and analytics. Practical learning is promoted through labs, projects, and case studies. Ethical and responsible use of data is strongly emphasized. The program enhances communication and teamwork skills for effective presentation of insights. Students are encouraged toward independent learning and innovation. The curriculum prepares learners for industry roles, entrepreneurship, higher studies, and research. Overall, the program builds competent data professionals ready for evolving technological landscapes.
Program Outcome (PO)	**PO1:** To build strong foundations in mathematics, statistics, computing, and core data science principles for data-driven analysis. **PO2:** To develop analytical, critical thinking, and problem-solving skills for interpreting and extracting insights from data. **PO3:** To equip students with practical programming, data analysis, visualization, and modeling skills using modern tools and technologies. **PO4:** To enable the design and implementation of data-driven solutions for real-world and interdisciplinary problems. **PO5:** To promote ethical, responsible, and secure use of data, including awareness of privacy, governance, and professional ethics. **PO6:** To prepare graduates for careers, higher education, research, and lifelong learning in data science, analytics, and related fields.
Program Specific Outcomes (PSO)	**PSO1:** Apply statistical and computational techniques to collect, preprocess, and analyze structured and unstructured datasets. **PSO2:** Design and implement data analytics solutions using programming languages, libraries, and frameworks relevant to data science. **PSO3:** Develop and evaluate predictive and descriptive models using machine learning and analytical techniques. **PSO4:** Create meaningful data visualizations and dashboards to communicate analytical findings effectively to technical and non-technical stakeholders. **PSO5:** Integrate databases, data warehouses, and big data tools for efficient data storage, retrieval, and processing. **PSO6:** Apply ethical principles, data privacy laws, and governance frameworks while handling and analyzing data. **PSO7:** Work effectively as an individual and as part of a team to solve real-world data-driven problems through projects and case studies.

	PSO8: Demonstrate self-learning ability and adaptability by exploring emerging tools, technologies, and research trends in data science and analytics.
Mapping between POs and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
PO1								
PO2								
PO3								
PO4								
PO5								
PO6								

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)
(SEM – 5)
(w.e.f. Academic Year June, 2026-2027)

Structure of Program (Semester-5)

Course Category	Course Code	Course Title	Marksheet Title in English	Level of Course	Teaching Hours/Week		Exam Duration		Credit	Internal Marks		External Marks		Total Marks
					TH	PR	TH	PR		TH	PR	TH	PR	
MINOR	DS-501	Cloud Computing Fundamentals	Cloud Computing Fundamentals	300-399	4	-	2	-	4	50	-	50	-	100
MINOR	DS-502	Computer Network	Computer Network	300-399	4	-	2	-	4	50	-	50	-	100
MAJOR	DS-503	Fundamentals of Machine Learning	Fundamentals of Machine Learning	400-499	2	4	1	2	4	25	25	25	25	100
MAJOR	DS-504	Advanced Data Visualization and Dashboard Development	Advanced Data Visualization and Dashboard Development	400-499	2	4	1	2	4	25	25	25	25	100
MAJOR	DS-505	Big Data Handling and Management for Machine Learning Applications	Big Data Handling and Management for Machine Learning Applications	400-499	2	4	1	2	4	25	25	25	25	100
SEC (Skill Enhancement Course)	DS-506	Ethics of Data Science	Ethics of Data Science	200-299	2	-	-	2	2	-	25	-	25	50

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
SYLLABUS
DS-501: Cloud Computing Fundamentals

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**Minor**
Course Subtype	**Employability**
Subject Type	**Discipline Specific**
Course Code	**DS-501**
Course Level	**300-399**
Course Title	**Cloud Computing Fundamentals**
Credit	**4 Credit**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Explain the history, evolution, merits, and limitations of cloud computing, highlighting the need for cloud-based solutions in modern IT environments. **CO2:** Describe and compare the core concepts, characteristics, and service models of cloud computing, including the paradigm shift from traditional computing to cloud-based architectures. **CO3:** Differentiate and evaluate various cloud deployment models and service models, along with their advantages, challenges, and real-world use cases. **CO4:** Identify and demonstrate the use of popular cloud service providers and platforms, such as Amazon Web Services (AWS) and Microsoft Azure, for basic cloud operations and services. **CO5:** Discuss advanced cloud concepts, emerging technologies, and future trends, including scalability, cloud security concerns, and the evolving role of cloud computing in industry.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			■
CO3	■			■			■	
CO4			■			■		■
CO5			■		■	■		■

Course Content	**Unit 1: Basics of Cloud Computing** 1.1 Introduction to Cloud Computing 1.1.1 Definition and Key Characteristics 1.1.2 Evolution and History of Cloud Computing 1.1.3 Benefits: Cost-efficiency, Scalability, Flexibility, Reliability 1.1.4 Challenges: Security, Compliance, Vendor Lock-in

	1.2. Cloud Models 1.2.1 Deployment Models: Public, Private, Hybrid, Multi-Cloud 1.2.2 Service Models: 1.2.2.1 IaaS, PaaS, SaaS 1.2.2.2 Additional Models: Network as a Service (NaaS), Database as a Service (DBaaS) 1.3 Cloud Applications and Use Cases 1.3.1 Business Applications 1.3.2 Data Backup and Recovery 1.3.3 Media Streaming, File Sharing **Unit 2: Cloud Architecture and Virtualization** 2.1 Cloud Computing Architecture 2.1.1 Components of Cloud Infrastructure 2.1.2 Front-end and Back-end Architecture 2.1.3 Resource Pooling and Multi-tenancy 2.2 Virtualization Technologies 2.2.1 Concept of Virtualization 2.2.2 Types of Virtualization: Hardware (Full, Para, Emulation) 2.2.3 Hypervisors: Type 1 and Type 2 2.2.4 Role of Virtual Machines in Cloud 2.3 Cloud Planning and Design 2.3.1 Business and IT Architecture 2.3.2 Cloud Transformation Planning 2.3.3 Introduction to Service-Oriented Architecture (SOA) 2.3.4 Utility Computing Concepts **Unit 3: Cloud Platforms and Management (AWS and Azure)** 3.1 Overview of Leading Cloud Platforms 3.1.1 Basic Concepts of AWS, Azure 3.1.2 Global Infrastructure: Regions and Availability Zones 3.2 Compute and Storage Services 3.2.1 AWS EC2 and Azure Virtual Machines 3.2.2 AWS Lambda and Azure Functions (Serverless Computing) 3.2.3 AWS S3 vs Azure Blob Storage 3.2.4 Backup and Archival Services (Amazon Glacier, Azure Backup) 3.3 Databases and Networking 3.3.1 AWS RDS and Azure SQL Database 3.3.2 NoSQL: DynamoDB (AWS), Cosmos DB (Azure) 3.3.3 Basics of Networking: Virtual Private Cloud (VPC), Azure Virtual Network (VNet) 3.4 Cloud Management and Monitoring 3.4.1 AWS CloudWatch, Azure Monitor 3.4.2 Resource Management Tools: AWS CloudFormation, Azure Resource Manager 3.4.3 Identity and Access Management (IAM and AAD) **Unit 4: Cloud Security, Big Data & Emerging Trends** 4.1 Cloud Security and Compliance 4.1.1 Cloud Security Principles 4.1.2 Cloud Security Alliance (CSA) 4.1.3 Role-Based Access Control (RBAC) 4.1.4 Compliance: GDPR, HIPAA, SOC2 4.2 Cloud Operations and Service Agreements

	4.2.1 Service Level Agreements (SLAs) 4.2.2 Operational Models 4.2.3 State Management and Automation Tools 4.3 Big Data and Data Lakes 4.3.1 Introduction to Big Data 4.3.2 OLTP vs OLAP 4.3.3 Data Warehouse vs Data Lake 4.3.4 Architecture and Benefits of Data Lakes 4.4 Future of Cloud Computing 4.4.1 Edge Computing and IoT (AWS IoT Core, Azure IoT Hub) 4.4.2 Cloud for AI & ML (SageMaker, Azure ML) 4.4.3 Trends: Quantum Computing, Green Cloud
Reference Books	1. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Prentice Hall, ISBN: 9780133387520 2. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, McGraw-Hill Education, ISBN: 9780071626943 3. Cloud Computing Bible, Barrie Sosinsky, Wiley India, ISBN: 9780470903568 4. Cloud Computing and Distributed Systems, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Morgan Kaufmann, ISBN: 9780123850591 5. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley, ISBN: 9780470887998 6. Architecting the Cloud: Design Decisions for Cloud Computing Service Models, Michael J. Kavis, Wiley, ISBN: 9781118617618 7. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw-Hill Education (India), ISBN: 9780070683534 8. Cloud Computing for Dummies, Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Wiley, ISBN: 9780470484708 9. Cloud Computing Black Book, Kailash Jayaswal, Dreamtech Press (India) ISBN: 9789351194174 10. Cloud Computing and Virtualization, Borko Furht, Armando Escalante, Springer, ISBN: 9781461479463
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage External Assessment : - Theory exam - 50% weightage

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
SYLLABUS
DS-502: Computer Network

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**Minor**
Course Subtype	**Employability**
Subject Type	**Discipline Specific**
Course Code	**DS-501**
Course Level	**300-399**
Course Title	**Cloud Computing Fundamentals**
Credit	**4 Credit**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1**: Explain the fundamental concepts of computer networks, including network types, topologies, transmission media, and networking models. **CO2:** Describe the functions and working of OSI and TCP/IP reference models and compare their respective layers and protocols. **CO3:** Apply knowledge of data communication techniques, switching methods, and network devices to analyze basic networking scenarios. **CO4:** Analyze the working of core network protocols related to IP addressing, routing, transport, and application services. **CO5:** Evaluate network performance, security issues, and emerging trends in computer networking for real-world applications.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			■
CO3	■			■			■	
CO4		■	■			■		■
CO5			■		■	■		■

Course Content	**Unit 1: Network Fundamentals & Architecture** 1.1 Introduction to Networks 1.1.1 Types of networks (LAN, WAN, MAN, PAN) 1.1.2 Need, uses, and advantages of networking 1.2 Networking Topologies 1.2.1 Bus, Star, Ring, Mesh, Hybrid 1.2.2 Advantages and disadvantages of each 1.3 Network Models 1.3.1 Client-Server, Peer-to-Peer, Hybrid networks 1.4 Data Communication Basics 1.4.1 Signals, Bandwidth, Frequency

	1.4.2 Transmission modes: Simplex, Half-duplex, Full-duplex 1.4.3 Multiplexing techniques (FDM, TDM, WDM) 1.5 Basic Networking Commands (In Linux) 1.5.1 ping, traceroute/tracert, netstat, ipconfig/ifconfig, nslookup 1.5.2 Case Study: Troubleshooting network connectivity issues **Unit 2: OSI Model & Network Infrastructure** 2.1 OSI Model & Functions of Each Layer 2.2 Physical and Data Link Layer 2.2.1 MAC & LLC sublayers 2.2.2 CSMA/CD, CSMA/CA 2.2.3 IEEE 802 Standards 2.2.4 Transmission media (wired & wireless) 2.2.5 Devices: NIC, Repeaters, Hubs, Bridges 2.3 Network and Transport Layer 2.3.1 Logical addressing, IPv4 vs IPv6 2.3.2 Switching techniques (Circuit, Packet, Message switching) 2.3.2 Routing Basics (Static vs Dynamic) 2.3.3 Layer 2 & Layer 3 switches, Routers 2.4 Application & Upper Layers 2.4.1 Session Layer: Session management, Remote procedure calls 2.4.2 Presentation Layer: Encryption & Compression techniques 2.4.3 Application Layer: FTP, NFS, Proxy, Gateway 2.5 Case Study & Commands (In Linux) 2.5.1 arp, route, ip route, netsh 2.5.2 Case Study: Packet Capture Analysis using Wireshark **Unit 3: TCP/IP & Network Security** 3.1 TCP/IP Protocol Suite 3.1.1 Comparison of OSI and TCP/IP models 3.2 IP Addressing & Routing 3.2.1 IPv4/IPv6, Subnetting, Supernetting 3.2.2 CIDR & VLSM 3.2.3 Routing types (Static, Dynamic – RIP, OSPF, BGP) 3.3 Data Transmission Methods 3.3.1 Unicast, Broadcast, Multicast, Anycast 3.4 Protocols & Network Communication 3.4.1 ICMP, ARP, RARP 3.4.2 Ports & Sockets 3.4.3 TCP vs UDP (Features, Flow control, Congestion control) 3.5 Security & Network Attacks 3.5.1 Common threats: Man-in-the-Middle (MITM), DoS, DDoS 3.5.2 Firewalls & Packet Filtering 3.5.2 IDS & IPS Overview **Unit 4: Internet Technologies & Advanced Topics** 4.1 DNS & Name Resolution 4.1.1 DNS namespace, Resource records, Query resolution, Name servers 4.2 Web Technologies 4.2.1 HTTP/HTTPS Protocols, Web Services, API Calls 4.3 Email Technologies & Protocols 4.3.1 SMTP, POP3, IMAP 4.4 Modern Networking Concepts

	4.4.1 Cloud Networking & Edge Computing 4.4.2 SDN (Software-Defined Networking) 4.4.3 IoT Networking
Reference Books	1. Computer Networks, Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, ISBN: 9780132126953 2. Data Communications and Networking, Behrouz A. Forouzan, McGraw-Hill Education, ISBN: 9780073376226 3. Computer Networking: A Top-Down Approach, James F. Kurose and Keith W. Ross, Pearson Education, ISBN: 9780133594140 4. Data and Computer Communications, William Stallings, Pearson Education, ISBN: 9780133506488 5. Computer Networks and Internets, Douglas E. Comer, Pearson Education, ISBN: 9780136060129 6. Internetworking with TCP/IP (Volume 1), Douglas E. Comer, Pearson Education, ISBN: 9780136085306 7. TCP/IP Illustrated, Volume 1: The Protocols, W. Richard Stevens, Addison-Wesley, ISBN: 9780201633467 8. Network Security Essentials: Applications and Standards, William Stallings, Pearson Education, ISBN: 9780134527338 9. Networking Essentials, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson Education, ISBN: 9780134527338 10. Computer Networking and the Internet, Fred Halsall, Addison-Wesley, ISBN: 9780201398274
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage External Assessment : - Theory exam - 50% weightage

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
SYLLABUS
DS-503: Fundamentals of Machine Learning

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**Minor**
Course Subtype	**Employability**
Subject Type	**Discipline Specific**
Course Code	**DS-503**
Course Level	**400-499**
Course Title	**Fundamentals of Machine Learning**
Credit	**4 Credit**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Explain the fundamental concepts of unsupervised learning and identify its applications in data science and real-world data analysis. **CO2:** Apply clustering techniques such as K-Means, Hierarchical Clustering, and DBSCAN to discover patterns and group similar data in large datasets. **CO3:** Analyze high-dimensional datasets using dimensionality reduction techniques such as Principal Component Analysis (PCA) for improved data visualization and model efficiency. **CO4:** Describe and interpret the working principles of Artificial Neural Networks (ANN) including neurons, layers, activation functions, and learning processes. **CO5:** Implement basic unsupervised learning models and simple neural network structures using Python and Scikit-learn libraries for data analysis tasks.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

Course Content	**UNIT 1: Introduction to Unsupervised Learning** 1.1 Fundamentals of Unsupervised Learning 1.1.1 Definition and characteristics of unsupervised learning 1.1.2 Difference between supervised and unsupervised learning 1.1.3 Applications of unsupervised learning (customer segmentation, anomaly detection, recommendation systems) 1.2 Types of Unsupervised Learning Techniques 1.2.1 Clustering techniques 1.2.2 Association rule learning 1.2.3 Dimensionality reduction (basic idea)

	1.3 Clustering Concepts and Terminology 1.3.1 Similarity and distance measures 1.3.2 Euclidean distance and Manhattan distance 1.3.3 Cluster formation and cluster evaluation concepts 1.4 Tools and Environment for Unsupervised Learning 1.4.1 Overview of Python libraries used in unsupervised learning 1.4.2 Introduction to clustering modules in Scikit-learn 1.4.3 Loading datasets and preparing data for clustering **UNIT 2: Clustering Algorithms** 2.1 K-Means Clustering 2.1.1 Concept and working of K-Means algorithm 2.1.2 Selecting number of clusters (K value) 2.1.3 Advantages and limitations of K-Means 2.2 Implementation of K-Means 2.2.1 Using K-Means module in Scikit-learn 2.2.2 Training clustering models 2.2.3 Visualizing clusters using matplotlib 2.3 Hierarchical Clustering 2.3.1 Concept of hierarchical clustering 2.3.2 Agglomerative and divisive clustering approaches 2.3.3 Dendrogram representation and interpretation 2.4 Density Based Clustering 2.4.1 Concept of density-based clustering 2.4.2 DBSCAN algorithm (basic idea) 2.4.3 Identifying noise and outliers in datasets **UNIT 3: Dimensionality Reduction Techniques** 3.1 Need for Dimensionality Reduction 3.1.1 Problems caused by high-dimensional data 3.1.2 Curse of dimensionality (basic idea) 3.1.3 Benefits of dimensionality reduction in ML models 3.2 Principal Component Analysis (PCA) 3.2.1 Concept of principal components 3.2.2 Variance and dimensionality reduction process 3.2.3 PCA implementation using Scikit-learn 3.3 Feature Selection Techniques 3.3.1 Importance of selecting relevant features 3.3.2 Basic feature selection methods 3.3.3 Impact of feature selection on model performance 3.4 Visualization of High Dimensional Data 3.4.1 Visualizing reduced datasets 3.4.2 Scatter plots for cluster visualization 3.4.3 Interpreting clustering and dimensionality reduction results **UNIT 4: Introduction to Artificial Neural Networks** 4.1 Fundamentals of Neural Networks 4.1.1 Biological inspiration of neural networks 4.1.2 Artificial neuron model 4.1.3 Input layer, hidden layer, and output layer 4.2 Neural Network Architecture 4.2.1 Weights, bias, and activation functions

	4.2.2 Common activation functions (Sigmoid, ReLU, Tanh) 4.2.3 Feedforward neural networks 4.3 Training of Neural Networks 4.3.1 Concept of loss function 4.3.2 Gradient descent optimization (basic idea) 4.3.3 Backpropagation (conceptual overview) 4.4 Implementation Basics 4.4.1 Introduction to neural network libraries in Python 4.4.2 Simple neural network model using Keras/TensorFlow (conceptual demonstration) 4.4.3 Applications of neural networks in classification and prediction tasks
Reference Books	1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, ISBN: 9781492032649. 2. Python Machine Learning, Sebastian Raschka and Vahid Mirjalili, Packt Publishing, ISBN: 9781789955750. 3. Machine Learning with Python Cookbook, Chris Albon, O'Reilly Media, ISBN: 9781491989388. 4. Introduction to Machine Learning with Python, Andreas C. Müller and Sarah Guido, O'Reilly Media, ISBN: 9781449369415. 5. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, ISBN: 9780387310732. 6. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer, ISBN: 9783319944630. 7. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, ISBN: 9780262035613. 8. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, ISBN: 9780262018029. 9. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly Media, ISBN: 9781492041139. 10. Practical Machine Learning with Python, Dipanjan Sarkar, Apress, ISBN: 9781484232066.
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignment, continuous evaluation and Internal Practicals.
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage for Practical and Theory exams External Assessment : - Theory exam - Practical exam - 50% weightage for Practical and Theory exams

[Subject code for Theory-2611001305022001]

[Subject code for Practical-2611001305022002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
SYLLABUS
DS-504: Advanced Data Visualization and Dashboard Development

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**Major**
Course Subtype	**Employability**
Subject Type	**Discipline Specific**
Course Code	**DS-504**
Course Level	**400-499**
Course Title	**Advanced Data Visualization and Dashboard Development**
Credit	**4 Credit**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Explain advanced concepts of data modeling and DAX functions in Power BI for performing analytical calculations and data transformations. **CO2:** Apply advanced data visualization techniques in Power BI to create interactive dashboards using filters, slicers, drill-down, and custom visuals. **CO3:** Analyze datasets using appropriate visualization methods to identify trends, patterns, and insights relevant to data-driven decision making. **CO4:** Design effective analytical dashboards and data stories using visualization best practices for communicating insights clearly. **CO5:** Develop interactive reports and dashboards using Power BI and Tableau tools and demonstrate the ability to publish and share them for real-world analytical applications.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

Course Content	**UNIT-1: Advanced Data Modeling and DAX in Power BI** 1.1 Advanced Data Modeling Concepts 1.1.1 Star schema and snowflake schema 1.1.2 Fact tables and dimension tables 1.1.3 Designing efficient data models for analytics 1.2 Advanced Relationships and Model Optimization 1.2.1 Managing multiple relationships between tables 1.2.2 Active vs inactive relationships 1.2.3 Resolving relationship ambiguity 1.3 Introduction to DAX (Data Analysis Expressions)

	1.3.1 What is DAX and its role in Power BI 1.3.2 Difference between calculated columns and measures 1.3.3 Basic DAX syntax and expressions 1.4 Commonly Used DAX Functions 1.4.1 Aggregation functions: SUM(), AVERAGE(), COUNT(), DISTINCTCOUNT() 1.4.2 Logical functions: IF(), SWITCH() 1.4.3 Time-based calculations (basic concepts) **UNIT-2: Advanced Data Visualization Techniques** 2.1 Principles of Data Visualization 2.1.1 Importance of visualization in Data Science 2.1.2 Choosing appropriate charts for different datasets 2.1.3 Avoiding misleading visualizations 2.2 Advanced Visualizations in Power BI 2.2.1 Creating dashboards with multiple visuals 2.2.2 Drill-down and drill-through analysis 2.2.3 Creating hierarchical visuals 2.3 Interactive Data Visualization 2.3.1 Using slicers for interactive reports 2.3.2 Applying filters and cross-filtering 2.3.3 Tooltips and dynamic highlighting 2.4 Custom Visuals and Advanced Chart Types 2.4.1 Using marketplace visuals in Power BI 2.4.2 Maps and geographical visualizations 2.4.3 KPI cards and gauge charts **UNIT-3: Dashboard Design and Storytelling with Data** 3.1 Designing Analytical Dashboards 3.1.1 Understanding dashboard components 3.1.2 Designing dashboards for business decision making 3.1.3 Layout and alignment techniques 3.2 Data Storytelling Techniques 3.2.1 Presenting insights through visual narratives 3.2.2 Highlighting trends and patterns in data 3.2.3 Communicating insights effectively 3.3 Dashboard Performance Optimization 3.3.1 Managing large datasets efficiently 3.3.2 Reducing report load time 3.3.3 Best practices for visualization performance 3.4 Case Studies in Data Visualization 3.4.1 Sales performance dashboard 3.4.2 Customer segmentation visualization 3.4.3 Trend analysis using dashboards **UNIT-4: Advanced Visualization Tools and Deployment** 4.1 Introduction to Tableau for Data Visualization 4.1.1 Overview of Tableau Desktop interface 4.1.2 Connecting datasets to Tableau 4.1.3 Comparison between Power BI and Tableau 4.2 Building Visualizations in Tableau 4.2.1 Creating charts and graphs in Tableau 4.2.2 Filters, parameters, and calculated fields

	4.2.3 Interactive dashboards in Tableau 4.3 Publishing and Sharing Reports 4.3.1 Publishing reports to Power BI Service 4.3.2 Sharing dashboards with users 4.3.3 Managing permissions and access 4.4 Applications of Data Visualization in Data Science 4.4.1 Visualizing machine learning results 4.4.2 Data-driven decision making 4.4.3 Real-world use cases of BI dashboards
Reference Books	1. Data Visualization with Microsoft Power BI: How to Design Savvy Dashboards, Alex Kolokolov and Maxim Zelensky, ISBN: 9781098152789 2. Power BI Data Analysis and Visualization, Suren Machiraju and Suraj Gaurav, ISBN: 9781547400720 3. Microsoft Power BI Complete Reference: Bring Your Data to Life with the Powerful Features of Microsoft Power BI, Devin Knight, Brian Knight, Mitchell Pearson, Manuel Quintana and Brett Powell, ISBN: 9781789955637 4. Tableau: Creating Interactive Data Visualizations, Jen Stirrup, Ashutosh Nandeshwar, Ashley Ohmann and Matt Floyd, ISBN: 9781784395296 5. Storytelling with Data: A Data Visualization Guide for Business Professionals, Cole Nussbaumer Knaflic, ISBN: 9781119002253 6. The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios, Steve Wexler, Jeffrey Shaffer and Andy Cotgreave, ISBN: 9781119282716 7. Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau Zen Master, Ryan Sleeper, ISBN: 9781491977316 8. Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software, Daniel G. Murray, ISBN: 9781118612040 9. Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, Claus O. Wilke, ISBN: 9781492031086 10. Data Visualization: A Practical Introduction, Kieran Healy, ISBN: 9780691181622
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignment, continuous evaluation and Internal Practicals.
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage for Practical and Theory exams External Assessment : - Theory exam - Practical exam - 50% weightage for Practical and Theory exams

[Subject code for Theory-2611001305033001]

[Subject code for Practical-2611001305033002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
SYLLABUS
DS-505: Big Data Handling and Management for Machine Learning Applications

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**Major**
Course Subtype	**Employability**
Subject Type	**Discipline Specific**
Course Code	**DS-505**
Course Level	**400-499**
Course Title	**Big Data Handling and Management for Machine Learning Applications**
Credit	**4 Credit**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1**: Explain the fundamental concepts of Big Data and identify the need for handling large datasets in Machine Learning and AI applications. **CO2:** Apply Python libraries such as NumPy and Pandas to load, explore, and manage large datasets using essential data processing functions. **CO3:** Demonstrate the use of PySpark to perform distributed data processing and execute basic operations on large datasets. **CO4:** Apply data preprocessing and feature engineering techniques to prepare large datasets for Machine Learning models using Scikit-learn. **CO5:** Analyze and implement basic text data processing and simple LLM-based applications using Python and pretrained APIs.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■	■	■
CO2	■	■		■	■	■		■
CO3	■	■			■		■	
CO4		■	■		■		■	
CO5	■		■	■			■	■

Course Content	**Unit – 1: Introduction to Big Data and Large Dataset Handling** 1. Big Data Fundamentals 1.1 Introduction to Big Data 1.1.1 Definition and characteristics of Big Data (Volume, Velocity, Variety) 1.1.2 Need for Big Data in Machine Learning and AI applications 1.1.3 Examples of large datasets (social media, sensor data, text datasets) 1.2 Working with Large Datasets using Python

	1.2.1 Loading large datasets using Python 1.2.2 Working with CSV, JSON, and Excel datasets 1.2.3 Memory management concepts while handling large datasets 1.3 Essential Python Libraries 1.3.1 Introduction to NumPy and Pandas for large dataset processing 1.3.2 DataFrames and Series concepts 1.3.3 Data exploration techniques 1.4 Practical Commands and Functions 1.4.1 Pandas Functions : read_csv(), read_json(), head(), tail(), info(), describe(), shape, columns 1.4.2 Data Handling functions: drop(), dropna(), fillna(), rename() **Unit – 2: Big Data Processing using PySpark** 2.1 Distributed Data Processing 2.2 Introduction to Distributed Processing 2.2.1 Limitations of traditional data processing 2.2.2 Concept of distributed data processing 2.2.3 Introduction to Apache Spark 2.3 Apache Spark Basics 2.3.1 Spark architecture overview 2.3.2 Spark DataFrames 2.3.3 Advantages of Spark for large datasets 2.4 Working with PySpark 2.4.1 Installing PySpark using pip 2.4.2 Creating Spark sessions 2.4.3 Loading large datasets 2.5 Practical Commands and Functions [Unit-2: Suggested practical : Students should practice: Installation of spark session, ,load dataset and practic Basic operations like: df.show(), df.printSchema(), df.select(), df.filter(), df.groupBy(), df.count()] **Unit – 3: Preparing Big Data for Machine Learning** 3. Data Preparation for ML 3.1 Data Cleaning 3.1.1 Handling missing values 3.1.2 Removing duplicate records 3.1.3 Data normalization and scaling 3.2 Feature Engineering 3.2.1 Selecting relevant features 3.2.2 Encoding categorical data 3.2.3 Splitting datasets for training and testing 3.3 Working with Machine Learning Libraries 3.3.1 Introduction to Scikit-learn 3.3.2 Using datasets for ML models 3.4 Practical Commands and Functions 3.4.1 Scikit-learn Functions:train_test_split(),StandardScaler(), LabelEncoder() fit(), predict() 3.4.2 Example Models 3.4.3 LinearRegression 3.4.4 DecisionTreeClassifier 3.4.5 KNeighborsClassifier **Unit – 4: Introduction to Large Language Models and Big Data Applications** 4.1 Introduction to LLM 4.1.1Concept of Large Language Models 4.1.2 Examples of LLM applications (chatbots, text summarization)

	4.1.3 Importance of large datasets for LLM training 4.2 Text Data Processing 4.2.1 Working with large text datasets 4.2.2 Tokenization and text cleaning 4.2.3 Basic Natural Language Processing concepts 4.3 Using Pretrained LLM APIs 4.3.1 Introduction to HuggingFace models 4.3.2 Using APIs for text generation 4.3.3 Ethical considerations in AI systems 4.4 Practical Implementation and important Functions 4.4.1 Installation of transformers 4.4.2 Text Processing using Python : split(), lower(), replace(), count() [Tools recommended : Python, NumPy, Pandas, PySpark, Scikit-learn, HuggingFace Transformers, Google Colab / Jupyter Notebook]
Reference Books	1. Big Data: Principles and Best Practices of Scalable Real-Time Data Systems, Nathan Marz and James Warren, ISBN: 9781617290341 2. Hadoop: The Definitive Guide, Tom White, ISBN: 9781491901632 3. Learning Spark: Lightning-Fast Data Analytics, Jules S. Damji, Brooke Wenig, Tathagata Das and Denny Lee, ISBN: 9781492050049 4. Python for Data Analysis, Wes McKinney, ISBN: 9781491957660 5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, ISBN: 9781492032649 6. Data Science from Scratch: First Principles with Python, Joel Grus, ISBN: 9781492041139 7. Machine Learning with PySpark, Tomasz Drabas and Denny Lee, ISBN: 9781784390796 8. Natural Language Processing with Transformers, Lewis Tunstall, Leandro von Werra and Thomas Wolf, ISBN: 9781098103247 9. Mastering Large Datasets with Python, John Wolohan, ISBN: 9781617295285 10. Big Data Analytics with Spark: A Practitioner's Guide to Using Spark for Large Scale Data Analysis, Mohammed Guller, ISBN: 9781484206487
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignment, continuous evaluation and Internal Practicals.
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage for Practical and Theory exams External Assessment : - Theory exam - Practical exam - 50% weightage for Practical and Theory exams

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
B.Sc.(Data Science and Analytics) (Semester-5)
DS-506: Ethics of Data Science
SYLLABUS

Program Name	**Bachelors of Science in Data Science and Analytics**
Semester	**5**
NCrF Credit Level	**5.5**
Course Type	**SEC (Skill Enhancement Course)**
Course Subtype	**Skill Development**
Subject Type	**Intra-disciplinary**
Course Code	**DS-506**
Course Level	**200-299**
Course Title	**Ethics of Data Science**
Credit	**2 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Understand the fundamental concepts of data ethics, ethical frameworks, responsible data usage, and the role of data scientists in society. **CO2:** Explain data security and privacy principles, identify types of data breaches, and understand data protection techniques and privacy regulations. **CO3:** Analyze the social impact of big data and AI technologies, including issues related to algorithmic bias, fairness, accountability, and automated decision-making. **CO4**: Evaluate real-world case studies of data misuse and ethical failures, and apply tools and methods to audit bias and fairness in machine learning models. **CO5:** Apply ethical principles and data governance practices while collecting, processing, and managing data in data science projects. **CO6:** Develop awareness of legal, social, and professional responsibilities in handling sensitive data and deploying data-driven systems.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■						
CO2	■	■				■	■	■
CO3	■	■	■	■		■	■	
CO4		■			■			
CO5					■		■	
CO6	■	■	■	■	■	■	■	■

Course Content	**Unit–1: Data Ethics Foundations** 1.1 Introduction to Ethics in Data Science 1.2 Moral Principles and Ethical Frameworks 1.3 Ethical Issues in Data Collection and Analysis 1.4 Responsible Use of Data 1.5 Bias and Fairness in Algorithms 1.6 Role of Data Scientists in Society 1.7 Case Studies of Data Misuse and Ethical Failures **Unit–2: Data Security and Privacy** 2.1 Importance of Data Security in Data Science

	2.2 Types of Data Breaches 2.3 Data Privacy Principles 2.4 Data Protection Techniques 2.5 Methods to Detect, Measure, and Mitigate Bias 2.6 Data Privacy Regulations (GDPR and Indian Data Protection Act) 2.7 Secure Handling of Sensitive Data **Unit–3: Social Impact and Accountability** 3.1 Impact of Big Data on Society 3.2 Addressing Societal Consequences of Data Technologies 3.3 Algorithmic Colonialism 3.4 Interpreting Model Outcomes 3.5 Accountability in Automated Decision-Making **Unit–4: Case Studies** 4.1 Analysis of Real-World Data Ethics Cases 4.2 Facebook Data Controversy Case Study 4.3 Ethical Failures in AI and Data Systems 4.4 Toolkit for Auditing Bias and Fairness in Machine Learning Models
Reference Books	1. Michael Kearns, Aaron Roth, The Ethical Algorithm: The Science of Socially Aware Algorithm Design, Oxford University Press, ISBN: 9780190948207. 2. Cathy O'Neil, Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy, Crown Publishing, ISBN: 9780553418811. 3. Solon Barocas, Moritz Hardt, Arvind Narayanan, Fairness and Machine Learning: Limitations and Opportunities, MIT Press, ISBN: 9780262047074. 4. Helen Nissenbaum, Privacy in Context: Technology, Policy, and the Integrity of Social Life, Stanford University Press, ISBN: 9780804772891. 5. Neil M. Richards, Woodrow Hartzog, Privacy's Blueprint: The Battle to Control the Design of New Technologies, Harvard University Press, ISBN: 9780674976009. 6. Cathy O'Neil, Rachel Schutt, Doing Data Science: Straight Talk from the Frontline, O'Reilly Media, ISBN: 9781449358655. 7. Virginia Eubanks, Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor, St. Martin's Press, ISBN: 9781250074317. 8. Ian Foster, Rayid Ghani, Ron S. Jarmin, Frauke Kreuter, Julia Lane, Big Data and Social Science: Data Science Methods and Tools for Research and Practice, Chapman and Hall/CRC, 2nd Edition, 2020. 9. Loukides, Mike, Hilary Mason, and DJ Patil. 2018. Ethics and Data Science. Sebastopol, CA: O'Reilly Media., "Doing Good Data Science"
Teaching Methodology	Interactive lectures, Case study discussions, Real-life incident analysis, Student presentations, Scenario-based learning.
Evaluation Method	Internal Assessment (50%) : - Presentation / Seminar - Class-participation, Attendance External Assessment (50%) : - Presentation on any 1 Case study selected by the student, generation of reports, preparation and presentation of documentation and seminar/viva-voce.

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)
(SEM – 6)
(w.e.f. Academic Year June, 2026-2027)

Structure of Program (Semester-6)

Course Category	Course Code	Course Title	Marksheet Title in English	Level of Course	Teaching Hours/ Week		Exam Duration		Credit	Internal Marks		External Marks		Total Marks
					TH	PR	TH	PR		TH	PR	TH	PR	
MINOR	DS-601-01	E-Commerce & Cyber Security	E-Commerce & Cyber Security	300-399	4	-	2	-	4	50	-	50	-	100
	DS-601-02	Computer Graphics	Computer Graphics											
MAJOR	DS-602	Advanced Machine Learning Models and Neural Networks	Advanced Machine Learning Models and Neural Networks	300-399	4	-	2	-	4	50	-	50	-	100
MAJOR	DS-603	Big Data and Cloud-Based Machine Learning	Big Data and Cloud-Based Machine Learning	400-499	2	4	1	2	4	25	25	25	25	100
MAJOR	DS-604	PROJECT	PROJECT	400-499	-	-	-	2	4	-	50	-	50	100
AEC	DS-605	Project and Interview Presentation Soft Skills [Ability Enhancement Course] (AEC)	Project and Interview Presentation Soft Skills [Ability Enhancement Course] (AEC)	200-299	-	2	-	2	2	-	25	-	25	50
INTERNSHIP	DS-606	INTERNSHIP	INTERNSHIP	400-499	-	-	-	-	4	-	50	-	50	100

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

(w.e.f. Academic Year June, 2026-2027)

601-01: E-Commerece and Cyber Security

PROGRAM NAME	**Bachelors of Science in Data Science and Analytics**
Semester	**VIth**
NCrFr Credit Level	**5.5**
Course Type	**MINOR**
Course Subtype	**Employability**
Subject Type	**Minor Discipline Specific**
Course Code	**601-01**
Course Level	**300-399**
Course Title	**E-Commerce and Cyber Security**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Understand the fundamental concepts and framework of e-Commerce and m-Commerce. **CO2:** Explain the network infrastructure, payment methods, and associated security issues in e-Commerce. **CO3:** Identify various types of cybercrimes and their technical aspects. **CO4:** Describe key concepts, terminologies, and threats related to cyber security. **CO5:** Differentiate between types of hackers and understand common system vulnerabilities.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			
CO3	■			■			■	
CO4			■			■		■
CO5	■			■		■	■	■

Course Content	**Unit 1: Introduction to Electronic Commerce** 1.1 Concepts of e-Commerce 1.2 Aims of e-Commerce 1.3 e-Commerce Framework 1.4 e-Commerce Consumer Applications 1.5 e-Commerce Organizational Applications 1.6 Introduction to m-Commerce **Unit 2: Network Infrastructure of e-Com , Payment and Security:** 2.1. Concepts of Information Way 2.2. Components of I-Way 2.2.1. Network Access Equipment

	2.2.2. Local on-ramps 2.2.3. Global Information Distribution Network 2.3. Transaction Models 2.4 e-Commerce Payments and Security Issues 2.4.1. e-Commerce Payment Systems 2.4.2. Debit Card Based, Credit Card Based,. Risks & EPS 2.4.3. e-Cash, e-Cheque, e-wallet 2.5. Security on Web, SSL **Unit-3: Introduction to Cyber Crimes:** 3.1 Category of Cyber Crimes 3.2 Technical Aspects of Cyber Crimes 3.2.1 Unauthorized access & Hacking 3.2.2 Trojan, Virus and Worm Attacks 3.2.3 E-Mail related Crimes: Spoofing, Spamming, Bombing 3.2.4 Denial of Service Attacks 3.2.5 Distributed Denial of Service Attack 3.3 Various crimes : 3.3.1 IPR Violations (Software piracy, Copyright Infringement, Trademarks Violations, Theft of Computer source code, Patent Violations) 3.3.2 Cyber Squatting, Cyber Smearing, Cyber Stacking 3.3.3 Financial Crimes: (Banking, credit card, Debit card related) **Unit-4: Cyber Security Fundamentals:** 4.1 Concepts of Cyber Security: 4.1.1 Types of Threats 4.1.2 Advantages of Cyber Security 4.2 Basic Terminologies: 4.2.1 IP Address, MAC Address 4.2.2 Domain name Server(DNS) 4.2.3 DHCP, Router, Bots 4.3 Common Types of Attacks: 4.3.1 Distributed Denial of Service 4.3.2 Man in the Middle, Email Attack 4.3.3 Password Attack, Malware 4.4 Hackers: 4.4.1 Various Vulnerabilities: 4.4.1.1 Injection attacks, Changes in security settings 4.4.1.2 Exposer of Sensitive Data 4.4.1.3 Breach in authentication protocol 4.4.2 Types of Hackers: White hat and Black hat [All Units carry Equal Weightage]
Reference Books	1. Frontiers of Electronic Commerce, Ravi Kalakota and Andrew Whinston, Addition Wesley 2. Electronic Commerce: A Managerial Perspective, Efraim turban, Jae Lee, David King, H. Michel Chung, Addition Wesley 3. E-Commerce: An Indian Perspective, Joseph, PHI 4. E-Mail Hacking, Ankit Fadia, Vikas Publishing House Pvt. Ltd. 5. E-Commerce Concept, Models Strategies, G.V.S. Murthy, Himalaya Publisher 6. Cyber Crime in India, Dr M Dasgupta, Centax Publications Pvt Ltd 7. Cyber Laws and Crimes, Barkha U, Rama Mohan, Universal Law Publishing Co. Pvt Ltd. 8. Cyber Crime, Bansal S.K., A.P.H. Publishing Corporation 9. Cyber Security Understanding Cyber Crime, Computer Forensic and Legal Perspectives, Nina Godbole, Sunit Belapur, Willey India Publication

Teaching Methodology	Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment. - Unit Tests, continuous assessment 50% External assessment. - Written Theory exam

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

(w.e.f. Academic Year June, 2026-2027)

601-02: Computer Graphics

PROGRAM NAME	**Bachelors of Science in Data Science and Analytics**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**MINOR**
Course Subtype	**Employability**
Subject Type	**Minor Discipline Specific**
Course Code	**601-02**
Course Level	**300-399**
Course Title	**Computer Graphics**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:**Remembering**:** Recall the application areas, file formats, and graphic standards used in computer graphics systems. **CO2:**Understanding**:** Describe the architecture and functioning of various display devices, scan methods, and graphic object types. **CO3:**Applying: Implement standard line drawing algorithms such as DDA and Bresenham for rendering basic graphic primitives. **CO4:**Analyzing: Analyze the behavior and effects of geometric transformations like scaling, rotation, translation, reflection, and shearing on 2D objects. **CO5:**Creating:Construct and manipulate graphical objects by integrating transformations and rendering techniques for simple graphic applications.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			
CO3	■			■			■	
CO4			■			■		■
CO5	■			■		■	■	■

Course Content	**Unit 1. Introduction** 1.1 Application areas of Graphics Systems 1.1.1. Presentation Graphics 1.1.2. Entertainment 1.1.3. Education and Training 1.1.4. Image Processing 1.2 Computer Graphics Files 1.3 Introduction to graphic standards **Unit 2. Graphics Systems** 2.1. Video Display Devices

	2.1.1. Refresh CRT 2.1.2. Color CRT 2.1.3. LCD 2.1.4. Direct View Storage Tube 2.2. Raster scan and Random Scan Display 2.3. Raster Graphics and Vector Graphics 2.4. Concepts of various objects: Point, Line, Circle, Ellipse and Polygons **Unit 3. Line generation** 3.1. Geometry of line 3.2. Frame Buffer 3.3. Line Drawing Algorithms 3.3.1. DDA Algorithm 3.3.2. VECGEN 3.3.3. Bresnahan 3.4. Line Styles 3.4.1. Thick line 3.4.2. Line caps and joint **Unit 4. Geometric Transformations** 4.1 Basic Transformations 4.1.1 Scaling 4.1.2 Translation 4.1.3 Rotation 4.1.3.1 Rotation about origin 4.1.3.2 Rotation about Homogeneous Coordinates 4.2 Other transformations 4.2.1 Reflection 4.2.2 Shearing
Reference Books	1. Computer Graphics - second edition, Donald Hearn & M. Pauline Baker – Tata McGraw Hill Pub. 2. Computer Graphics, Harrington S. -Tata McGraw Hill. 3. Computer Graphics, Desai A. A. –PHI. 4. Computer Graphics: Algorithms & Implementations, Mukherjee & Jana – PHI. 5. Interactive Computer Graphics, Giloi W. K. –Prentice Hall India. 6. Principles of Interactive Computer Graphics, New Man W. & Sproul P. F.McGraw 7. Procedural Elements for Computer Graphics, Rogers D. F. – McGraw Hill. 8. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson Education, 9780136053583 9. Computer Graphics: Principles and Practice, John F. Hughes, Andries van Dam, Morgan McGuire, David Sklar, Addison-Wesley, 9780321399526 10. Interactive Computer Graphics, Edward Angel, Dave Shreiner, Pearson Education, 9780132545235 11. Fundamentals of Computer Graphics, Peter Shirley, Steve Marschner, A K Peters / CRC Press, 9781482229394
Teaching Methodology	Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment. - Unit Tests, Continuous assessment 50% External assessment. - Written Theory exam

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

(w.e.f. Academic Year June, 2026-2027)

602: Advanced Machine Learning Models and Neural Networks

PROGRAM NAME	**Bachelors of Science in Data Science and Analytics**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**MAJOR**
Course Subtype	**Employability**
Subject Type	**Major Discipline Specific**
Course Code	**602**
Course Level	**400-499**
Course Title	**Advanced Machine Learning Models and Neural Networks**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Explain the concepts of advanced machine learning models, kernel methods and ensemble techniques used in data science applications. *(Understand)* **CO2:** Apply machine learning libraries such as NumPy, Pandas and Scikit-learn to implement and evaluate machine learning models on real datasets. *(Apply)* **CO3:** Analyze the structure and working of Artificial Neural Networks and deep learning architectures for solving classification and prediction problems. *(Analyze)* **CO4:** Develop and train neural network and deep learning models using frameworks such as TensorFlow or Keras. *(Apply/Create)* **CO5:** Design and implement Convolutional Neural Network (CNN) models for practical data science tasks such as image classification and pattern recognition. *(Create)*
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								
CO5								

Course Content	**UNIT 1: Advanced Machine Learning Models** 1.1 Overview of Advanced Machine Learning 1.1.1 Review of supervised and unsupervised learning concepts 1.1.2 Need for advanced machine learning models in Data Science 1.1.3 Applications of ML models in real-world data science problems 1.2 Support Vector Machines (SVM) 1.2.1 Concept of hyperplane and margin 1.2.2 Kernel trick and types of kernels (Linear, Polynomial, RBF) 1.2.3 Advantages and limitations of SVM

	1.3 Ensemble Learning Methods 1.3.1 Concept of ensemble learning 1.3.2 Bagging and Random Forest 1.3.3 Boosting concepts and Gradient Boosting (basic idea) 1.4 Practical Implementation using Python 1.4.1 Important libraries: NumPy, Pandas, Scikit-learn 1.4.2 Implementing SVM using sklearn.svm 1.4.3 Implementing Random Forest using sklearn.ensemble 1.4.4 Model evaluation using accuracy, confusion matrix, and cross-validation **UNIT 2: Advanced Artificial Neural Networks** 2.1 Review of Neural Network Fundamentals 2.1.1 Structure of artificial neurons 2.1.2 Layers in neural networks (input, hidden, output) 2.1.3 Role of activation functions in neural networks 2.2 Deep Neural Networks 2.2.1 Concept of deep learning and deep neural networks 2.2.2 Multiple hidden layers and representation learning 2.2.3 Applications of deep neural networks 2.3 Training Deep Neural Networks 2.3.1 Gradient descent and optimization techniques 2.3.2 Loss functions for classification and regression 2.3.3 Regularization techniques: dropout and early stopping 2.4 Implementation using Python Libraries 2.4.1 Introduction to TensorFlow and Keras frameworks 2.4.2 Building simple neural network models using Keras 2.4.3 Model compilation, training, and evaluation **UNIT 3: Deep Learning Techniques** 3.1 Introduction to Deep Learning Frameworks 3.1.1 Overview of TensorFlow, Keras, and PyTorch 3.1.2 Setting up deep learning environment in Python 3.1.3 Working with datasets for deep learning models 3.2 Neural Network Design and Implementation 3.2.1 Creating sequential models in Keras 3.2.2 Adding dense layers and activation functions 3.2.3 Compiling and training models 3.3 Model Evaluation and Optimization 3.3.1 Evaluating deep learning models using validation datasets 3.3.2 Accuracy, loss curves, and model performance analysis 3.3.3 Hyperparameter tuning concepts 3.4 Practical Applications in Data Science 3.4.1 Predictive analytics using deep learning models 3.4.2 Classification problems using neural networks 3.4.3 Regression tasks using deep learning models **UNIT 4: Convolutional Neural Networks (CNN) and Applications** 4.1 Introduction to Convolutional Neural Networks 4.1.1 Motivation for CNN in deep learning 4.1.2 Difference between ANN and CNN 4.1.3 Applications of CNN in image and pattern recognition 4.2 CNN Architecture 4.2.1 Convolution layers and filters 4.2.2 Pooling layers and feature extraction

	4.2.3 Fully connected layers and output layer 4.3 Training CNN Models 4.3.1 Preparing image datasets for CNN models 4.3.2 Data augmentation techniques 4.3.3 Model training and validation 4.4 Practical Implementation using Python 4.4.1 Implementing CNN using TensorFlow/Keras 4.4.2 Image classification using CNN models 4.4.3 Evaluating CNN performance and interpreting results
Reference Books	1. Machine Learning, Tom M. Mitchell, McGraw-Hill Education, ISBN: 978-0070428072 2. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, ISBN: 978-0387310732 3. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow, Aurélien Géron, O'Reilly Media, ISBN: 978-1492032649 4. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, ISBN: 978-0262035613 5. Python Machine Learning, Sebastian Raschka and Vahid Mirjalili, Packt Publishing, ISBN: 978-1789955750 6. Deep Learning with Python, François Chollet, Manning Publications, ISBN: 978-1617296864 7. Introduction to Machine Learning with Python, Andreas C. Müller and Sarah Guido, O'Reilly Media, ISBN: 978-1449369415 8. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Pearson Education, ISBN: 978-0134610993 9. The Hundred-Page Machine Learning Book, Andriy Burkov, Andriy Burkov Self-Published, ISBN: 978-1999579500 10. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, ISBN: 978-0262018029
Teaching Methodology	Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage for Practical and Theory exams External Assessment : - Theory exam - Practical exam - 50% weightage for Practical and Theory exams

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

(w.e.f. Academic Year June, 2026-2027)

603: Big Data and Cloud-Based Machine Learning

PROGRAM NAME	**Bachelors of Science in Data Science and Analytics**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**MAJOR**
Course Subtype	**Employability**
Subject Type	**Major Discipline Specific**
Course Code	**603**
Course Level	**400-499**
Course Title	**Big Data and Cloud-Based Machine Learning**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:** Explain the concepts of cloud computing and cloud storage used for handling and managing large datasets in data science applications. (Understand) **CO2:** Apply cloud-based environments such as Google Colab to access and process large datasets stored on cloud platforms. (Apply) **CO3:** Implement techniques for saving, loading and deploying machine learning models using tools such as Pickle and Joblib. (Apply) **CO4:** Integrate deployed machine learning models with large datasets stored on cloud platforms to perform prediction and analysis tasks. (Analyze / Apply) **CO5:** Develop simple API-based applications to access machine learning models and generate predictions for real-world data science problems. (Create)
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			
CO3	■			■			■	
CO4			■			■		■
CO5	■			■		■	■	■

Course Content	**Unit – 1: Cloud Platforms and Big Data Storage** 1. Cloud Computing for Data Science 1.1 Introduction to Cloud Computing 1.1.1 Concept of cloud computing 1.1.2 Advantages of cloud for Big Data and Machine Learning 1.1.3 Examples of cloud platforms (AWS, Google Cloud, Microsoft Azure) 1.2 Cloud Storage for Large Datasets 1.2.1 Concept of cloud storage and distributed storage 1.2.2 Storing large datasets on cloud platforms 1.2.3 Data access from cloud environments

	1.3 Working with Cloud-based Notebooks 1.3.1 Introduction to Google Colab and cloud notebooks 1.3.2 Mounting and accessing cloud storage 1.3.3 Managing datasets stored on cloud platforms 1.4 Practical Commands and Functions 1.4.1 Mounting Google Drive: drive.mount() 1.4.2 File access commands: os.listdir(), open() 1.4.3 Loading datasets from cloud using Pandas: read_csv(), read_json() **Unit – 2: Deploying Machine Learning Models** 2. Model Deployment Concepts 2.1 Introduction to Model Deployment 2.1.1 Need for deployment in real-world applications 2.1.2 Difference between training and deployment 2.1.3 Overview of ML deployment workflow 2.2 Model Serialization Techniques 2.2.1 Concept of model saving and loading 2.2.2 Model serialization using Pickle 2.2.3 Model serialization using Joblib 2.3 Deploying Models using Python 2.3.1 Saving trained machine learning models 2.3.2 Loading models for prediction tasks 2.3.3 Using deployed models with new datasets 2.4 Practical Commands and Functions 2.4.1 Pickle Functions: pickle.dump(), pickle.load() 2.4.2 Joblib Functions: joblib.dump(), joblib.load() 2.4.3 Scikit-learn prediction: predict(), predict_proba() **Unit – 3: Integrating ML Models with Cloud Data** 3. Working with Cloud-based Datasets 3.1 Accessing Large Datasets from Cloud 3.1.1 Loading datasets from Google Drive or cloud storage 3.1.2 Working with datasets stored in remote locations 3.1.3 Managing large datasets in cloud environments 3.2 Data Processing for Prediction 3.2.1 Data preprocessing for deployed models 3.2.2 Feature transformation and scaling 3.2.3 Preparing new data for predictions 3.3 Using Deployed Models with Cloud Data 3.3.1 Fetching stored models 3.3.2 Running predictions on large datasets 3.3.3 Storing prediction results 3.4 Practical Commands and Functions 3.4.1 Pandas functions: read_csv(), to_csv(), apply() 3.4.2 Feature scaling: StandardScaler().transform() 3.4.3 Prediction functions: predict() **Unit – 4: Model Access through APIs and Cloud Applications** 4. ML Model Access and Applications 4.1 Introduction to APIs for Machine Learning 4.1.1 Concept of APIs in ML systems 4.1.2 Role of APIs in accessing ML models 4.1.3 Examples of ML services using APIs

	4.2 Creating Simple ML APIs 4.2.1 Introduction to API frameworks 4.2.2 Using Flask for simple ML APIs 4.2.3 Handling requests and responses 4.3 Integrating APIs with Cloud Data 4.3.1 Sending data to ML models through APIs 4.3.2 Receiving prediction outputs 4.3.3 Applications of deployed ML services 4.4 Practical Commands and Functions 4.4.1 Flask functions: Flask(), route(), request, jsonify() 4.4.2 Sending requests using Python: requests.get(), requests.post() 4.4.3 Running applications: app.run() [Suggested Tools: Python, Pandas, Scikit-learn, Pickle, Joblib, Flask, Google Colab, Cloud Storage (Google Drive / AWS S3 / Azure Blob)].
Reference Books	1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, ISBN: 978-1492032649 2. Machine Learning with PySpark, Tomasz Drabas and Denny Lee, O'Reilly Media, ISBN: 978-1491972953 3. Learning Spark: Lightning-Fast Big Data Analysis, Holden Karau, Andy Konwinski, Patrick Wendell and Matei Zaharia, O'Reilly Media, ISBN: 978-1449358624 4. Deep Learning with Python, François Chollet, Manning Publications, ISBN: 978-1617296864 5. Python for Data Analysis, Wes McKinney, O'Reilly Media, ISBN: 978-1491957660 6. Practical MLOps: Operationalizing Machine Learning Models, Noah Gift and Alfredo Deza, O'Reilly Media, ISBN: 978-1098103019 7. Designing Data-Intensive Applications, Martin Kleppmann, O'Reilly Media, ISBN: 978-1449373320 8. Cloud Computing: Concepts, Technology and Architecture, Thomas Erl, Ricardo Puttini and Zaigham Mahmood, Pearson Education, ISBN: 978-0133387520 9. Building Machine Learning Powered Applications, Emmanuel Ameisen, O'Reilly Media, ISBN: 978-1492045113 10. Data Science on the Google Cloud Platform, Valliappa Lakshmanan, O'Reilly Media, ISBN: 978-1491974568
Teaching Methodology	Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments
Evaluation Method	Internal Assessment : - Continuous evaluation, Assignment, Attendance - 50% weightage for Practical and Theory exams External Assessment : - Theory exam - Practical exam - 50% weightage for Practical and Theory exams

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

(w.e.f. Academic Year June, 2026-2027)

604: PROJECT

COURSE NANME	**PROJECT**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**MAJOR**
Course Subtype	**Employability And Skill oriented**
Subject Type	**Major Discipline Specific**
Course Code	**604**
Course Level	**400-499**
Course Title	**Project**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1**:Analyze: Students will be able to analyze project requirements, identify suitable tools, and prepare an implementation strategy. **CO2**:Create: Students will develop full-fledged applications using relevant web, mobile, or hybrid technologies. **CO3**:Apply: Students will gain experience in applying the Software Development Life Cycle (SDLC) to real-world problems. **CO4**:Create: Students will prepare and submit a comprehensive project report that meets academic and professional standards. **CO5**:Evaluate: Students will present their project solutions confidently and clearly to technical and non-technical audiences.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			
CO3	■			■			■	
CO4			■			■		■
CO5	■			■		■	■	■

Course Content	**Final Semester Project, aligned with the subjects they studied such as:** • **Python Programming** • **Data Analysis (NumPy, Pandas)** • **Data Visualization (Power BI / Tableau)** • **Machine Learning** • **Big Data Handling (PySpark)** • **Cloud-based ML and Big Data Applications** • **LLM basics and NLP** **STEP – 1: Project Planning and Problem Definition** 1.1 Understanding Problem Statement 1.1.1 Identification of real-world data science problem

	1.1.2 Defining objectives of the project 1.1.3 Identifying type of problem (Prediction, Classification, Clustering, Recommendation, NLP, etc.) 1.2 Feasibility Study and Requirement Analysis 1.2.1 Technical feasibility (tools, libraries, computing resources) 1.2.2 Availability of datasets (public datasets, cloud datasets, APIs) 1.2.3 Identifying input data and expected outputs 1.3 Technology Stack Selection 1.3.1 Programming tools: Python, Jupyter Notebook, Google Colab 1.3.2 Data science libraries: NumPy, Pandas, Matplotlib, Seaborn, Scikit-learn 1.3.3 Big data tools: PySpark 1.3.4 Visualization tools: Power BI / Tableau 1.3.5 Cloud tools: Google Colab / Google Drive / Cloud storage 1.4 Project Scheduling and Team Role Allocation 1.4.1 Preparing project timeline and milestones 1.4.2 Assigning roles in team (data collection, preprocessing, modelling, visualization, documentation) 1.4.3 Weekly progress monitoring and reporting **STEP – 2: Data Science Project Design** 2.1 System Design and Architecture 2.1.1 Overview of the data science workflow 2.1.2 Designing architecture for data collection, processing and modelling 2.1.3 Data pipeline planning 2.2 Dataset Design and Data Understanding 2.2.1 Identifying data sources (CSV, JSON, APIs, cloud datasets) 2.2.2 Understanding dataset structure and attributes 2.2.3 Exploratory Data Analysis (EDA) 2.3 Data Visualization and Interface Design 2.3.1 Planning dashboards and visual reports 2.3.2 Designing charts, graphs and visual insights 2.3.3 Dashboard layout planning using Power BI / Tableau 2.4 Data Flow and Model Architecture 2.4.1 Data Flow Diagram (DFD) for data processing 2.4.2 Model architecture diagram 2.4.3 System workflow representation **STEP – 3: Project Development and Implementation** 3.1 Data Collection and Preprocessing 3.1.1 Data loading using Pandas / PySpark 3.1.2 Data cleaning and missing value handling 3.1.3 Feature engineering and data transformation 3.2 Machine Learning Model Development 3.2.1 Selecting suitable ML algorithms 3.2.2 Training machine learning models 3.2.3 Model evaluation and performance analysis 3.3 Big Data and Cloud Integration 3.3.1 Handling large datasets using PySpark 3.3.2 Using cloud storage for datasets 3.3.3 Deploying trained models and fetching predictions 3.4 Testing and Validation 3.4.1 Testing model accuracy and reliability

<table>
<tr><td></td><td>
3.4.2 Validation using test datasets
3.4.3 Result analysis and performance improvement

STEP – 4: Documentation, Deployment and Presentation
4.1 Project Documentation Preparation
4.1.1 Software Requirement Specification (SRS)
4.1.2 Design and implementation documentation
4.1.3 User manual and installation guide
4.2 Deployment of Data Science Project
4.2.1 Deployment on cloud platforms (Google Colab / cloud hosting)
4.2.2 Creating dashboards or web interfaces
4.2.3 Demonstration of prediction system
4.3 Project Report Writing
4.3.1 Writing final project report in standard academic format
4.3.2 Including methodology, datasets, models and results
4.3.3 Preparing result analysis and conclusion
4.4 Project Presentation and Demonstration
4.4.1 Preparing presentation slides
4.4.2 Demonstration of project working
4.4.3 Final viva-voce evaluation

[Project Guidelines:
• Students will submit E-Document of the Project Report.
• One internal guide will be allocated for every ten groups.
• All groups must meet their internal guide once a week to report project progress.
• Project should involve data analysis, machine learning or big data applications using the tools studied in the program.]
</td></tr>
<tr><td>Project Evaluation Scheme</td><td>
<table>
<tr><th>Component</th><th>Marks</th></tr>
<tr><td>Problem Definition and Planning</td><td>10%</td></tr>
<tr><td>Design and Architecture</td><td>15%</td></tr>
<tr><td>Implementation and Functionality</td><td>30%</td></tr>
<tr><td>Testing and Deployment</td><td>15%</td></tr>
<tr><td>Documentation</td><td>10%</td></tr>
<tr><td>Final Presentation & Viva</td><td>20%</td></tr>
<tr><td>Total</td><td>100%</td></tr>
</table>
</td></tr>
<tr><td>Teaching Methodology</td><td>Discussion, Experimental work, Project work, Self-Study, Seminars and/or Assignments.</td></tr>
<tr><td>Evaluation Method</td><td>
50% Internal assessment.
- Attendance and reporting to internal guides
- Internal project presentation and demonstration, project documentation.
50% External assessment.
- Project presentation and demonstration, viva-voce and e-project report.
</td></tr>
</table>

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

605: Project and Interview Presentation Soft Skills (A.E.C.)

(w.e.f. Academic Year June, 2026-2027)

COURSE NANME	**Project and Interview Presentation Soft Skills**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**AEC (Ability Enhancement Course)**
Course Subtype	**Soft Skills**
Subject Type	**Intra Disciplinary**
Course Code	**605**
Course Level	**200-299**
Course Title	**Project and Interview Presentation Soft Skills**
Credit	**2 Credits**
Effective From	**Academic Year : 2026-2027**
Course Outcomes	**CO1:**(Understand)**:** Explain the essential components of professional project documentation and communication in the software and IT industry. **CO2:**(Apply)**:** Demonstrate the ability to present project concepts clearly using structured presentation techniques and visual aids relevant to IT solutions. **CO3:**(Analyze)**:** Evaluate the technical and soft skill requirements of various IT job roles and align personal project work and presentation accordingly. **CO4:**(Create)**:** Develop a mini-project or prototype by integrating appropriate software tools and technologies and document it as per standard industry practices. **CO5:**(Evaluate)**:** Justify design choices, tool selection, and development approach during interviews or viva presentations using logical reasoning and industry-specific language.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■		■	■		■		
CO2	■	■			■			
CO3	■			■			■	
CO4			■			■		■
CO5	■			■		■	■	■

Course Content	**Unit 1: Communication and Presentation Skills in the IT Industry** 1.1 Fundamentals of Communication 1.1.1 Verbal and Non-verbal Communication 1.1.2 Barriers in Communication in Technical Teams 1.1.3 Listening and Clarity in Technical Discussions 1.2 Presentation Skills for IT Professionals 1.2.1 Creating Technical Presentations 1.2.2 Using Tools like PowerPoint, Canva, Prezi 1.2.3 Speaking with Confidence in Team and Client Meetings 1.3 Email and Technical Writing Etiquette

	1.3.1 Writing Clear Technical Emails 1.3.2 Preparing Professional Reports and Documentation **Unit 2: Project Documentation and Reporting** 2.1 Understanding Software Development Life Cycle (SDLC) 2.1.1 Role of Documentation at Each Phase 2.1.2 Agile Documentation vs Traditional Models 2.2 Technical Project Documentation 2.2.1 Problem Statement and Requirements 2.2.2 Design Diagrams: UML, ER Diagrams 2.2.3 Testing and Deployment Documentation 2.3 Final Report Writing and Formatting 2.3.1 Structuring a Complete Project Report 2.3.2 IEEE/ACM Style Guidelines and Referencing 2.3.3 Common Errors to Avoid in Technical Reports **Unit 3: Interview Readiness and Soft Skills for Developers** 3.1 Resume and LinkedIn Profile Building 3.1.2 Components of a Tech Resume 3.1.3 Tailoring Resumes for Software Roles 3.2 Interviewing Skills for IT Roles 3.2.1 Understanding the Interview Process in Software Companies 3.2.2 Technical Round vs HR Round Expectations 3.2.3 STAR Method for Behavioural Interview Questions 3.3 Mock Interview Sessions 3.3.1 Self-Introduction Practice 3.3.2 Group Feedback and Interview Etiquette **Unit 4: Final Project Presentation and Seminar** 4.1 Project Showcase Guidelines 4.1.1 Preparing for Project Presentation 4.1.2 Demonstrating Code, UI, and Deployment 4.2 Seminar and Peer Review 4.2.1 Presentation to Class and Faculty Panel 4.2.2 Peer Evaluation Criteria 4.3 Soft Skill Reflection and Final Assessment 4.3.1 Student Reflections on Soft Skills Gained 4.3.2 Final Grading and Suggestions for Improvement [One topic will be allocated to every students. The student will prepare a seminar and presentation along with a documentation.]
Reference Books	1. Technical Communication: Principles and Practice, Meenakshi Raman & Sangeeta Sharma, Oxford University Press India, ISBN: 9780195695747 2. Soft Skills: Know Yourself and Know the World, Dr. Alex K., S. Chand Publishing, ISBN: 9789352534357 3. Communication Skills for Engineers, Sunita Mishra & C. Muralikrishna, Pearson Education India, ISBN: 9788131733844 4. Business Communication, P.D. Chaturvedi & Mukesh Chaturvedi, Pearson Education India, ISBN: 9788131733585 5. Developing Soft Skills, Gajendra Singh Chauhan, Wiley India, ISBN: 9788126577500 6. The Quick and Easy Way to Effective Speaking, Dale Carnegie, Simon & Schuster, ISBN: 9780743528322

	7. Cracking the Coding Interview, Gayle Laakmann McDowell, CareerCup, ISBN: 9780984782857 8. Presentation Skills for Technical Professionals, Naomi Karten, Dorset House Publishing, ISBN: 9780932633585 9. Interviewing: Principles and Practices, Charles Stewart & William Cash Jr., McGraw-Hill Education, ISBN: 9780078036804 10. The Art of Public Speaking, Stephen E. Lucas, McGraw-Hill Education, ISBN: 9780073523910
Teaching Methodology	Class Work, Discussion, Presentation, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit Tests (Seminar). - Internal presentations, documentation, viva-voce and Seminar 50% External assessment. - Presentation, documentation and Viva-voce.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

T.Y.B.Sc.(DATA SCIENCE AND ANALYTICS)

(SEM – 6)

606: INTERNSHIP

(w.e.f. Academic Year June, 2026-2027)

COURSE NANME	**INTERNSHIP**
Semester	**VIth**
NCrF Credit Level	**5.5**
Course Type	**Skill Enhancement and Employment Oriented**
Course Subtype	**Technical and Soft Skills**
Subject Type	**Subject Specific**
Course Code	**606**
Course Level	**400-499**
Course Title	**INTERNSHIP**
Credit	**4 Credits**
Effective From	**Academic Year : 2026-2027**
Minimum Hours/Semester	120 hours of internship work (Including Direct interaction, interactive sessions, applied/training work, Task works, Evaluation, Preparation etc.)
Purpose of Course	NEP-2020 emphasizes on Vocationalization of Education. A key aspect of the new UG programme is its utility into a real life situation. All students are expected to do Internships/Apprenticeships/OJT in a firm, industry, or organization. Students will be provided the opportunities for do Internships/Apprenticeships/OJT with local industry, business organizations, health, and allied areas, local governments (such as panchayats, and municipalities), local Police Stations, Parliament or elected representatives, media organizations, artists, crafts persons, and a wide range of organizations so that students may engage with the practical side of their learning, which will improve their employability.
Course Objective	1) To provide students with practical exposure to industry standards and practices. 2) To foster the application of academic knowledge in real-life work scenarios. 3) To enhance students' interpersonal, communication, and problem-solving skills. 4) To help students identify their strengths and areas of interest in professional domains. 5) To inculcate a sense of responsibility, discipline, and work ethics.
Course Outcomes	**CO1 (Apply):** Apply programming, development, or analytical skills gained in the classroom to solve real-world computing problems during the internship. **CO2 (Analyze):** Analyze the architecture, workflow, and practices of the host organization to understand the integration of computer systems in business or technical environments. **CO3 (Evaluate):** Evaluate project requirements, software tools, and technologies used during the internship to recommend improvements or alternative approaches.

<table>
<tr><td></td><td>CO4 (Create): Create a structured technical report and project documentation summarizing the tasks, challenges, and outcomes of the internship.
CO5 (Present): Present the project findings and experience effectively using professional communication and presentation skills tailored to the IT/software industry.</td></tr>
<tr><td>Internship Structure and Deliverable by Students:</td><td>Duration: 120 Hours
Mode: Offline / Online / Hybrid
Location: Industry, business firms, IT companies, local government offices, health organizations, media, artisans, etc.
Deliverables by Student:
1. Internship Joining Report
2. Weekly Progress Logbook
3. Project or Assignment Work (if applicable)
4. Final Internship Report (with photographs, certificates, etc.)
5. Presentation and Viva Voce</td></tr>
<tr><td>Course Evaluation</td><td><table><tr><th>Component</th><th>Marks/Weightage</th></tr><tr><td>Attendance and Participation</td><td>20%</td></tr><tr><td>Weekly Progress Logbook</td><td>20%</td></tr><tr><td>Final Internship Report</td><td>30%</td></tr><tr><td>Presentation & Viva Voce</td><td>30%</td></tr><tr><td>Total</td><td>100%</td></tr></table></td></tr>
<tr><td>Internship Report Template</td><td>INTERNSHIP REPORT TEMPLATE (to be submitted after internship completion)
Front Page
Title: Internship Report
Student Name:
Roll Number:
Program and Semester:
College Name and Department:
Name of Organization/Company:
Internship Duration (From – To):
Internship Guide Name (Industry and Faculty):
Submission Date:

1. Acknowledgment
A short paragraph acknowledging the guidance and support of the organization and faculty mentor.
2. Certificate
Internship Completion Certificate (copy from organization)
3. Declaration
Declaration by the student that the report is original and submitted for academic purposes.
4. Internship Details
Name and Address of Organization
Nature of Business/Services
Department/Team worked in
Name and Designation of Industry Supervisor
5. Objectives of Internship
What you aimed to learn and accomplish.
6. Description of Work Done
Overview of the tasks and responsibilities handled
Description of technologies/tools used
Screenshots, flowcharts, or diagrams (if applicable)</td></tr>
</table>

	7. Learning Outcomes Skills developed, software or tools learned, industry exposure gained. **8. Challenges and Solutions** Mention any problems faced and how you solved them. **9. Weekly Summary** Brief of what was done in each week (can be derived from the logbook). **10. Conclusion** Summary of overall experience, learning, and impact on career development. **11. References** Any websites, books, or resources referred to during the internship.

INTERNSHIP LOGBOOK FORMAT (to be maintained weekly)

Week No.	Date (From–To)	Tasks Assigned	Tasks Completed	Tools/Technologies Used	Remarks by Internship Guide
Week 1	01/06/2026 – 07/06/2026	Task 1 description	Task 1 completed	e.g., HTML, Python, MySQL	Signature & comments
Week 2					
...					
Week N					

Note: The logbook must be signed weekly by the industry/place of internship allocated supervisor and finally verified by the faculty mentor allocated by the institute. In case of the online internship, the consolidated Logbook should be submitted at the end of the successful completion of the Internship.