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 કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬-૨૭ થી અમલમાં આવનાર સ્નાતક કક્ષાના વિવિધ વિષયોના સેમેસ્ટર-૧,૩,૪ અને ૫ ના Skill Enhancement Course (SEC)ના પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમો કોમ્પ્યુટર સાયન્સ વિષય ની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિવતી અને કોમ્પ્યુટર સાયન્સ ફેકલ્ટીના ઈ.ચા.ડીનશ્રીએ ફેકલ્ટીવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૭/૦૫/૨૦૨૬ ની સભાનાં ઠરાવ ક્રમાંકઃ ૬૬ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/૧૦૦૮૧/૨૦૨૬
તા.૧૨/૦૫/૨૦૨૬

કુલસચિવ

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.

SKILL ENHANCMET COURSE (SEC)

FOR

SEM-1 , SEM-2, SEM-3, SEM-4 AND SEM-5

FOR

B.C.A. , B.SC.(COMPUTER SCIENCE), B.SC.(C.A.), B.VOC.(I.T.) AND

ALL B.C.A. SPECIALISED PROGRAMS (A.I.& DATA ANALYTICS, DATASCIENCE, CYBER SECURITY)

[Subject code-2611000903060263]

SEMESTER- 3

Course Code: 306-01
Course Title: EDA using Python

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	3
NCrF Credit Level	5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific
Course Code	306-01
Course Level	200-299
Course Title	EDA using Python
Credit	2 (2 theory)
Effective From	A.Y. 2026 - 27
CourseOutcomes	1. Understand different types of data and sources 2. Identify and handle data errors effectively 3. Use Python libraries for data cleaning and analysis 4. Create meaningful visualizations 5. Perform complete EDA on real-world datasets
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

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

Course Content

Unit 1: Introduction to Data and Data Sources

1.1 Types of Data

1.1.1 Structured, Semi-structured, and Unstructured Data
1.1.2 Qualitative vs Quantitative Data
1.1.3 Discrete vs Continuous Data
1.1.4 Time-series and Cross-sectional Data

1.2 Data Sources

1.2 .1 Primary vs Secondary Data
1.2.2 Open data sources (government portals, APIs)
1.2.3 Web scraping basics

1.3 Types of Databases

1.3.1Relational Databases (RDBMS)
1.3.2 NoSQL Databases (MongoDB, Cassandra)
1.3.3 Data Warehouses and Data Lakes

1.3 Types of Data Files

1.4.1 CSV, Excel, JSON, XML, TXT
1.4.2. Differences and use cases
1.4.3 File handling basics in Python

1.5 Introduction to Python for EDA

1.5.1 Python environment setup (Anaconda/Jupyter Notebook)
1.5.2 Basic syntax and data structures (lists, dictionaries, tuples)

	Unit 2: Data Quality, Errors, and Cleaning **2.1 Common Errors in Data** 2.1.1 Missing values (NaN, NULL) 2.1.2 Duplicate data 2.1.3 Inconsistent formats (date, text, units) 2.1.4 Outliers and noise 2.1.5 Typographical errors **2.2 Disadvantages of Poor Data Quality** **2.3 Importance of Data Cleaning** **2.4 Data Cleaning Techniques** 2.4.1 Handling missing values (imputation, deletion) 2.4.2 Removing duplicates 2.4.3 Data type conversion 2.4.4 String cleaning and formatting 2.4.5 Outlier detection and treatment **Unit 3: Python Libraries for Data Cleaning and Analysis** **3.1 Introduction to Key Libraries** 3.1. 1NumPy (numerical operations) 3.1.2 Pandas (data manipulation) **3.2 Pandas Functions for Data Cleaning** 3.2.1 read_csv(), read_excel() 3.2.2 info(), describe() 3.2.3 isnull(), dropna(), fillna() 3.2.4 duplicated(), drop_duplicates() 3.2.5 astype() 3.2.6 apply(), map() **3.3 Data Transformation** 3.3.1 Filtering and sorting data 3.3.2 Grouping (groupby()) 3.3.3 Merging and joining datasets 3.3.4 Feature creation and modification **3.4 Introduction to Data Analysis** 3.4.1 Descriptive statistics 3.4.2 Correlation and covariance 3.4.3 Aggregation techniques **Unit 4: Data Visualization Techniques in Python** **4.1 Importance of Data Visualization** **4.2 Visualization Libraries** 4.2.1 Matplotlib 4.2.2 Seaborn 4.2.3 Plotly (basic introduction) **4.3 Types of Visualizations** 4.3.1 Line charts 4.3.2 Bar charts 4.3.3 Histograms 4.3.4 Scatter plots 4.3.5 Box plots 4.3.5 Heatmaps

Reference Books

Sr. No.	Book Name	Author(s)	Publication	ISBN
1	*Python for Data Analysis*	Wes McKinney	O'Reilly Media	978-1491957660
2	*Data Science from Scratch*	Joel Grus	O'Reilly Media	978-1492041139
3	*Practical Statistics for Data Scientists*	Peter Bruce, Andrew Bruce	O'Reilly Media	978-1492072942
4	*Hands-On Data Analysis with Pandas*	Stefanie Molin	Packt Publishing	978-1789615326
5	*Data Wrangling with Python*	Jacqueline Kazil, Katharine Jarmul	O'Reilly Media	978-1491948811
6	*Python Data Science Handbook*	Jake VanderPlas	O'Reilly Media	978-1491912058
7	*Think Stats*	Allen B. Downey	O'Reilly Media	978-1491907337
8	*Introduction to Data Science*	Laura Igual, Santi Seguí	Springer	978-3319500164
9	*Applied Data Science with Python*	Alex Galea	Packt Publishing	978-1786468253
10	*Mastering Pandas*	Femi Anthony	Packt Publishing	978-1789343236

Teaching Methodology

Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments

Evaluation Method

50% Internal assessment.

- Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level

50% External assessment.

- Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2611000903060264]

Course Code: 306-02
Course Title: Fundamentals of Android

<table>
<tr><td>Program Name</td><td>BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)</td></tr>
<tr><td>Semester</td><td>3</td></tr>
<tr><td>NCrF Credit Level</td><td>4.5</td></tr>
<tr><td>Course Type</td><td>SEC</td></tr>
<tr><td>Course Subtype</td><td>Skill Development</td></tr>
<tr><td>Subject Type</td><td>Discipline Specific</td></tr>
<tr><td>Course Code</td><td>306-02</td></tr>
<tr><td>Course Level</td><td>200 - 299</td></tr>
<tr><td>Course Title</td><td>Fundamentals of Android</td></tr>
<tr><td>Credit</td><td>2 (2 Theory)</td></tr>
<tr><td>Effective From</td><td>A.Y. 2026 - 27</td></tr>
<tr><td>Course Outcomes</td><td>CO1 : Explain Android architecture, features, and application framework.
CO2 : Develop simple Android applications using Android Studio and basic knowledge of XML
CO3 : Design user interfaces using various layouts and widgets.
CO4 : Implement event handling for UI components like buttons and checkboxes.
CO5 : Create interactive applications using dialogs, list views, and image views. Use intents to navigate between different application components.</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td>
<table>
<tr><td></td><td>PSO1</td><td>PSO2</td><td>PSO3</td><td>PSO4</td><td>PSO5</td><td>PSO6</td><td>PSO7</td><td>PSO8</td></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Course Content</td><td>Unit - 1: Android OS Architecture & Features
1.1 History, concepts and Features of Android
1.2 Concepts of API framework
1.3 Kernel Native Libraries& DVM (Dalvik Virtual Machine)
1.4 Application Framework
Unit – 2: XML Introduction
2.1 Characteristics of XML
2.2 XML Declaration, Tags and elements
2.3 Root element
2.4 XML documents
Unit - 3: Android widgets and its implementation
3.1 First Android Project
3.2 Title Bar
3.3 Screen Orientation (Portrait, Landscape)
3.4 Android Layouts
3.4.1 Constraint Layout
3.4.2 Linear Layout
3.4.3 Table Layout
3.4.4 Grid View
3.5 Text Field, Button, Checkbox, Radiobutton
3.5.1 Event Handling on Button, Checkbox, Radiobutton</td></tr>
</table>

	3.6 ToggleButton 3.7 Toast **Unit - 4: Android Widgets** 4.1 Alert Dialog Box 4.2 List View 4.3 Custom Listview 4.4 ImageView, Image Slider 4.5 Search View 4.6 Intent
Reference Books	1) Android Programming for Beginners - Second Edition, Author:John Horton, Publisher: Image Short ISBN: 978-1789538502 2) Android 9 Development Cookbook, Author: Rick Boyer, Publisher: Packet Publishing, ISBN:978-1788991216 3) Android Application Development (With Kitkat Support), Author: Pradeep Kothari, Publisher: DreamTech Press.,ISBN:978-9351194095 4) Android Studio 4.0 Development Essentials – Kotlin Edition, Author – Neil Smyth,Publisher: Payload Media, ISBN – 13: 978 – 1951442194 5) Head First Android Development - 3rd Edition, Author: Dawn Griffiths, David Griffiths, Publisher: O'Reilly Media, ISBN: 9781492076522 6) Android Application Development Black Book, Author: Pradeep Kothari, Publisher: Dreamtech Press, ISBN: 9789351194095 7) Professional Android (4th Edition), Author: Reto Meier, Ian Lake, Publisher: Wiley, ISBN: 9781118949527 8) Programming Android: Java Programming for the New Generation of Mobile Devices, Author: Zigurd Mednieks, Publisher: O'Reilly Media, ISBN: 9781449316648 9) Learning Android Application Development, Author: Wallace Jackson, Publisher: Apress, ISBN: 9781484217848 10) Beginning Android Programming with Android Studio, Author: Jerome (J.F.) DiMarzio, Publisher: Wiley, ISBN: 9781118705598
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars, Assignments, Viva-Voce/ Presentation
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2611000903060265]

Course Code: 306-03
Course Title: Fundamentals of Graphic Design with designing software

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	3
NCrF Credit level	5
Course Type	SEC
Course Subtype	Skill Enhancement Course (SEC)
Subject Type	Intra-Discipline
Level of Course	200-299 (Intermediate level)
Credits	2 Credits (30 hours of Practical/Applied knowledge)
Implementation Year	2026-27
Purpose of Course	The purpose of the course is to equip learners with essential design knowledge and practical skills to create visually appealing content easily and efficiently.
Course Objective	(1) Provide a user-friendly platform so beginners can produce high-quality graphics without advanced software knowledge. (2) Use Canva tools to create posters, presentations, social media posts, brochures, and more.
Pre-requisite	Basic knowledge of Computer
Course Outcome	After successful completion of the course, students will be able to: **CO1:** Understand and apply fundamental principles of graphic design such as color theory, typography, layout, and visual hierarchy. **CO2:** Use Canva tools and features effectively to create various types of visual content. **CO3:** Design professional-quality materials including posters, presentations, social media graphics, and brochures. **CO4:** Apply creativity and critical thinking to communicate ideas visually in an effective manner. **CO5:** Customize templates and create original designs suitable for academic, personal, and professional use.
Mapping Between COs and PSOs	

COs / PSOs	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**
CO1								
CO2								
CO3								
CO4								
CO5								

Course content	**Unit 1: Introduction** 1.1 What is Graphics Design? 1.2 Applications of Graphics Design 1.3 Basic shapes of Graphics 1.4 Overview of Canva 1.5 Exploration of Canva Dashboard **Unit 2: Canva Editing Basics and Social Media** 2.1 Fonts & texts 2.2 Colors& Combination 2.3 The taskbar: Effects, Filters, Crop, Rotate, position and transparency 2.4 Zooming, pages and notes 2.5 Animation for text and images 2.6 Background removal 2.7 Downloading, copying and sharing 2.8 Business cards 2.9 Instagram post 2.10 Instagram reel video 2.11 Creating Youtube Thumbnail **Unit 3: Canva for Presentation** 3.1 Overview of Canva presentation 3.2 Using Canva Default templates 3.3 Ways to present Canva presentation 3.4 Record your presentations with audio and image in Canva **Unit 4: Canva Design for Enterprise and Business** 4.1 Personalised flyer for event 4.2 Infographics 4.3 Resume 4.4 Websites
Reference Books	1. Design with Canva: A step by step guide on how to use Canva by LateefahRaji –Independently published 2. Design Better and Build Your Brand in Canva: A beginner's guide to producing professional branding, marketing, and social content for businesses by Laura Goodsell – Packt 3. The A to Z Field Guide to Canva: A User's Companion to Canva Terms and Features by Amanda Fox – TeacherGoals 4. Canva Tips and Tricks Beyond The Limits by Koushik K - Draft2Digital 5. Ready, Set, Brand!: The Canva for Work Quickstart Guide by Lisa Larson-Kelley - Beginners Brain 6. Graphic Design School: The Principles and Practice of Graphic Design by David Dabner, Sandra Stewart, Eric Zempol - Wiley 7. Graphic Design Theory by Helen Armstrong - Princeton Architectural Press
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments

Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

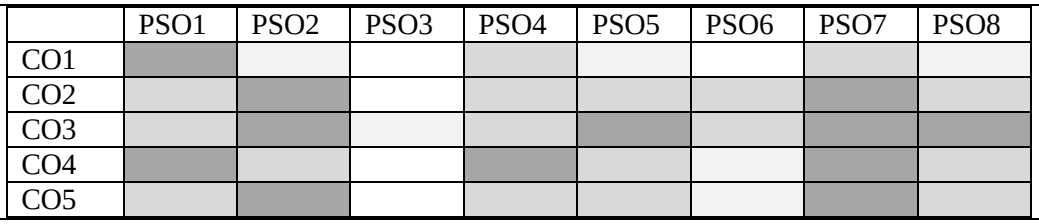
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.C.A.(ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS)

(SEM – 3)

AI-306-04: IoT Data Handling and Basic Smart Systems

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

Program Name	**B.C.A.(A.I. & Data Analytics)**
COURSE NAME	**IoT Data Handling and Basic Smart Systems**
Semester	**III**
NCrF Credit Level	**Level-5.0**
Course Type	**Skill Enhancement Course**
Course Subtype	**Employability**
Subject Type	**Skill Enhancement course**
Course Code	**AI-306-04**
Course Level	**200-299**
Course Title	**Basic IoT Applications and Smart Device Projects (SEC-02)**
Credit	**2 Credits**
Effective From	**Academic Year : 2026-2027**
Course Objective:	• Introduce basic data collection and communication in IoT • Enable students to send and visualize data • Develop understanding of simple IoT platforms • Build interactive smart systems • Prepare foundation for AI integration in IoT
Course Outcomes	**CO1:** Collect and read data from sensors using Arduino **CO2:** Transmit data using basic communication methods **CO3:** Visualize IoT data using simple tools **CO4:** Develop interactive IoT-based systems **CO5:** Apply basic data understanding for smart decision systems
Mapping between Cos and PSOs	
Course Content	**Unit-1:** 1.1 Sensor Data Collection 1.1.1 Revision of sensors 1.1.1.1 Light sensor (LDR)

	1.1.1.2 Temperature sensor 1.1.1.3 Motion sensor (PIR) 1.1.2 Reading sensor values 1.1.2.1 Analog input basics 1.1.2.2 Digital input basics 1.1.2.3 Continuous data reading 1.1.3 Understanding sensor output 1.1.3.1 Raw values 1.1.3.2 Range of values 1.1.3.3 Simple interpretation 1.2 Serial Communication Basics 1.2.1 Introduction to serial communication 1.2.1.1 What is communication? 1.2.1.2 Data transfer concept 1.2.2 Serial Monitor usage 1.2.2.1 Displaying data 1.2.2.2 Reading output 1.2.2.3 Debugging using Serial Monitor 1.2.3 Data formatting 1.2.3.1 Text display 1.2.3.2 Numeric display 1.2.3.3 Structured output **Unit–2:** 2.1 Introduction to IoT Communication 2.1.1 Concept of data transmission 2.1.2 Wired vs Wireless communication 2.2 Introduction to Wi-Fi Module 2.2.1 Basic idea of Wi-Fi module 2.2.2 Sending simple data 2.3 IoT Platforms 2.3.1 Introduction to ThingSpeak 2.3.2 Creating account and channel 2.3.3 Sending data to cloud **Unit–3: Data Visualization and Simple Dashboard** 3.1 Data Visualization Basics 3.1.1 Why visualization is needed 3.1.2 Graphs and charts 3.2 Viewing IoT Data 3.2.1 Real-time data display 3.2.2 Graph plotting 3.3 Basic Dashboard 3.3.1 Creating simple dashboards 3.3.2 Monitoring sensor data **Unit–4: Smart IoT Systems (Applied)** 4.1 Data-Based Decision Systems 4.1.1 Threshold-based decision 4.1.2 If–Else logic in IoT 4.2 Smart Monitoring Systems 4.2.1 Environment monitoring system 4.2.2 Light/temperature monitoring 4.3 Mini Projects

	4.3.1 Data logging system 4.3.2 Smart alert system 4.3.3 Student-defined project [Students are expected to work on following suggested Practicals during Lab- hours : 1. Continuous sensor data reading ,2. Serial monitor data formatting, 3.Sending sensor data via communication module , 4. Upload data to cloud platform, 5. Create graph of sensor data, 6. Build simple dashboard, 7. Threshold-based alert system, 8. Multi-sensor data monitoring , 9. Real-time data visualization, 10. Mini IoT project] [Suggested components for lab : (One set per 10 students): (i) Arduino Uno – 1, (ii) Breadboard – 1, (iii) USB Cable – 1 (iv) LEDs –10nos. (v) Resistors – Assorted (vi) Jumper wires – Set (vii) Push buttons –3nos. (viii) LDR sensor – 1nos. (ix) Temperature sensor – 1nos., (x) PIR sensor – 2 nos. (xi) Buzzer – 2 nos., (xii) Wi-Fi Module (basic) (xiii) Jumper wires (xiv) USB cable]
Reference Books	1. Getting Started with Arduino (3rd Edition), 978-9352139819, Massimo Banzi, Maker Media 2. Arduino Cookbook, 978-1449313876, Michael Margolis, O'Reilly Media 3. Programming Arduino: Getting Started with Sketches, 978-0071784229, Simon Monk, McGraw-Hill Education 4. Exploring Arduino: Tools and Techniques for Engineering Wizardry, 978-1119405373, Jeremy Blum, Wiley 5. Internet of Things: A Hands-On Approach, 978-0996025515, Arshdeep Bahga and Vijay Madisetti, Universities Press 6. Learning Internet of Things, 978-1788399119, Peter Waher, Packt Publishing 7. Beginning Arduino, 978-1430232401, Michael McRoberts, Apress 8. Make: Electronics (2nd Edition), 978-1680450260, Charles Platt, Maker Media 9. Practical Electronics for Inventors (4th Edition), 978-1259587549, Paul Scherz and Simon Monk, McGraw-Hill Education 10. Hands-On Internet of Things with MQTT, 978-1789341780, Agus Kurniawan, Packt Publishing
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Practical Unit tests. - Practical exam, viva-voce, E-Journal 50% External assessment. - Practical Exam, viva-voce, E-Journal

[Subject code-2611000904060268]

SEMESTER – 4

Course Code: 406-01
Course Title: Introduction to Machine Learning

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	4
NCrF Credit Level	5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific
Course Code	406-01
Course Level	200-299
Course Title	Introduction to Machine Learning
Credit	2 (2 theory)
Effective From	A.Y. 2026 - 27
Course Outcomes	1. Explain the basic concepts and evolution of Machine Learning. 2. Classify Machine Learning approaches such as supervised, unsupervised, and reinforcement learning. 3. Apply appropriate Machine Learning techniques to different problem domains. 4. Describe the complete Machine Learning workflow from data collection to model evaluation. 5. Compare various ML techniques based on performance, complexity, and applicability.
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

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

Course Content

Unit 1: Introduction to Machine Learning

1.1 History and Evolution of Machine Learning

1.1.1 Early developments and milestones

1.1.2 Evolution from Artificial Intelligence to Machine Learning

1.2 Importance of Machine Learning

1.2.1 Role in modern technology

1.2.2 Impact on industries (healthcare, finance, retail, etc.)

1.3 Why Machine Learning is Required

1.3.1 Limitations of traditional programming

1.3.2 Need for automation and intelligent systems

1.4 Basic Concepts

1.4.1 Data, features, labels

1.4.2 Training and testing datasets

Unit 2: Types of Machine Learning and Use Cases

2.1 Types of Machine Learning

- **2.1.1** Supervised Learning
- **2.1.2** Unsupervised Learning
- **2.1.3** Semi-Supervised Learning
- **2.1.4** Reinforcement Learning

2.2 Common Algorithms (Overview)

- **2.2.1** Regression (Linear Regression)
- **2.2.2** Classification (Decision Trees, KNN)
- **2.2.3** Clustering (K-Means)

2.3 Use Cases of Machine Learning

- **2.3.1** Recommendation systems
- **2.3.2** Fraud detection
- **2.3.3** Image and speech recognition
- **2.3.4** Predictive analytics

2.4 Application of Machine Learning

- **2.4.1** Business applications
- **2.4.2** Healthcare systems
- **2.4.3** Smart systems and automation

Unit 3: Machine Learning Process (Lifecycle)

3.1 Steps in Machine Learning Process

- **3.1.1** Data collection
- **3.1.2** Data preprocessing
- **3.1.3** Feature selection and engineering
- **3.1.4** Model selection
- **3.1.5** Training and testing
- **3.1.6** Evaluation and validation

3.2 Model Evaluation Techniques

- **3.2.1** Accuracy, precision, recall
- **3.2.2** Confusion matrix
- **3.2.3** Overfitting and underfitting

3.3 Tools and Platforms (Overview)

- **3.3.1** Python libraries (Scikit-learn, Pandas, NumPy)
- **3.3.2** ML development environments

Unit 4: Advantages, Disadvantages, and Characteristics of ML Techniques

4.1 Advantages of Machine Learning

4.2 Disadvantages of Machine Learning

4.3 Characteristics of ML Techniques

- **4.3.1** Supervised Learning: labeled data, predictive models
- **4.3.2** Unsupervised Learning: pattern discovery
- **4.3.3** Reinforcement Learning: reward-based learning

4.4 Comparison of Techniques

- **4.4.1** Strengths and weaknesses
- **4.4.2** Suitable scenarios for each method

Reference Books

Sr. No.	Book Name	Author(s)	Publication	ISBN
1	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy	MIT Press	978-0262018029
2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	978-0387310732
3	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	Aurélien Géron	O'Reilly Media	978-1492032649
4	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media	978-1449369415
5	Machine Learning	Tom M. Mitchell	McGraw-Hill	978-0070428072
6	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing	978-1789955750
7	Understanding Machine Learning: From Theory to Algorithms	Shai Shalev-Shwartz, Shai Ben-David	Cambridge University Press	978-1107057135
8	Applied Machine Learning	M. Gopal	McGraw-Hill Education	978-0070703698
9	Machine Learning for Absolute Beginners	Oliver Theobald	Scatterplot Press	978-1530839407
10	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	978-0262035613

Teaching Methodology

Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments

Evaluation Method

50% Internal assessment.

- Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level

50% External assessment.

- Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2511000904060091]

Course Code: 406 - 02
Course Title: Data Analysis and Dashboard Reporting using Worksheet

<table>
<tr><td>Program Name</td><td>BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)</td></tr>
<tr><td>Semester</td><td>4</td></tr>
<tr><td>NCrF Credit Level</td><td>5</td></tr>
<tr><td>Course Type</td><td>SEC</td></tr>
<tr><td>Course Subtype</td><td>Skill Development</td></tr>
<tr><td>Subject Type</td><td>Discipline Specific</td></tr>
<tr><td>Course Code</td><td>406-02</td></tr>
<tr><td>Course Level</td><td>200 - 299</td></tr>
<tr><td>Course Title</td><td>Data Analysis and Dashboard Reporting using Worksheet</td></tr>
<tr><td>Credit</td><td>2 (2 Theory)</td></tr>
<tr><td>Effective From</td><td>A.Y. 2026 - 27</td></tr>
<tr><td>Course Outcomes</td><td>CO1 : Manage and clean data efficiently
CO2 : Apply formulas and functions
CO3 : Create reports using Power BI
CO4 : Design dashboards
CO5 : Present data insights</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Course Content</td><td>Unit 1: Introduction to Power BI
1.1 Power BI environment
1.2 Data entry and formatting
1.3 Data cleaning
1.4 Sorting and filtering
1.5 Uploading CSV
1.6 Creating reports
Unit 2: Visualization Techniques
2.1 Create and format visuals
2.2 Charts and graphs
2.3 Map and gauge visuals
2.4 Slicers and filters
Unit 3: Reports and Dashboard
3.1 Create and modify reports
3.2 Dashboard creation
3.3 Power BI Q&A
3.4 Sharing and publishing
Unit 4: DAX Functions
4.1 Date and time
4.2 Filter functions
4.3 Logical functions
4.4 Math & Trig
4.5 Text functions</td></tr>
</table>

Reference Books	1) Microsoft Power BI Data Analyst Guide, Author: Daniil Maslyuk, Publisher: Packt Publishing, ISBN: 9781803232057 2) Beginning Microsoft Power BI: A Practical Guide to Self-Service Data Analytics, Author: Dan Clark, Publisher: Apress, ISBN: 9781484236238 3) Microsoft Power BI Cookbook, Author: Brett Powell, Publisher: Packt Publishing, ISBN: 9781788290141 4) Pro Power BI Desktop, Author: Adam Aspin, Publisher: Apress, ISBN: 9781484234760 5) Mastering Microsoft Power BI, Author: Brett Powell, Publisher: Packt Publishing, ISBN: 9781801811483 6) Analyzing Data with Power BI and Power Pivot for Excel, Author: Alberto Ferrari, Marco Russo, Publisher: Microsoft Press, ISBN: 9781509302764 7) Data Visualization: A Practical Introduction, Author: Kieran Healy, Publisher: Princeton University Press, ISBN : 9780691181621 8) Fundamentals of Business Intelligence, Author: Wilfried Grossmann, Stefanie Rinderle-Ma, Publisher: Springer, ISBN: 9783662574836 9) Dashboarding and Reporting with Power BI, Author: Kasper de Jonge, Publisher: Microsoft, ISBN: 9781509308025 The Definitive Guide to DAX, Author: Marco Russo, Alberto Ferrari, Publisher: Microsoft Press, ISBN: 9781509306977
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars, Assignments, Viva-Voce/ Presentation
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2511000904060145]

Course Code: 406 - 03
Course Title: Data Science with Python

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	4
NCrF Credit level	5
Course Type	SEC
Course Subtype	Skill Enhancement Course (SEC)
Subject Type	Intra-Discipline
Course Code	406-03
Level of Course	200-299 (Foundation/Introductory)
Course Title	Data Science with Python
Credits	2 Credits (30 hours of Practical/Applied knowledge)
Implementation Year	2026-27
Purpose of the Course	The primary purpose of this course is to provide students with a **strong foundational understanding of Data Science using Python**, enabling them to handle real-world data and extract meaningful insights. It aims to: • **Build conceptual clarity** in Data Science and its applications across industries. • **Develop programming skills in Python**, specifically tailored for data analysis tasks. • **Equip students with data handling abilities** using libraries like Pandas, including cleaning, transforming, and managing datasets. • **Enhance analytical thinking** by teaching how to explore and interpret data effectively. • **Enable data visualization skills** using tools like Matplotlib, Seaborn, and Plotly to communicate insights clearly. • **Introduce core Machine Learning concepts**, including supervised and unsupervised learning, and fundamental techniques like classification, regression, and clustering.
Course Objective	(1) Provide Practical knowledge and practice of Python (2) Provide fundamental knowledge about Data Science
Pre-requisite	Basic knowledge of Python
Course Outcome	After successful completion of the course a student will be **CO1**: Able to understand about need of data science **CO2**: Able to work on data with visualization **CO3**: Able to understand how python is important in data science **CO4**: Able to understand about machine learning and libraries used to work in it.

Mapping Between COs and PSOs

COs / PSOs	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**

	CO1 | CO2 | CO3 | CO4
Course content	**Unit 1: Overview** 1.1 Introduction to Data Science 1.2 Introduction to Python programming 1.3 Setting up Python environment (Google Colab) **Unit 2: Data Manipulation with Pandas** 2.1 Introduction to Pandas Library 2.2 Data Cleaning and manipulation with Pandas 2.3 Handling missing data 2.4 Grouping, aggregating, merging and joining data frames **Unit 3: Data Visualization with Matplotlib and Seaborn** 3.1 Introduction to data visualization 3.2 Plotting and customization with Matplotlib 3.3 Seaborn for statistical visualization 3.4 Creating interactive visualization with Plotly **Unit 4: Fundamentals of Machine learning** 4.1 Introduction to machine learning 4.2 Supervised and unsupervised learning 4.3 Classification, Regression and Clustering
Reference Books	1. Sharma, R.K., Nandi. G (2020). Data Science fundamentals and practical approaches: Understand why data science is the Next, India: BPB Publications. ISBN: 9789389845662, 9389845661 2. Mulla, R. (2019) Data Science with Python: For complete Beginners 3. VanderPlas, J., Python Data Science Handbook, O'Reilly 4. Foundations of Data Science with Python, John M. Shea, CRC Press, 9781032350424, 2024 5. From Concepts to Code: Introduction to Data Science, Adam P. Tashman, CRC Press, 9781032517957, 2024 6. Software Engineering for Data Scientists, Catherine Nelson, O'Reilly Media, 9781098136208, 2024 7. Linear Algebra in Data Science, Peter Zizler & Roberta La Haye, Springer, 9783031549076, 2024 8. Graph Algorithms for Data Science, Tomaž Brataniz, Manning Publications, 9781617299469, 2024 9. Data Science for Decision Makers, Erik Herman, Independently Published, 9781501520648, 2024 10. AI Snake Oil: What Artificial Intelligence Can Do, What It Can't, and How to Tell the Difference, Arvind Narayanan & Sayash Kapoor, Princeton University Press, 9780691249131, 2024
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments

Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

S.Y.B.C.A.(ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS)

(SEM – 4)

AI-406-04: AI for IoT – Smart Intelligent Systems

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

Program Name	**B.C.A.(A.I. & Data Analytics)**
COURSE NAME	**AI for IoT – Smart Intelligent Systems**
Semester	**IV**
NCrF Credit Level	**Level-5.0**
Course Type	**Skill Enhancement Course**
Course Subtype	**Employability**
Subject Type	**Skill Enhancement course**
Course Code	**AI-406-03**
Course Level	**200-299**
Course Title	**Basic IoT Applications and Smart Device Projects (SEC-02)**
Credit	**2 Credits**
Effective From	**Academic Year : 2026-2027**
Course Objective:	1. Introduce basic AI concepts in simple terms 2. Enable students to use IoT data for decision making 3. Apply basic Machine Learning (very beginner level) 4. Build intelligent IoT systems 5. Develop real-life smart applications
Course Outcomes	**CO1:** Understand basic AI and Machine Learning concepts **CO2:** Prepare and use IoT data for analysis **CO3:** Apply simple Machine Learning models **CO4:** Develop intelligent IoT-based systems **CO5:** Demonstrate smart decision-making using data
Mapping between Cos and PSOs	

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

Course Content	**Unit-1: Introduction to AI and IoT Data** 1.1 Basics of Artificial Intelligence 1.1.1 What is AI? 1.1.1.1 Simple definition 1.1.1.2 Real-life examples 1.1.2 AI vs Automation

	1.1.2.1 Rule-based systems 1.1.2.2 Intelligent systems 1.2 Introduction to Machine Learning 1.2.1 What is Machine Learning? 1.2.1.1 Learning from data 1.2.1.2 Examples 1.2.2 Types of learning 1.2.2.1 Supervised learning 1.2.2.2 Unsupervised learning 1.3 IoT Data for AI 1.3.1 Source of IoT data 1.3.2 Data collection from sensors 1.3.3 Preparing data for analysis **Unit–2: Basic Data Analysis using Python** 2.1 Introduction to Python for Data 2.1.1 Basic Python concepts 2.1.2 Reading data 2.2 Data Handling 2.2.1 Introduction to Pandas 2.2.1.1 DataFrame concept 2.2.1.2 Reading CSV data 2.2.2 Data cleaning 2.2.2.1 Missing values 2.2.2.2 Formatting data 2.3 Data Visualization 2.3.1 Introduction to Matplotlib 2.3.2 Plotting simple graphs 2.3.3 Understanding trends **Unit–3: Simple Machine Learning Models** 3.1 Introduction to ML Tools 3.1.1 Introduction to Scikit-learn 3.1.2 Basic workflow 3.2 Classification 3.2.1 Concept of classification 3.2.2 Example: Temperature → Normal / High 3.2.3 Using simple classification models 3.2.4 Simple Prediction-based Model 3.2.5 Using data to predict output **Unit–4: Unit–4: AI-Based IoT Applications (Projects)** 4.1 Smart Decision Systems 4.1.1 Sensor data → decision 4.1.2 Intelligent alert systems 4.2 AI-Based Mini Applications 4.2.1 Smart temperature monitoring 4.2.2 Smart light control system 4.2.3 Basic anomaly detection 4.3 Mini Projects 4.3.1 Data collection + analysis 4.3.2 Model application

	4.3.3 Output decision system [Students are expected to work on following suggested Practicals during Lab- hours : 1. Collect IoT data and save as CSV, 2. Load data using Python, 3. Clean and preprocess data , 4. Plot sensor data graph, 5. Simple classification example, 6. Apply KNN model (basic), 7. Threshold-based prediction, 8. Build simple decision system, 9. Combine IoT + ML, 10. Final mini project] [Suggested components for lab : (One set per 10 students): (i) Arduino Uno – 1, (ii) Breadboard – 1, (iii) USB Cable – 1 (iv) LEDs –10nos. (v) Resistors – Assorted (vi) Jumper wires – Set (vii) Push buttons –3nos. (viii) LDR sensor – 1nos. (ix) Temperature sensor – 1nos., (x) PIR sensor – 2 nos. (xi) Buzzer – 2 nos., (xii) Wi-Fi Module (basic) (xiii) Jumper wires (xiv) USB cable]
Reference Books	1. Getting Started with Arduino (3rd Edition), 978-9352139819, Massimo Banzi, Maker Media 2. Arduino Cookbook, 978-1449313876, Michael Margolis, O'Reilly Media 3. Programming Arduino: Getting Started with Sketches, 978-0071784229, Simon Monk, McGraw-Hill Education 4. Exploring Arduino: Tools and Techniques for Engineering Wizardry, 978-1119405373, Jeremy Blum, Wiley 5. Internet of Things: A Hands-On Approach, 978-0996025515, Arshdeep Bahga and Vijay Madisetti, Universities Press 6. Learning Internet of Things, 978-1788399119, Peter Waher, Packt Publishing 7. Beginning Arduino, 978-1430232401, Michael McRoberts, Apress 8. Make: Electronics (2nd Edition), 978-1680450260, Charles Platt, Maker Media 9. Practical Electronics for Inventors (4th Edition), 978-1259587549, Paul Scherz and Simon Monk, McGraw-Hill Education 10. Hands-On Internet of Things with MQTT, 978-1789341780, Agus Kurniawan, Packt Publishing
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Practical Unit tests. - Practical exam, viva-voce, E-Journal 50% External assessment. - Practical Exam, viva-voce, E-Journal

[Subject code-2511000905060186]

SEMESTER – 5

Course Code: 506-01
Course Title: Working with AI Based Software

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	5
NCrF Credit Level	5.5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific, Emerging Technology
Course Code	506-01
Course Level	200 - 299
Course Title	Working with AI based Software
Credit	2 (2 Theory)
Effective From	A.Y. 2026 - 27
Course Outcomes	**CO1 :** Understand the core concepts and architecture of AI. **CO2 :** Identify and apply free AI tools for academic, research, and creative tasks. **CO3 :** Use AI tools to automate writing, video creation, and presentation design. **CO4 :** Create engaging academic content with minimal effort using AI platforms. **CO5 :** Make informed and ethical decisions while using AI in their academic journey.

Mapping between Cos and PSOs

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

Course Content

Unit 1: Introduction to Artificial Intelligence (7.5 Hours)

1.1. Definition and history of AI
1.2. Types of AI: Narrow, General, and Super AI
1.3. Applications of AI in education, healthcare, and daily life
1.4. Ethical concerns and responsible AI usage
1.5. AI vs Human intelligence: Myths and facts

Unit 2: Architecture of AI Systems (7.5 Hours)

2.1 AI System components: Input, Processing, Output
2.2 Basic structure of AI algorithms and models
2.3 Role of data, training, and feedback loops in AI
2.4 Concept of Machine Learning, Deep Learning, and Natural Language Processing
2.5 AI workflow: From problem to solution

Unit 3: Free AI Tools for Academic Tasks (7.5 Hours)

3.1 List and demo of AI tools for:
3.1.1 Writing & summarizing (e.g., Grammarly, Quillbot, ChatGPT)
3.1.2 Presentation generation (e.g., Beautiful.ai, Tome.app)

	3.1.3 Research assistance (e.g., Elicit.org, Semantic Scholar, Research Rabbit) 3.2 Benefits and limitations of each tool 3.3 AI tools for document formatting and language translation **Unit 4: AI for Multimedia, Video Creation & Study Support (7.5 Hours)** 4.1 AI tools for video making (e.g., Pictory, Lumen5, Animoto) 4.2 Text-to-speech and voiceover tools (e.g., ElevenLabs, Natural Readers) 4.3 Image generation tools (e.g., Canva AI, Craiyon, Bing Image Creator) 4.4 AI chatbots as study companions (e.g., Socratic, ChatGPT, You.com) 4.5 Mini-project: Create a study video or presentation using AI tools 4.6 Mini-project: Create website or python project using AI tool.
Reference Books	1. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson Education, ISBN-13: 978-0134610993 2. Artificial Intelligence Basics: A Non-Technical Introduction, Tom Taulli, Apress, ISBN-13: 978-1484235155 3. Machine Learning for Absolute Beginners, Oliver Theobald, CreateSpace, ISBN - 978-1520951400 4. ChatGPT for Beginners, Pam Baker, Wiley, ISBN - 978-1394203783 5. Ethics of Artificial Intelligence, Mark Coeckelbergh, MIT Press, ISBN - 978-0262538190 6. "Artificial Intelligence: A Guide for Thinking Humans", Melanie Mitchell, Farrar, Straus and Giroux (US), ISBN-978-1250758040 7. "AI Basics foryone", Dale Lane, ISBN - 978-1718500563 8. "Hands-On Artificial Intelligence for Beginners", Patrick D. Smith, Packt Publishing Ltd, ISBN - 978-1788991063 9. Generative AI Basics & Beyond, Tom Taulli, Apress, 9781484293538 10. Artificial Intelligence Basics: A Non-Technical Introduction, Tom Taulli, Apress, 9781484233572
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars, Assignments, Viva-Voce/ Presentation
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2511000905060180]

Course Code: 506-02
Course Title: Fundamentals of Software Engineering

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	5
NCrF Credit level	5
Course Type	SEC
Course Subtype	Skill Enhancement Course (SEC)
Subject Type	Intra-Discipline
Course Code	506-02
Level of Course	200-299
Course Title	Fundamental of Software Engineering
Credits	2 Credits (30 hours of Practical/Applied knowledge)
Implementation Year	2026-27
Purpose of Course	The purpose of this course is to provide students with a **comprehensive understanding of Software Engineering principles and practices**, enabling them to systematically develop high-quality software systems. It aims to: • **Introduce fundamental concepts of software and software engineering**, including types of software and their characteristics. • **Develop knowledge of software development life cycle (SDLC)** and various process models such as Waterfall, Prototype, Incremental, and Spiral. • **Build analytical skills** to study existing systems, identify limitations, and prepare structured **Software Requirement Specifications (SRS)**. • **Equip students with modeling techniques** like DFD and UML diagrams (Use Case, Activity, Sequence) for clear system representation. • **Enhance design capabilities** by understanding key principles, concepts, cohesion, and coupling for creating efficient system architectures. • **Provide knowledge of software testing practices**, including test case design, types of testing, and handling security and system limitations. • **Enable practical application** of concepts through real-world case studies like College Management Systems and other domain-based systems.
Course Objective	(1) Provide knowledge and practice of Software Engineering phases like analysis, design and testing (2) Provide fundamental knowledge about Software Requirement Specification and Software Process Model
Pre-requisite	Basic understanding of Problem Solving
Course Outcome	After successful completion of this course, students will be able to: **CO1:** Understand and explain fundamental concepts of software, software engineering, and various software process models.

CO2: Analyze existing systems, identify their limitations, and prepare a structured Software Requirement Specification (SRS).
CO3: Apply modeling techniques such as DFD and UML diagrams (Use Case, Activity, Sequence) to represent system requirements effectively.
CO4: Design software systems using appropriate design principles, concepts, and by applying cohesion and coupling.
CO5: Develop and evaluate test cases, understand different testing techniques, and identify security issues and system limitations.
CO6: Apply software engineering concepts to real-world case studies like College Management System and other domain-based applications.

Mapping Between COs and PSOs

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8
CO1								
CO2								
CO3								
CO4								
CO5								
CO6								

Course content

Unit 1: Software and Software Engineering
1.1 Concepts of Software
1.2 Software characteristics
1.3 Types of Software
1.4 Overview of Software Engineering
1.5 Software Process Model
1.5.1 Waterfall Model
1.5.2 Prototype Model
1.5.3 Incremental Model
1.5.4 Spiral Model

Unit 2: Analysis Report
2.1 Fact Finding: Current System and its limitations
2.2 Introduction to SRS and its characteristics
2.3 Proposed System and its advantages
2.4 Elements of Analysis Model
2.5 DFD, PSPEC, DD
2.6 Unified Modeling Language (UML)
2.6.1 UML Diagrams
2.6.1.1 Use Case Diagram
2.6.1.2 Activity Diagram
2.6.1.3 Sequence Diagram

Unit 3: Design Report and Testing Report
3.1 Design Principles
3.2 Design Concepts
3.3 Overview: Cohesion and Coupling
3.4 Overview: Testing and its types
3.5 Test Case Design
3.6 Testing issues
3.7 Security Issue
3.8 Limitations of proposed system
3.7 Future Enhancement

	Unit 4: Case Study 4.1 College Management System 4.2 Self study: Online Shopping System 4.3 Self study: Tours and Travels Management System
Reference Books	11. Software Engineering , A Practitioners Approach , Roger Pressman 2018, Mc Graw Hill Education, ISBN: 978-9353165710 12. Software Engineering with UML, Bhuvan Unhelkar, 2017, CRC Press ISBN : 978-1138297432 13. Grady Booch, James Rumbaugh, Ivar Jacobson | Unified Modeling Language User Guide | Addison Wesley 14. Engineering Software Products (Global Edition eText), Ian Sommerville, Pearson, 9781292474601, 2024 15. Software Engineering (10th Edition – updated digital/global), Ian Sommerville, Pearson, 9781292443157, 2023 16. Software Engineering (Global Edition eText), Ian Sommerville, Pearson, 9781292770680, 2026 (latest update, based on 2023 edition) 17. Software Engineering at Google: Lessons Learned from Programming Over Time, Titus Winters, Tom Manshreck & Hyrum Wright, O'Reilly Media, 9781492082798, 2020 18. Modern Software Engineering: Doing What Works to Build Better Software Faster, David Farley, Addison-Wesley, 9780137314911, 2021 19. Software Engineering for Data Scientists, Catherine Nelson, O'Reilly Media, 9781098136208, 2024
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests (Theory /Practical /MCQ) at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2611000901066001]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

F.Y.B.C.A.(ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS)
(SEM – 1)

AI-106-03: Introduction to IoT Devices

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

COURSE NAME	**Introduction to IoT Devices**
Semester	**I**
NCrF Credit Level	**Level-4.5**
Course Type	**Skill Enhancement Course**
Course Subtype	**Employability**
Subject Type	**Skill Enhancement course**
Course Code	**AI-106-03**
Course Level	**100-199**
Course Title	**Introduction to IoT Devices (SEC-01)**
Credit	**2 Credits**
Effective From	**Academic Year : 2026-2027**
Course Objective:	• Introduce basic IoT concepts and devices • Develop understanding of Arduino and hardware interfacing • Enable students to build simple circuits • Provide hands-on experience with sensors • Encourage practical learning through experimentation
Course Outcomes	**CO1:** Identify IoT components and devices **CO2:** Understand working of Arduino **CO3:** Build simple circuits **CO4:** Interface basic sensors and devices **CO5:** Develop simple IoT-based applications
Mapping between Cos and PSOs	

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

Course Content	**Unit-1: Concept of IoT** 1.1 Introduction to IoT 1.1.2 Definition of Internet of Things 1.1.2 Everyday examples of IoT devices 1.1.3 Basic components of IoT system 1.1.3.1 Sensors

	1.1.3.2 Actuators 1.1.3.3 Controller 1.2 Basic Electronic Components 1.2.1 LED (Light Emitting Diode) 1.2.1.1 Structure and polarity 1.2.1.2 Applications 1.2.2 Resistor 1.2.2.1 Purpose of resistor 1.2.2.2 Basic idea of resistance 1.2.3 Jumper wires and connectors 1.2.4 Power supply (Battery / USB) 1.3 Breadboard and Circuit Basics 1.3.1 Introduction to breadboard 1.3.2 Internal connections of breadboard 1.3.3 Basic circuit building concepts 1.4 Introduction to Arduino 1.4.1 What is Arduino? 1.4.2 Purpose and importance 1.4.3 Overview of Arduino board components **Unit 2 :** Understanding Arduino and Basic Programming 2.1 Arduino Fundamentals 2.1.1 Introduction to Arduino (with reference to Arduino Uno) 2.1.2 Role of Arduino as controller 2.1.3 Basic architecture (simple explanation) 2.2 Arduino Pins and Connections 2.2.1 Digital pins 2.2.2 Power pins (5V, GND) 2.2.3 Input and Output concept 2.3 Arduino Software Setup 2.3.1 Installation of Arduino IDE 2.3.2 Connecting Arduino to computer 2.3.3 Uploading first program 2.4 Basic Programming Structure 2.4.1 Structure of Arduino program 2.4.1.1 setup() function 2.4.1.2 loop() function 2.4.2 Basic commands (digitalWrite, delay) 2.4.3 Understanding program flow **Unit-3 :** Interfacing Input and Output Devices 3.1 Output Devices 3.1.1 LED as output device 3.1.2 Controlling LED using Arduino 3.2 Input Devices 3.2.1 Push button 3.2.2 Working principle of switch 3.2.3 Reading input from button 3.3 Input–Process–Output Concept 3.3.1 Basic system model 3.3.2 Real-life examples 3.4 Practical Interfacing 3.4.1 LED blinking program

	3.4.2 Button-controlled LED 3.4.3 Changing delay and behavior **Unit-4:** Introduction to Sensors and Basic IoT Applications 4.1 Introduction to Sensors 4.1.1 What is a sensor? 4.1.2 Types of sensors (basic overview) 4.2 Common Sensors 4.2.1 Light sensor (LDR) 4.2.1.1 Working principle 4.2.1.2 Applications 4.2.2 Temperature sensor 4.2.2.1 Basic concept 4.2.2.2 Applications 4.3 Sensor Data Handling 4.3.1 Reading sensor values 4.3.2 Serial Monitor usage 4.3.3 Displaying output 4.4 Basic IoT Applications 4.4.1 Concept of smart devices 4.4.2 Simple automation idea 4.4.3 Introduction to real-world applications 4.4.3.1 Smart lighting 4.4.3.2 Temperature monitoring [Students are expected to work on following suggested Practicals during Lab- hours : 1. Identification of electronic components, 2. LED circuit using battery, 3. Breadboard circuit setup, 4. Arduino LED blinking program, 5. Changing LED blinking speed, 6. Button-controlled LED, 7. Multiple LED blinking, 8. LDR sensor reading, 9. Temperature sensor reading, 10.Display output on Serial Monito] [Suggested components for lab : (One set per 10 students): (i) Arduino Uno – 1, (ii) Breadboard – 1, (iii) USB Cable – 1 (iv) LEDs –10nos. (v) Resistors – Assorted (vi) Jumper wires – Set (vii) Push buttons –3nos. (viii) LDR sensor – 1nos. (ix) Temperature sensor – 1nos.]
Reference Books	1. Getting Started with Arduino (3rd Edition), 978-9352139819, Massimo Banzi, Maker Media 2. Arduino Cookbook, 978-1449313876, Michael Margolis, O'Reilly Media 3. Programming Arduino: Getting Started with Sketches, 978-0071784229, Simon Monk, McGraw-Hill Education 4. Exploring Arduino: Tools and Techniques for Engineering Wizardry, 978-1119405373, Jeremy Blum, Wiley 5. Internet of Things: A Hands-On Approach, 978-0996025515, Arshdeep Bahga and Vijay Madisetti, Universities Press 6. Learning Internet of Things, 978-1788399119, Peter Waher, Packt Publishing 7. Beginning Arduino, 978-1430232401, Michael McRoberts, Apress 8. Make: Electronics (2nd Edition), 978-1680450260, Charles Platt, Maker Media 9. Practical Electronics for Inventors (4th Edition), 978-1259587549, Paul Scherz and Simon Monk, McGraw-Hill Education 10. Hands-On Internet of Things with MQTT, 978-1789341780, Agus Kurniawan, Packt Publishing
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments

Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Practical Unit tests. - Practical exam, viva-voce, E-Journal 50% External assessment. - Practical Exam, viva-voce, E-Journal

[Subject code-2611000903060263]

SKILL ENHANCEMENT COURSES FOR B.SC. (COMPUTER SCIENCE) / B.VOC.(I.T.) B.SC.(C.A.)

Course Code: 306-01
Course Title: EDA using Python

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	3
NCrF Credit Level	5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific
Course Code	306-01
Course Level	200-299
Course Title	EDA using Python
Credit	2 (2 theory)
Effective From	A.Y. 2026 - 27
CourseOutcomes	6. Understand different types of data and sources 7. Identify and handle data errors effectively 8. Use Python libraries for data cleaning and analysis 9. Create meaningful visualizations 10. Perform complete EDA on real-world datasets
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

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

Course Content	**Unit 1: Introduction to Data and Data Sources** **1.2 Types of Data** 1.2.1 Structured, Semi-structured, and Unstructured Data 1.2.2 Qualitative vs Quantitative Data 1.2.3 Discrete vs Continuous Data 1.2.4 Time-series and Cross-sectional Data **1.3 Data Sources** 1.4 .1 Primary vs Secondary Data 1.2.2 Open data sources (government portals, APIs) 1.2.3 Web scraping basics **1.3 Types of Databases** 1.3.1Relational Databases (RDBMS)

	1.3.2 NoSQL Databases (MongoDB, Cassandra) 1.3.3 Data Warehouses and Data Lakes **1.5 Types of Data Files** 1.4.2 CSV, Excel, JSON, XML, TXT 1.4.2. Differences and use cases 1.5.3 File handling basics in Python **1.6 Introduction to Python for EDA** 1.5.2 Python environment setup (Anaconda/Jupyter Notebook) 1.5.2 Basic syntax and data structures (lists, dictionaries, tuples) **Unit 2: Data Quality, Errors, and Cleaning** **2.3 Common Errors in Data** 2.3.1 Missing values (NaN, NULL) 2.3.2 Duplicate data 2.3.3 Inconsistent formats (date, text, units) 2.3.4 Outliers and noise 2.1.5 Typographical errors **2.4 Disadvantages of Poor Data Quality** **2.5 Importance of Data Cleaning** **2.6 Data Cleaning Techniques** 2.6.1 Handling missing values (imputation, deletion) 2.6.2 Removing duplicates 2.6.3 Data type conversion 2.6.4 String cleaning and formatting 2.6.5 Outlier detection and treatment **Unit 3: Python Libraries for Data Cleaning and Analysis** **3.5 Introduction to Key Libraries** 3.1. 1NumPy (numerical operations) 3.1.2 Pandas (data manipulation) **3.6 Pandas Functions for Data Cleaning** 3.6.1 read_csv(), read_excel() 3.6.2 info(), describe() 3.6.3 isnull(), dropna(), fillna() 3.6.4 duplicated(), drop_duplicates() 3.6.5 astype() 3.2.6 apply(), map() **3.7 Data Transformation** 3.7.1 Filtering and sorting data 3.7.2 Grouping (groupby()) 3.7.3 Merging and joining datasets 3.3.4 Feature creation and modification **3.8 Introduction to Data Analysis** 3.8.1 Descriptive statistics 3.8.2 Correlation and covariance 3.4.3 Aggregation techniques **Unit 4: Data Visualization Techniques in Python** **4.1 Importance of Data Visualization** **4.4 Visualization Libraries** 4.4.1 Matplotlib 4.4.2 Seaborn 4.2.3 Plotly (basic introduction) **4.5 Types of Visualizations** 4.5.1 Line charts 4.5.2 Bar charts

	4.5.3 Histograms 4.5.4 Scatter plots 4.5.5 Box plots 4.3.5 Heatmaps
Reference Books	

Sr. No.	Book Name	Author(s)	Publication	ISBN
1	*Python for Data Analysis*	Wes McKinney	O'Reilly Media	978-1491957660
2	*Data Science from Scratch*	Joel Grus	O'Reilly Media	978-1492041139
3	*Practical Statistics for Data Scientists*	Peter Bruce, Andrew Bruce	O'Reilly Media	978-1492072942
4	*Hands-On Data Analysis with Pandas*	Stefanie Molin	Packt Publishing	978-1789615326
5	*Data Wrangling with Python*	Jacqueline Kazil, Katharine Jarmul	O'Reilly Media	978-1491948811
6	*Python Data Science Handbook*	Jake VanderPlas	O'Reilly Media	978-1491912058
7	*Think Stats*	Allen B. Downey	O'Reilly Media	978-1491907337
8	*Introduction to Data Science*	Laura Igual, Santi Seguí	Springer	978-3319500164
9	*Applied Data Science with Python*	Alex Galea	Packt Publishing	978-1786468253
10	*Mastering Pandas*	Femi Anthony	Packt Publishing	978-1789343236

Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level

[Subject code-2611000904060268]

Course Code: 406-1
Course Title: Introduction to Machine Learning

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	4
NCrF Credit Level	5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific
Course Code	406-01
Course Level	200-299
Course Title	Introduction to Machine Learning
Credit	2 (2 theory)
Effective From	A.Y. 2026 - 27
Course Outcomes	1. Explain the basic concepts and evolution of Machine Learning. 2. Classify Machine Learning approaches such as supervised, unsupervised, and reinforcement learning. 3. Apply appropriate Machine Learning techniques to different problem domains. 4. Describe the complete Machine Learning workflow from data collection to model evaluation. 5. Compare various ML techniques based on performance, complexity, and applicability.
Mapping between Course Outcomes(CO) with Program Specific Outcomes(PSO)	

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

Course Content

Unit 1: Introduction to Machine Learning

1.1 History and Evolution of Machine Learning

1.1.1 Early developments and milestones

1.1.2 Evolution from Artificial Intelligence to Machine Learning

1.2 Importance of Machine Learning

1.2.1 Role in modern technology

1.2.2 Impact on industries (healthcare, finance, retail, etc.)

1.3 Why Machine Learning is Required

1.3.1 Limitations of traditional programming

1.3.2 Need for automation and intelligent systems

1.4 Basic Concepts

1.4.1 Data, features, labels

1.4.2 Training and testing datasets

Unit 2: Types of Machine Learning and Use Cases

2.1 Types of Machine Learning

2.1.1 Supervised Learning

2.1.2 Unsupervised Learning

2.1.3 Semi-Supervised Learning
2.1.4 Reinforcement Learning

2.2 Common Algorithms (Overview)
2.2.1 Regression (Linear Regression)
2.2.2 Classification (Decision Trees, KNN)
2.2.3 Clustering (K-Means)

2.3 Use Cases of Machine Learning
2.3.1 Recommendation systems
2.3.2 Fraud detection
2.3.3 Image and speech recognition
2.3.4 Predictive analytics

2.4 Application of Machine Learning
2.4.1 Business applications
2.4.2 Healthcare systems
2.4.3 Smart systems and automation

Unit 3: Machine Learning Process (Lifecycle)

3.1 Steps in Machine Learning Process
3.1.1 Data collection
3.1.2 Data preprocessing
3.1.3 Feature selection and engineering
3.1.4 Model selection
3.1.5 Training and testing
3.1.6 Evaluation and validation

3.2 Model Evaluation Techniques
3.2.1 Accuracy, precision, recall
3.2.2 Confusion matrix
3.2.3 Overfitting and underfitting

3.3 Tools and Platforms (Overview)
3.3.1 Python libraries (Scikit-learn, Pandas, NumPy)
3.3.2 ML development environments

Unit 4: Advantages, Disadvantages, and Characteristics of ML Techniques

4.1 Advantages of Machine Learning

4.2 Disadvantages of Machine Learning

4.3 Characteristics of ML Techniques
4.3.1 Supervised Learning: labeled data, predictive models
4.3.2 Unsupervised Learning: pattern discovery
4.3.3 Reinforcement Learning: reward-based learning

4.4 Comparison of Techniques
4.4.1 Strengths and weaknesses
4.4.2 Suitable scenarios for each method

Reference Books

Sr. No.	Book Name	Author(s)	Publication	ISBN
1	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy	MIT Press	978-0262018029

	2	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	978-0387310732
	3	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	Aurélien Géron	O'Reilly Media	978-1492032649
	4	Introduction to Machine Learning with Python	Andreas C. Müller, Sarah Guido	O'Reilly Media	978-1449369415
	5	Machine Learning	Tom M. Mitchell	McGraw-Hill	978-0070428072
	6	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing	978-1789955750
	7	Understanding Machine Learning: From Theory to Algorithms	Shai Shalev-Shwartz, Shai Ben-David	Cambridge University Press	978-1107057135
	8	Applied Machine Learning	M. Gopal	McGraw-Hill Education	978-0070703698
	9	Machine Learning for Absolute Beginners	Oliver Theobald	Scatterplot Press	978-1530839407
	10	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press	978-0262035613
Teaching Methodology	Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments				
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level				

[Subject code-2511000905060186]

Course Code: 506-01
Course Title: Working with AI Based Software

Program Name	BCA / B.Voc.(I.T.) / B.Sc.(C.A.)/ B.C.A.(A.I. & Data Analytics) / B.C.A. (Cyber Security) / B.C.A. (Data Science)
Semester	5
NCrF Credit Level	5.5
Course Type	SEC
Course Subtype	Skill Development
Subject Type	Discipline Specific, Emerging Technology
Course Code	506-01
Course Level	300 - 399
Course Title	Certificate in Working with AI based Software
Credit	2 (2 Theory)
Effective From	A.Y. 2026 - 27
Course Outcomes	**CO1 :** Understand the core concepts and architecture of AI. **CO2 :** Identify and apply free AI tools for academic, research, and creative tasks. **CO3 :** Use AI tools to automate writing, video creation, and presentation design. **CO4 :** Create engaging academic content with minimal effort using AI platforms. **CO5 :** Make informed and ethical decisions while using AI in their academic journey.

Mapping between Cos and PSOs

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

Course Content

Unit 1: Introduction to Artificial Intelligence (7.5 Hours)

1.6. Definition and history of AI
1.7. Types of AI: Narrow, General, and Super AI
1.8. Applications of AI in education, healthcare, and daily life
1.9. Ethical concerns and responsible AI usage
1.10. AI vs Human intelligence: Myths and facts

Unit 2: Architecture of AI Systems (7.5 Hours)

2.6 AI System components: Input, Processing, Output
2.7 Basic structure of AI algorithms and models
2.8 Role of data, training, and feedback loops in AI
2.9 Concept of Machine Learning, Deep Learning, and Natural Language Processing
2.10 AI workflow: From problem to solution

Unit 3: Free AI Tools for Academic Tasks (7.5 Hours)

3.4 List and demo of AI tools for:
3.4.1 Writing & summarizing (e.g., Grammarly, Quillbot, ChatGPT)
3.4.2 Presentation generation (e.g., Beautiful.ai, Tome.app)
3.4.3 Research assistance (e.g., Elicit.org, Semantic Scholar, Research Rabbit)

	3.5 Benefits and limitations of each tool 3.6 AI tools for document formatting and language translation Unit 4: AI for Multimedia, Video Creation & Study Support (7.5 Hours) 4.7 AI tools for video making (e.g., Pictory, Lumen5, Animoto) 4.8 Text-to-speech and voiceover tools (e.g., ElevenLabs, Natural Readers) 4.9 Image generation tools (e.g., Canva AI, Craiyon, Bing Image Creator) 4.10 AI chatbots as study companions (e.g., Socratic, ChatGPT, You.com) 4.11 Mini-project: Create a study video or presentation using AI tools 4.12 Mini-project: Create website or python project using AI tool.
Reference Books	1. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson Education, ISBN-13: 978-0134610993 2. Artificial Intelligence Basics: A Non-Technical Introduction, Tom Taulli, Apress, ISBN-13: 978-1484235155 3. Machine Learning for Absolute Beginners, Oliver Theobald, CreateSpace, ISBN - 978-1520951400 4. ChatGPT for Beginners, Pam Baker, Wiley, ISBN - 978-1394203783 5. Ethics of Artificial Intelligence, Mark Coeckelbergh, MIT Press, ISBN - 978-0262538190 6. "Artificial Intelligence: A Guide for Thinking Humans", Melanie Mitchell, Farrar, Straus and Giroux (US), ISBN-978-1250758040 7. "AI Basics foryone", Dale Lane, ISBN - 978-1718500563 8. "Hands-On Artificial Intelligence for Beginners", Patrick D. Smith, Packt Publishing Ltd, ISBN - 978-1788991063 9. Generative AI Basics & Beyond, Tom Taulli, Apress, 9781484293538 10. Artificial Intelligence Basics: A Non-Technical Introduction, Tom Taulli, Apress, 9781484233572
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars, Assignments, Viva-Voce/ Presentation
Evaluation Method	50% Internal assessment. - Attendance, Class and home Assignment, Unit tests at college level 50% External assessment. - Test, Presentation, Practical Exam, Viva-Voce at college Level