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 બી.સી.એ. કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬ –૨૭ થી અમલમાં આવનાર T.Y.B.C.A. (Artificial Intelligence and Data Analytics) Semester-5 & 6 નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસ સમિતિની તા.૨૫/૦૩/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૮ થી મંજૂર કરી કોમ્પ્યુટર સાયન્સ ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ ફેકલ્ટીની તા.૨૯/૦૪/૨૦૨૬ની સભાના ઠરાવ ક્રમાંકઃ૦૫ થી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૭/૦૫/૨૦૨૬ની સભાનાં ઠરાવ ક્રમાંકઃ૪૮ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/સિલેબસ/૧૦૦૭૨/૨૦૨૬
તા.૨૧–૦૫–૨૦૨૬

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન બી.સી.એ. કોલેજોનાં આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) 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.C.A(A.I. & DATA ANALYTICS) (HONOUS)**

**(Semester-V and Semester-VI)**

**As per NEP-2020**

**To be implemented from**

**Academic Year: June, 2026-2027**

**(Including Winter Session)**

# Veer Narmad South Gujarat University, Surat

T.Y.B.C.A.(ARTIFICIAL INTELLIGENCE AND DATA ANALYTICS)
(SEM – 5 and SEM – 6)
(w.e.f. Academic Year June, 2026-2027)
Bachelor of Computer Application (B.C.A.)(A.I. & DATA ANALYTICS)
Three Year Program Bachelor of Computer Application
(B.C.A.(A.I. & DATA ANALYTICS)(Hon.))
Four Year Integrated Honours Program

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| **Name of Program** | Bachelor of Computer Application (Artificial Intelligence and Data Analytics) (Honours) |
| **Program Abbreviation** | B.C.A.(A.I. & Data Analytics)(Honours) |
| **Duration** | Four-year Integrated Program. With Multi-Level Entry and Exit option as per NEP. |
| **Eligibility Criteria** | $12^{th}$ (H.Sc.) from any stream with English as one of the subject. |
| **Pre-requisite** | |
| **Medium of Instruction** | English |
| **Objective of Program** | After successful completion of the B.C.A. Specialization in A.I. and Data Analytics, the learners will be able to:<br>Recall fundamental concepts of artificial intelligence, data analytics, machine learning, statistics, and big data technologies.<br>Identify key programming languages, AI frameworks, tools, and data visualization platforms used in analytics and AI applications.<br>Explain the working principles of AI algorithms, machine learning models, and statistical techniques used for data analysis.<br>Describe the role of data management, data preprocessing, and exploratory data analysis in AI-driven systems.<br>Apply programming skills to implement machine learning models and data analytics solutions using appropriate tools and frameworks.<br>Use data analytics and visualization techniques to interpret datasets and derive meaningful insights for real-world problems.<br>Analyze real-world datasets to identify patterns, trends, and relationships using AI and analytical methods.<br>Differentiate between various AI, machine learning, and analytics approaches based on problem requirements and data characteristics.<br>Evaluate the performance, accuracy, and effectiveness of AI-driven solutions using suitable evaluation metrics.<br>Assess ethical, societal, and business implications of AI and data analytics solutions across different industries.<br>Design and develop end-to-end AI and data analytics solutions for real-world applications using big data technologies and advanced analytical tools.<br>Collaborate in projects, internships, and research activities to innovate and propose practical AI-based solutions for industry and societal challenges.<br>Demonstrate proficiency in programming, data analysis, data visualization, AI frameworks, and analytics tools to pursue higher studies or careers as Data Scientist, Data Analyst, Business Intelligence Analyst, Business Analytics Professional, AI Specialist, Prompt Engineer, or Analytics Professional in a rapidly evolving technological environment. |
| **Program Outcome (PO)** | **PO1:** Ability to analyze a problem, identify and define the Computing requirements appropriate to its solution.<br>**PO2:** Enhancing the problem solving, logical, reasoning and analysis capabilities of a problem and integrate the ability with the coding using specific computer programming languages. |

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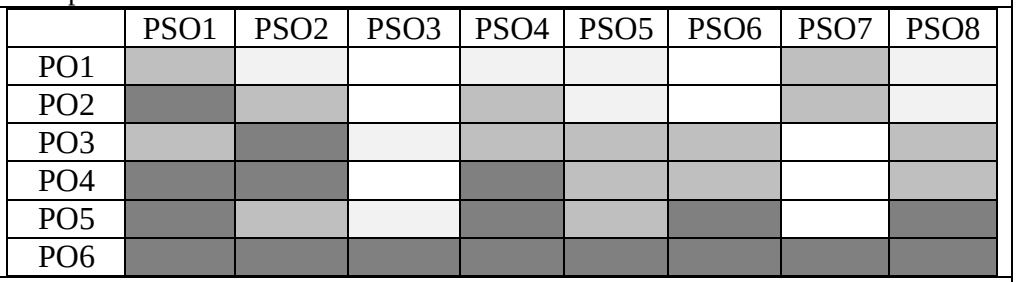
| | **PO3:** To generate Understanding regarding the core and fundamental ideas about the computer platforms, operating systems, software design concepts, networking concepts and advanced and emerging technologies.<br>**PO4:** Design, implement and evaluate a computer-based system, processing, component or program to meet desired goal with the help of various programming languages, application software, packages, tools, databases on various platforms.<br>**PO5:** An ability to apply design and development principles in construction of software systems of varying complexity using various algorithmic principles, modeling, coding and design of computer-based systems.<br>**PO6:** Prepare the aspiring students to become computer software professionals who can work in corporate/software industry at entry to advanced level as well as independent developers.<br>Overall, the program outcomes aim to produce graduates who are: (a) competent in computer application, development and design. (b) Adapt to changing technology and industry trends. (c) Can make significant contributions to the software applications coding, designing, database managements, testing, deployments and ready to adapt any upcoming technologies. |
| **Program Specific Outcomes (PSO)** | **PSO1:** Developing understanding about the fundamentals of core concepts of logic developments, critical thinking and problem solving capabilities. Emphasis on effective communication.<br>**PSO2:** Improving analytical and applied concepts using various technologies, coding concepts and implementation of coding to solve the problems.<br>**PSO3:** Development of team building concepts and working in team with positive approach, enhancing the mindset to contribute as an individual to the team. Improving interpersonal skills.<br>**PSO4:** Improving student's Understanding related to technical problems and enhancing their capabilities to address the problems to turn into solutions through various possible ways by enhancing critical thinking ability.<br>**PSO5:** Develop students to capabilities for self-learning, skill development through self-practicing and problem solving abilities.<br>**PSO6:** Develop students to address and work on the real-world problems as an individual and as part of team. Understand the business problems and ability to work on their solutions by applying various software technologies.<br>**PSO7:** To enhance development skills at various level including problem analysis, data analysis, logical and critical analysis of the problems and implementing the solutions by imparting various recent and upcoming technologies.<br>**PSO8:** Enhance the passion among the students for updating knowledge, innovative ideas, upskilling and implementing the knowledge in applied areas and research areas by understanding the real world problems, addressing the real world problems and their possible solutions that lead to build a successful Professional career. |
| **Mapping between POs and PSOs** |  |
| **Multi-Level Entry and Exit Criteria:** | As per the norms of the Veer Narmad South Gujarat University. |
| **Duration:** | 4 year of B.C.A.(A.I. & Data Analytics) (Honors) degree program with multi-level exit options at 1st, 2nd and 3rd Year to obtain Certificate, Diploma, Degree and Honours Degree in Computer Application respectively. |
| **Eligibility:** | Candidate must have passed standard 12th (H.S.C.) Examination in Science (Any Group) / Commerce / vocational / General stream from Gujarat Higher Secondary Board (G.H.S.E.B.) or any other equivalent board (C.B.S.E. / I.C.S.E. / NIOS etc. which must be approved and possess equivalence |

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| | certificate from Veer Narmad South Gujarat University) with English as one of the subject.<br>In case of candidates passed out from 12th Board from General Stream; having English as one of the subjects. In case of Students passed out with 12th (H.S.C.) vocational stream, Computer and English must be one of the subject. |

# Structure of Program (Semester-wise)

| Course Category | Course Code | Course Title | Mark-sheet 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 | AI-501 | Fundamentals of Linux Operating System (FLOS) | Fundamentals of Linux Operating System (FLOS) | 200-299 | 3 | 1 | 1 | 2 | 4 | 25 | 25 | 25 | 25 | 100 |
| MINOR | AI-502 | Basics of Network Technology Applications | Basics of Network Technology Applications (BNTA) | 200-299 | 3 | 1 | 1 | 2 | 4 | 25 | 25 | 25 | 25 | 100 |
| MAJOR | AI-503 | Applied Artificial Intelligence: Model Development and Deployment (AIMDD) | Applied Artificial Intelligence: Model Development and Deployment (AIMDD) | 400-499 | 2 | 4 | 1 | 2 | 4 | 25 | 25 | 25 | 25 | 100 |
| MAJOR | AI-504 | Artificial Intelligence application using Opensource tools (AIOT) | Artificial Intelligence application using Opensource tools (AIOT) | 400-499 | 3 | 2 | 1 | 2 | 4 | 25 | 25 | 25 | 25 | 100 |
| MAJOR | AI-505 | Artificial Neural Network and Deep Learning (ANN&DL) | Artificial Neural Network and Deep Learning (ANN&DL) | 400-499 | 3 | 2 | 1 | 2 | 4 | 25 | 25 | 25 | 25 | 100 |
| SEC | AI-506 | Web Design and Development (WDD) | Web Design and Development (WDD) | 300-399 | 1 | 2 | - | 2 | 2 | - | 25 | - | 25 | 50 |

**For Practical and Project:**

- Batch Size: Maximum 40 students can be accommodated in a batch. Separate batch should be considered if the student strength exceeds 45 numbers.
- Practical includes Lab. sessions for course-501.
- Seminar and presentation by the students for course-502.
- Practical/Project hours include Lab. sessions of 4 Hours for AI-503 course and 2 Hours each for AI-504, AI-505 and AI-506 per week. The students can work on project in-house/out-house as per their internal guide's guidance. Group of maximum three students can work on a project definition. One Internal Project guide will be allocated to each group. Each group is expected to work minimum 4 hours each on Project-1 and Project-2 per week. Out of which 2 hours will be in supervised mode and balance hours in un-supervised mode.
- The Practical journal/Project final reports must be certified by the concerned faculty and by the Head of the Department, failing which the student will not be allowed to appear for External Practical/Project Examination. Student will submit softcopy of Project duly certified by the internal guide.

**Internship:** A student who wish to exit after successfully completion of Third year (Semester-5 and Semester-6) without any backlog is required to obtain Four credits at the end of the year either through the internship/field-work or university approved two skill based certificate courses(two courses of 2-credits each or one 4-credit course). Student is required to enrol for the certificate courses separately by paying the course fees as decided by the college/institute. For Internship, the Institute/college will grant the permission and evaluate the training outcomes. Based on satisfactory completion of the internship training, the Institute head will recommend to the university to grant four credits for summer training. [All expenses for the internship/skill course/field-work will be bear by the student.]

** Minor/Major Practical based Subjects: Course AI-503, AI-504 AND AI-505 are 4-credit major courses consists of two components: Theory and Practical/Project. Course-AI-501 and is minor course and carry 4 credits consists of two components: Theory and Practical.

For Course-503-01/503-02 and Coruse-504: 2 Hours of Theory and 4 hours of Project contact hours per week are allocated.

For Course 501: 3 Hours of theory and 2 hours of practical per week are allocated.

For Course 505: 3 Hours of theory and 2 hours of practical per week are allocated.

Major courses carry 100 marks of exam weightage (50 theory and 50 practical/project). External and Internal distribution of marks are in ratio of 50:50 respectively. Students are required to acquire minimum passing marks from theory and practical collectively. Practical exams: For Course-501 (2 hours duration), course-505(2 hours duration) and course-506(2 hours duration): 25 marks each.

Project Exam: For course-503-01/503-02 and Coruse-504 – Separate project presentation and viva-voce will be conducted.

External Theory/Practical/Project exam marks (25 marks each for course-501, course-503,504 and 505.)

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-501: Fundamentals of Linux Operating System

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

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| **COURSE NAME** | **Fundamentals of Linux Operating System (FLOS)** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MINOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Minor Discipline Specific** |
| **Course Code** | **AI-501** |
| **Course Level** | **200-299** |
| **Course Title** | **Fundamentals of Linux Operating System (FLOS) (Minor-04)** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1:** Understand: Explain the structure and components of Linux systems.<br>**CO2:** Apply: Use Linux commands for file handling, text processing, and system tasks.<br>**CO3:** Create: Write and execute shell scripts to automate operations.<br>**CO4:** Analyze: Analyze file types, permissions, and directory structures.<br>**CO5:** Apply: Use redirection and pipes to control input/output streams. |
| **Mapping between Cos and PSOs** | |

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

**Course Content**

**Unit 1 :** Introduction to Linux Operating System

1.1 Features of Linux OS

1.2 Components of Linux OS (Hardware, Kernel, Shell, GNU Utilities & Applications)

1.3 Shell in Linux (Bash, Zsh, Dash – Features and Differences)

1.4 Introduction to Files and File Types in Linux (text, binary, special files)

1.5 Linux Directory Structure and File System Hierarchy Standard (FHS)

**Unit 2 :** Basic Linux Commands

2.1 Directory Navigation Commands (pwd, cd, mkdir, rmdir, ls, tree)

2.2 File Management Commands (cat, rm, cp, mv, touch)

2.3 File Permissions and Ownership (chmod, chgrp, chown, umask)

2.4 Common System Commands (who, whoami, man, echo, date, clear)

2.5 Text Processing Commands (head, tail, cut, sort, cmp, tr, uniq, wc, tee)

**Unit-3 :** Process control and Shell-script

3.1 Introduction to Process

3.2 Process Control commands : ps, fg, bg, kill, sleep

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| | 3.3 Creating and Executing Shell Scripts (nano, vi, ./script.sh)<br>3.4 Shell Meta-characters and Operators<br>3.4.1 Filename Expansion (wildcards: *, ?, [])<br>3.4.2 Input/Output Redirection (>, >>, <)<br>3.4.3 Control Flow Structures (if-else, case, for, while, until)<br>**Unit-4:** Text Processing<br>4.1 Logical Operators (&&, \|\|, !)<br>4.2 test and [ ] command for Condition Testing (file, numeric, string)<br>4.3 Arithmetic Operations (expr, $(( )))<br>4.4 Introduction to Regular Expressions (Basic and Extended)<br>4.5 Pattern Matching using grep, egrep, and fgrep |
| **Reference Books** | 1. Operating System: Unix and Linux, Behrouz A. Forouzan and Richard F. Gilberg, Cengage India Pvt. Ltd., ISBN:9788131502980<br>2. UNIX Concepts and Applications, Sumitabha Das, McGraw Hill Education (India), ISBN:9781259006382<br>3. Introduction to UNIX and Shell Programming, M. G. Venkateshmurthy, Pearson Education India, ISBN:9788131704377<br>4. Linux Programming and Administration, N.B. Venkateswarlu, BPB Publications, ISBN:9788176567813<br>5. UNIX and Shell Programming, B.A. Forouzan & F. Gilberg, Cengage Learning India, ISBN:9788131508050<br>6. Linux Command Line and Shell Scripting Bible, Richard Blum and Christine Bresnahan, Wiley India Pvt. Ltd., ISBN:9788126562169<br>7. How Linux Works: What Every Superuser Should Know, Brian Ward, No Starch Press, ISBN:9781593275679<br>8. The Linux Programming Interface, Michael Kerrisk, No Starch Press, ISBN:9781593272203<br>9. Linux Pocket Guide, Daniel J. Barrett, O'Reilly Media, ISBN:9781491927571<br>10. UNIX and Linux System Administration Handbook, Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education, ISBN:9780134277554 |
| **Teaching Methodology** | Class Work, Discussion, Lab work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment, Unit tests.<br>- Practical exam, viva-voce, E-Journal<br>50% External assessment.<br>- Written Theory exam<br>- Practical Exam, viva-voce, E-Journal |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-502: Basics of Network Technology Applications

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

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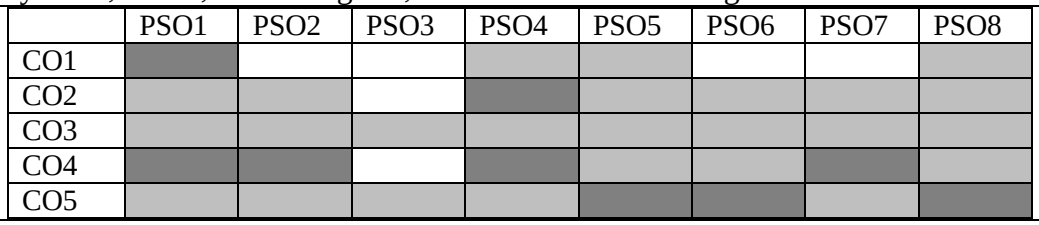
| **COURSE NAME** | **Basics of Network Technology Applications** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MINOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Minor - Discipline Specific** |
| **Course Code** | **AI-502** |
| **Course Level** | **200-299** |
| **Course Title** | **Basics of Network Technology Applications (BNTA) (Minor-05)** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1:** Understand the basic concepts of computer networks, their need, types, topologies, and common networking terminologies used in real-life scenarios.<br>**CO2:** Explain the concepts, architecture, and working of Internet and Intranet systems, including the role of network devices, cables, servers, and ISPs.<br>**CO3:** Describe mobile ad-hoc networks (MANET) and their applications such as VANET, SPAN, and FANET, along with the basic structure and purpose of the OSI model.<br>**CO4:** Identify and differentiate network protocols, IP addressing concepts, data packets, and security aspects including HTTP vs HTTPS and encryption mechanisms.<br>**CO5:** Apply knowledge of application layer services to explain the working of email systems, URLs, search engines, and website access using real-world case studies. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **Unit-1: Introduction to Network**<br>**1.1 Basics of Network**<br>Meaning of computer network,<br>Why networks are needed (data sharing, internet access, communication), Examples: college lab network, mobile hotspot, cloud systems<br>**1.1.1 Types of Networks**<br>Personal networks (mobile, laptop, Wi-Fi), Office and campus networks, Internet as a global network |

**1.1.2 Different Topologies (Bus, Ring, Star, Mesh, Tree)**

**1.2 Types of Networks (LAN, MAN, WAN)**

LAN: college lab / office network, MAN: city-level network, WAN: internet and cloud platforms

**1.3 Terminologies :**

1.3.1 Intranet vs Internet

1.3.2 Unicast, Broadcast and Multicast

1.3.3 Simple examples using email, WhatsApp, and live streaming

## Unit-2: Internet and Intranet

**2.1 Concepts of Internet and Intranet**

2.1.1 Meaning and purpose of Internet and Intranet,

2.1.2 Role of networks in cloud computing and AI services

2.1.3 Working of Internet and its Architecture

How data travels from one computer to another, Role of servers, ISPs, and data packets, Simple explanation of request and response

**2.2 Working of Intranet and its Architecture**

2.2.1 Internal network communication within an organization,

2.2.1.1 Access control and restricted usage

2.2.2 Case study of college ERP and library system.

2.2.3 Network Devices Terminologies

2.2.3.1 Hub, Modem, Switch, Gateway, Access Point

**2.3 Types of Cables**

2.3.1 Co-axial cable (basic idea and usage), UTP cable (Ethernet cable used in labs)

2.3.2 Fiber optic cable (high-speed internet concept), Practical identification of cables

## Unit-3: Mobile Ad-hoc Network

**3.1 Concepts and Types of MANET (Mobile Ad hoc Network)**

Meaning of wireless networks without fixed infrastructure, Temporary and dynamic networks, Examples: disaster recovery, temporary events

3.1.1 VANET (Vehicular Ad hoc Network)

Case Study: Communication between vehicles, Smart traffic systems and navigation

3.1.2 Smart Phone Ad hoc Network (SPAN)

Mobile-to-mobile communication, Bluetooth and hotspot-based networks

3.1.3 Flying Ad hoc Network (FANET)

Drone-based communication networks, Usage in surveillance and delivery systems

**3.2 Concepts of OSI (Open Systems Interconnection) Layers**

Purpose of OSI model and their significance.

3.2.1 Introduction of OSI Layers and Their Purpose

3.2.1.1 Physical layer: data transmission

3.2.1.2 Data Link layer: error handling

3.2.1.3 Network layer: routing and IP

3.2.1.4 Transport layer: reliable communication

3.2.1.5 Session layer: session control

3.2.1.6 Understanding it with Real-life analogy using courier delivery.

**3.3 Important Protocols of Network Layers**

3.3.1 Concepts of Data Packets and Datagram

Breaking data into small packets, Packet transmission and reassembly

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| | 3.3.2 Presentation Layer Protocols and Their Purpose<br>SSL: secure data transmission, HTTP: web communication<br>FTP: file transfer, Telnet: remote login (concept only)<br>3.3.3 Concepts of IP Address<br>3.3.3.1 Meaning of IP address<br>3.3.3.2 Private vs public IP (basic idea)<br>3.3.3.3 Checking IP address practically<br>3.4 Difference Between HTTP and HTTPS<br>3.4.1 Security difference<br>3.4.2 Role of encryption<br>**Unit-4: Mail Services**<br>**4.1 Application Layer Services**<br>4.1.1 Working of Email Account and Services<br>4.1.1.1 Sending and receiving emails<br>4.1.1.2 Role of mail servers<br>4.1.2 URL and URL Types (Absolute and Relative)<br>4.1.2.1 Meaning of URL, Examples of absolute and relative URLs<br>**4.2 Case Study of Email**<br>4.2.1From Sender to Receiver<br>4.2.1.1 Mailer → Mail Server → Mailbox<br>4.2.1.2 Step-by-step flow of email<br>**4.3 Case Study of Locating Website**<br>4.3.1 URL and Locating URL<br>4.3.1.1 Entering URL in browser<br>4.3.1.2 Understanding domain name<br>[Students will work on a real-life scenario of Network implementation and prepare a presentation. Seminar internal/external viva-presentation will be conducted.] |
| **Reference Books** | 1. Computer Networks, Andrew S. Tanenbaum, Pearson, ISBN: 9780132126953<br>2. Computer Networking: A Top-Down Approach, James F. Kurose & Keith W. Ross, Pearson, ISBN: 9780133594140<br>3. Data Communications and Networking, Behrouz A. Forouzan, McGraw-Hill Education, ISBN: 9780071326285<br>4. Computer Networking: Principles, Protocols and Practice, Olivier Bonaventure, Self-published, ISBN: 9780994000403<br>5. Computer Networks: A Systems Approach, Larry L. Peterson & Bruce S. Davie, Elsevier, ISBN: 9780123850591<br>6. Networking: A Beginner's Guide, Bruce Hallberg, McGraw-Hill Education, ISBN: 9780072226786<br>7. Data and Computer Communications, William Stallings, Pearson, ISBN: 9780133506488<br>8. Computer Networks and Internets, Douglas E. Comer, Pearson, ISBN: 9780136067416<br>9. Network Warrior, Gary A. Donahue, O'Reilly Media, ISBN: 9781449387866 10.<br>10. High-Performance Browser Networking, Ilya Grigorik, O'Reilly Media, ISBN: 9781449344760 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment, Unit tests.<br>- Seminar, Presentation and viva-voce<br>50% External assessment.<br>- Written Theory exam<br>- Seminar, Presentation and viva-voce |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-503: Applied Artificial Intelligence: Model Development and Deployment

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

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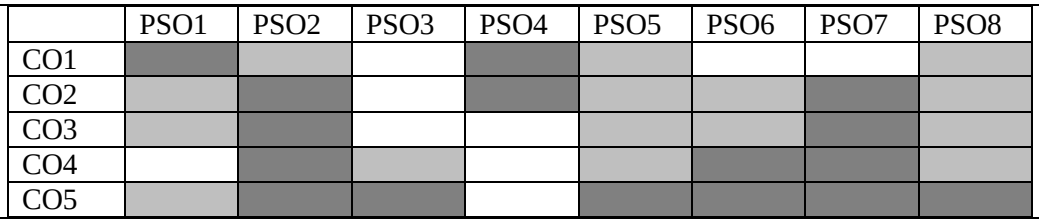
| **COURSE NANME** | **Applied Artificial Intelligence: Model Development and Deployment (AIMDD)** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability and Applied** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-503** |
| **Course Level** | **400-499** |
| **Course Title** | **Applied Artificial Intelligence: Model Development and Deployment (AIMDD)** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1:** Understand and explain the fundamental concepts of Artificial Intelligence, Machine Learning, and their role in solving real-world problems.<br>**CO2:** Apply appropriate machine learning techniques such as association rule mining, reinforcement learning, and ensemble learning to analyze datasets and build predictive models.<br>**CO3:** Implement machine learning algorithms using Python libraries and evaluate model performance using suitable metrics.<br>**CO4:** Design and deploy trained machine learning models by saving, loading, and integrating them into web applications using Flask and Streamlit.<br>**CO5:** Create end-to-end AI applications that demonstrate data processing, model inference, and user interaction through web-based interfaces. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **Unit-1 : Streamlit Fundamentals for AI Applications**<br>1.1 Setting up Development Environment for Streamlit<br>1.1.1 Installing Python, required libraries for Streamlit<br>1.1.2 Creating and running first Streamlit application<br>1.1.3 Understanding execution flow of a Streamlit app<br>1.2 Designing Interactive User Interfaces using Streamlit<br>1.2.1 Creating UI elements (text, headers, sidebar, columns)<br>1.2.2 Capturing user inputs using sliders, text inputs, dropdowns and buttons<br>1.2.3 Displaying outputs dynamically based on user interaction |

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| | 1.2.4 Designing Interactive User Interfaces using Streamlit<br>1.2.4.1 Capturing user input: Core Streamlit Commands (st.title(), st.header(), st.sidebar.selectbox(), st.slider(), st.text_input(), st.button(), st.dataframe(), st.line_chart(), st.pyplot(), st.session_state)<br>1.3 Data Visualization for Analytics Applications<br>1.3.1 Displaying datasets using tables and dataframes<br>1.3.2 Generating interactive charts using Streamlit<br>1.3.3 Applying filters and conditions for real-time analytics<br>1.4 Mini Application Development using Streamlit<br>1.4.1 Building a basic analytics dashboard using a sample dataset<br>1.4.2 Displaying summary statistics and visual insights<br>1.5 Working with Real-World Datasets<br>1.5.1 Loading CSV and Excel datasets into Streamlit<br>1.5.2 Preparing datasets for analytics and machine learning<br>1.5.3 Connecting Streamlit Applications with SQLite<br>1.5.3.1 Fetching data from SQLite and displaying in Streamlit UI<br>1.5.3.2 Implementing user-driven data queries and filters<br>1.5.3.3 Performing CRUD operations through Streamlit interface<br>1.6 Storing and Retrieving Application Results<br>1.6.1 Saving analytics results and user inputs in database<br>1.6.2 Displaying historical data and comparison reports<br>**Unit-2 : Learning Algorithms for Analytics and Intelligent Systems**<br>2.1 Un-supervised learning algorithms<br>2.1.1 Overview of learning paradigms and use-cases<br>2.1.2 Concepts of Association rule<br>2.1.3 Apriori Algorithm and its implementation.<br>2.1.4 FP-Growth Algorithm and its implementation<br>2.2 Reinforcement Learning<br>2.3 Ensemble learning.<br>2.4 Performance matrix evaluation<br>2.5 Parameter tuning<br>**Unit–3: Model Deployment using Flask and Streamlit**<br>3.1 Introduction to Model Deployment<br>3.1.1 Concept of Machine Learning Model Deployment<br>3.1.2 Difference between Model Training and Model Deployment<br>3.2 Concept of Model Persistence<br>3.2.1 Need for Saving Trained Models<br>3.2.2 Serialization Techniques in Python: Pickle, Joblib<br>3.2.3 Loading Saved Models for Reuse<br>3.3 Flask Framework for Backend Development<br>3.3.1 Introduction to Flask Framework<br>3.3.1.1 Role of Flask in Machine Learning Deployment<br>3.3.1.2 Flask Application Structure<br>3.3.1.3 Defining Routes<br>3.3.1.4 Handling HTTP Requests and Responses<br>3.3.2 Integrating Trained ML Model with Flask<br>3.3.2.1 Developing RESTful Prediction API<br>3.3.2.2 Testing Flask API using Client Tools<br>3.4 Integration of Streamlit with Flask<br>3.4.1 Client–Server Architecture Overview<br>3.4.2 Communication between Streamlit and Flask using HTTP<br>3.4.3 Sending User Input from Streamlit to Flask API<br>3.4.4 Receiving Prediction Response from Flask<br>3.4.5 Displaying API Results in Streamlit Interface<br>3.5 Introduction to FastAPI for Model Deployment |

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| | 3.5.1 Overview of FastAPI<br>3.5.1.1 Key features and advantages (speed, async support, automatic docs)<br>3.5.1.2 Comparison with Flask (performance, ease of use)<br>3.5.2 Building Simple FastAPI Endpoints<br>3.5.2.1 Creating basic API (GET, POST)<br>3.5.2.2 Running FastAPI using Uvicorn<br>3.5.3 FastAPI for ML Model Serving<br>3.5.3.1 Loading trained model<br>3.5.3.2 Creating prediction API<br>**Unit-4. Model implementation workflow**<br>4.1 End-to-End ML Deployment Workflow<br>4.1.1 Training, saving and loading Machine Learning Model<br>4.1.2 Backend Model Serving using Flask<br>4.1.3 Frontend Interaction using Streamlit<br>4.1.4 Complete Prediction Flow from User to Model<br>4.2 Error Handling and Validation<br>4.2.1 Input Validation Techniques<br>4.2.2 Handling API Errors and Exceptions<br>4.2.3 Debugging Flask and Streamlit Applications<br>4.3 Deployment and Execution<br>4.3.1 Running Flask Server<br>4.3.2 Running Streamlit Application<br>4.3.3 Local Deployment of ML Application<br>4.3.4 Basic Introduction to Production Deployment Concepts<br>4.4 Practical Implementation and Mini Projects<br>4.4.1 Deployment of Classification and regression Model<br>4.4.2 Integration of Multiple Input Features<br>4.4.3 User-Friendly Prediction Interface Design<br>4.4.4 End-to-End ML Deployment Mini Project |
| **Reference Books** | 1. Deploy Machine Learning Models to Production by Pramod Singh (Apress), ISBN: 9781484265451<br>2. Machine Learning Engineering with Python by Andrew P. McMahon (Packt Publishing), ISBN: 9781837631964<br>3. Practical MLOps by Noah Gift (O'Reilly Media), ISBN: 9781098103019<br>4. Scalable Artificial Intelligence Systems by Swarup Panda (Deep Science Publishing), ISBN: 978-93-7185-753-6<br>5. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig (Pearson), ISBN: 9780134610993<br>6. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Aurélien Géron (O'Reilly Media), ISBN: 9781098125944<br>7. Building Machine Learning Powered Applications by Emmanuel Ameisen (O'Reilly Media), ISBN: 9781098115786<br>8. Flask Web Development by Miguel Grinberg (O'Reilly Media), ISBN: 9781491991732<br>9. Python for Data Analysis by Wes McKinney (O'Reilly Media), ISBN: 9781491957660<br>10. Designing Data-Intensive Applications by Martin Kleppmann (O'Reilly Media), ISBN: 9781449373320<br>11. Operationalizing Machine Learning Pipelines: Building Reusable and Reproducible Machine Learning Pipelines Using MLOps, Vishwajyoti Pandey and Shaleen Bengani, BPB Publications, India, ISBN: 9789355510235<br>12. Machine Learning using Python, Manaranjan Pradhan and U Dinesh Kumar, Wiley India, 9789370609167. |

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| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment, Unit tests.<br>- Project Presentation and viva-voce<br>50% External assessment.<br>- Written Theory exam<br>- Project Presentation and Viva-voce<br>[In-house project will be assigned by the concerned faculty member of the institute. Students are expected to work on the project covering all units contents and present it during the internal and external Project exam evaluation.] |

**[Subject code for Theory-2611000905022003] [Subject code for Practical-2611000905022004]**

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-504: Artificial Intelligence application using Opensource tools

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

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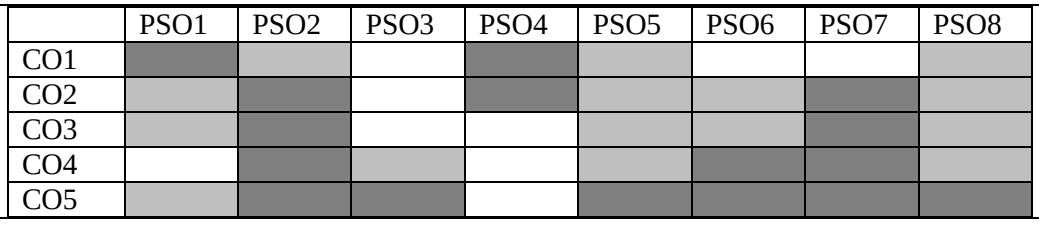
| **COURSE NANME** | **Artificial Intelligence application using Opensource tools (AIOT)** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability and Applied** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-504** |
| **Course Level** | **400-499** |
| **Course Title** | **Artificial Intelligence application using Open source tools (AIOT)** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1:** Understand the architecture, core components, and working principles of Generative AI models and Large Language Models (LLMs).<br>**CO2:** Apply prompt engineering techniques to design effective prompts for text generation, code generation, reasoning, and decision-support tasks.<br>**CO3:** Implement and analyze open-source Generative AI models and tools to generate content, software code, and data-driven insights.<br>**CO4:** Design and develop simple AI agents and agentic workflows that perform autonomous, goal-oriented tasks.<br>**CO5:** Evaluate ethical considerations and develop real-world Generative AI applications following responsible AI practices. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **UNIT 1: Foundations of Generative AI and LLMs:**<br>1.1 Evolution of Artificial Intelligence<br>1.1.1 Chronology of development from Symbolic AI, Machine Learning, Deep Learning, Generative AI<br>1.1.2 Limitations of traditional ML<br>1.1.3 Why Generative AI is disruptive<br>1.2 Generative AI Concepts<br>1.2.1 Understanding generation vs prediction<br>1.2.2 Tokens, embeddings, context window (conceptual)<br>1.2.3 Text, image, audio, video generation<br>1.3 Large Language Models (LLMs)<br>1.3.1 Transformer idea |

1.3.2 Pre-training vs fine-tuning
1.3.3 Instruction-tuned models
1.3.4 Multimodal LLMs
1.3.5 Practical view of inference pipeline
(prompt → tokens → model → output)
1.4 Open-Source Generative AI Ecosystem
1.4.1 Open vs closed models
1.4.2 Model hubs and repositories
1.4.3 Running models locally vs cloud
1.5 Small Language Models (SLMs) and On-Device Generative AI .
1.5.1 What are Small Language Models (SLMs)
1.5.2 On-device vs cloud-based LLMs
1.5.3 Resource constraints: memory, compute, energy
1.5.4 Privacy-preserving AI and offline inference
1.5.5 Industry slang and trends (e.g., "Nano models", "Nano Banana")
[Suggested Open source tools for Unit-1 : (i) Hugging Face – model hub & transformers (ii) Ollama – run LLMs locally (iii) LM Studio – local inference UI]
[Unit-1 Practical to implement : (i) Explore open-source LLMs (ii) Run a local model using Ollama / LM Studio (iii) Compare outputs of different models for same prompt]

**UNIT 2: Prompt Engineering**
2.1 Fundamentals of Prompt Engineering
2.1.1 Prompt anatomy: role, task, context, constraints, output format
2.1.2 Prompt vs query
2.1.3 Prompt failure cases
2.2 Prompting Techniques
2.2.1 Zero-shot, few-shot prompting
2.2.2 Role-based prompting
2.2.3 Step-by-step prompting
2.2.4 Self-refinement prompts
2.3 Advanced Prompt Strategies
2.3.1 Prompt templates
2.3.2 Prompt chaining
2.3.3 Reducing hallucinations
2.3.4 Evaluation of prompt quality
2.4 Domain-Specific Prompt Engineering
2.4.1 Programming & debugging prompt
2.4.2 Data analysis & reporting prompt
2.4.3 Education & teaching aids prompt
2.4.4 Research writing prompt
2.4.5 Business communication prompt
[Suggested Open source tools for Unit-2 : (i) LangChain – prompt chaining & workflows (ii) Haystack – QA & pipelines (iii) Promptfoo – prompt evaluation]
[Unit-2 Practical to implement : (i) Design prompt templates (ii) Prompt comparison experiments (iii) Build a prompt-based AI assistant using LangChain]

**UNIT 3: Agentic AI and Autonomous Systems**
3.1 Introduction to Agentic AI
3.1.1 What makes AI "agentic"
3.1.2 Reactive AI vs autonomous AI
3.1.3 Planning, memory, tools, action loop
3.1.4 Agent lifecycle: goal → plan → act → observe → reflect
3.2 Architecture of AI Agents
3.2.1 Agent components:
3.2.2 LLM brain

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| | 3.2.3 Tool calling<br>3.2.4 Short-term & long-term memory<br>3.2.5 Feedback loop<br>3.2.6 Single-agent vs multi-agent systems<br>3.3 Agentic AI Frameworks<br>3.3.1 Tool-using agents<br>3.3.2 Task decomposition<br>3.3.3 Autonomous execution<br>3.4 Applications of Agentic AI<br>3.4.1 Research assistant agent<br>3.4.2 Coding agent<br>3.4.3 Data analysis agent<br>3.4.4 Report generation agent<br>[ Suggested Open source tools for Unit-3 : (i) AutoGen – multi-agent collaboration (ii) CrewAI – role-based agents (iii) Semantic Kernel – agent planning & memory]<br>[Unit-3 Practical to implement : (i) Build a single-task AI agent (ii) Create a multi-agent workflow (planner + executor) (iii) Agent-based research summarizer]<br><br>**UNIT 4: AI Tools, Application Development & Ethics**<br>4.1 Generative AI Tools for Application Development<br>4.1.1 AI for Text generation, Image generation<br>4.1.2 AI for Code generation, Data analytics, Presentation & documentation<br>4.2 Open-Source AI for Images & Multimedia<br>4.2.1 Image diffusion models<br>4.2.2 Text-to-image pipelines<br>4.2.3 Prompt-based image control<br>4.2.4 Edge AI, On-Device Agents and Lightweight LLMs<br>4.2.4.1 Lightweight agents on laptops and mobiles<br>4.2.4.2 Local inference using small models<br>4.2.4.3 Role of nano/SLM models in autonomous agents<br>4.2.4.4 Trade-offs: accuracy vs latency vs cost<br>4.3 Building AI Applications<br>4.3.1 AI backend using simple UI<br>4.3.2 Local deployment concepts<br>4.3.3 Integrating AI with Python apps<br>4.4 Ethics, Governance & Responsible AI<br>4.4.1 Bias & fairness<br>4.4.2 Data privacy<br>4.4.3 Copyright & originality<br>4.4.4 Human-in-the-loop AI<br>4.5 Mini Capstone Project<br>4.5.1 Problem identification<br>4.5.2 Prompt + agent design<br>4.5.3 Tool selection<br>4.5.4 Application implementation<br>4.5.5 Ethics reflection<br>[Suggested Open source tools for Unit-4 : (i) Stable Diffusion – image generation (ii) Gradio – quick AI UI (iii) Streamlit – AI apps (iv) FastAPI – AI backend APIs]<br>[Unit-4 Practical to implement : (i) Build a Generative AI web app (ii) Image generation application (iii) AI-powered report generator]<br>[Suggested Open Source tools for reference :<br>LLMs: Hugging Face models, Ollama<br>Prompting & orchestration: LangChain, Haystack<br>Agents: AutoGen, CrewAI, Semantic Kernel<br>UI & deployment: Streamlit, Gradio, FastAPI<br>Image AI: Stable Diffusion] |

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| **Reference Books** | 1. Generative AI: Techniques, Models and Applications, Author: Rajan Gupta, Sanju Tiwari, Poonam Chaudhary , Publication: Springer Cham, ISBN: 978-3-031-82061-8.<br>2. Practical Generative AI: From Concept to Deployment — Building and Deploying Ethical AI-Powered Solutions, Author: Pramod Singh & James McKeone, Publication: Springer Nature / Apress, ISBN: 979-8-8688-1478-5<br>3. Large Language Models: An Introduction, Author: Oswald Campesato, Publication: Mercury Learning & Information, ISBN: 978-1501523298<br>4. Prompt Engineering for Generative AI: Future-Proof Inputs for Reliable AI Outputs, Author: James Phoenix & Mike Taylor, Publication: O'Reilly Media, ISBN: 978-1098153434<br>5. Agentic AI: Theories and Practices, Author: Ken Huang, Publication: Springer Cham, ISBN: 978-3-031-90025-9<br>6. Deep Learning, Author: Ian Goodfellow, Yoshua Bengio, Aaron Courville Publication: MIT Press, ISBN: 978-0262035613<br>7. Artificial Intelligence: A Modern Approach, Author: Stuart Russell, Peter Norvig, Publication: Pearson, ISBN: 978-0134610993<br>8. Title: Building Chatbots with Python: Using NLP and AI, Author: Sumit Raj Publication: Apress, ISBN: 978-1484240954<br>9. Title: Machine Learning Using Python, Author: Manaranjan Pradhan, U. Dinesh Kumar, Publication: Wiley India, ISBN: 978-9370609167<br>10. Title: Artificial Intelligence and Machine Learning, Author: P. Radha Krishna, R. Rathipriya, P. Subbalakshmi, Publication: SciTech Publications (India), ISBN: 978-9388178480 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment, Unit tests.<br>- Capstone Project development, Presentation and viva-voce<br>50% External assessment.<br>- Written Theory exam<br>- Capstone Project Development, Presentation and Viva-voce<br>[In-house project will be assigned by the concerned faculty member of the institute. Students are expected to work on the project covering all units contents and present it during the internal and external Project exam evaluation.] |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-505: Artificial Neural Network and Deep Learning

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

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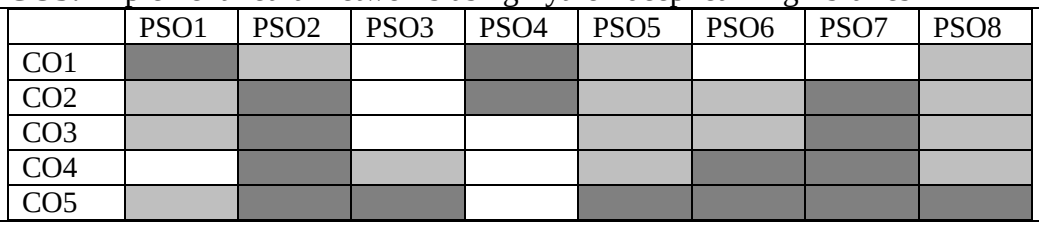
| **COURSE NAME** | **Artificial Neural Network and Deep Learning (ANN&DL)** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability and Applied** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-505** |
| **Course Level** | **400-499** |
| **Course Title** | **Artificial Neural Network** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1**: Understand fundamentals of neural networks and learning mechanisms<br>**CO2:** Design and train ANN models for real datasets<br>**CO3:** Explain deep learning architectures and training challenges<br>**CO4:** Build CNN models for image classification tasks<br>**CO5:** Implement neural networks using Python deep learning libraries |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **UNIT 1: Fundamentals of Artificial Neural Networks (ANN)**<br>1.1 Biological Inspiration & Neural Model<br>1.1.1 Human brain vs artificial neuron<br>1.1.2 Neuron structure: input, weight, bias, activation<br>1.2 Mathematical Model of ANN<br>1.2.1 Weighted sum<br>1.2.2 Understanding Activation functions:<br>1.2.2.1 Step<br>1.2.2.2 Sigmoid<br>1.2.2.3 ReLU<br>1.2.2.4 Softmax<br>1.3 ANN Architecture<br>1.3.1 Single-layer perceptron<br>1.3.2 Multi-layer perceptron (MLP)<br>1.3.3 Input, hidden, output layers<br>1.4 Learning in ANN<br>1.4.1 Forward propagation<br>1.4.2 Loss functions (MSE, Cross-Entropy) |

1.4.3 Backpropagation (conceptual, no derivation)
1.4.3 Error flow from output layer to input layer
1.4.4 Gradient descent (intuition)

[Unit-1 : Suggested Practicals: (i) Build a simple ANN using Python (ii) Predict student performance, house price, marks dataset(use open datset)]

**UNIT 2: Deep Learning Concepts & Training Techniques**

2.1 Introduction to Deep Learning
2.1.1 Difference between ANN and Deep Learning
2.1.2. Significance of deep networks work better
2.1.3 Role of data size and depth in deep learning performance
2.2 Deep Neural Network Architecture
2.2.1 Deep Multilayer perception (MLP)
2.2.2 Vanishing gradient problem
2.2.3 Overfitting in deep networks
2.3 Optimization Techniques (Intuition)
2.3.1 Batch, mini-batch learning
2.3.2 Learning rate tuning
2.3.3 Optimizers: SGD(Stochastic Gradient Descent), Adam, AdaGrad (Adaptive Gradient Algorithm), RMSProp
2.4 Regularization Techniques
2.4.1 Dropout
2.4.2 Early stopping
2.4.3 Batch normalization

[Unit-2 : Suggested Practicals: Build a deep neural network for: (i) Email spam classification, (ii) Customer churn prediction]

**UNIT 3: Convolutional Neural Networks (CNN)**

3.1 Introduction to CNN
3.1.1 Why ANN fails for images
3.1.2 CNN intuition using images
3.2 CNN Components
3.2.1 Convolution layer
3.2.2 Filters & feature maps
3.2.3 Pooling (max & average)
3.2.4 Flattening
3.2.5 Stride and padding (conceptual)
3.3 CNN Architecture
3.3.1 Basic CNN model
3.3.2 CNN vs ANN comparison
3.3.3 Overfitting in CNN
3.4 Applications of CNN
3.4.1 Image classification
3.4.2 Face recognition
3.4.3 Medical image analysis

[Unit-3: Suggested Practicals :Image classification using CNN : (i) image classification(two class classification (ii) Multi-class classification (iii) face classification (iv) medical image classification (use Datasets from open source MNIST / CIFAR-10 /Kaggle]

**UNIT 4: Tools, Frameworks & Real-World Applications**

4.1 Deep Learning Frameworks
4.1.1 Overview of TensorFlow
4.1.2 Keras API
4.1.3 Introduction of PyTorch (intro)
4.2 Model Evaluation

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| | 4.2.1 Accuracy, precision, recall<br>4.2.2 Confusion matrix<br>4.2.3 Overfitting vs underfitting<br>4.2.4 Comparison of ANN vs CNN accuracy<br>4.3 Deployment Concepts (Local deployment only)<br>4.3.1 Saving and loading models<br>4.3.2 Using trained models for prediction<br>4.3.3 Introduction of Streamlit for DL apps<br>4.4 Ethical Issues & Future Trends<br>4.4.1 Bias in AI models<br>4.4.2 Explainability<br>4.4.3 Future of deep learning<br>[Unit-4: Suggested Practicals : (i) Build a CNN-based image classifier web app (ii) Deploy model locally using Streamlit]<br>[Laboratory Mini Projects: (i) ANN for student result prediction (ii) ANN-based diabetes prediction (iii) Deep neural network for credit risk (iv) CNN for handwritten digit recognition (v) CNN for plant disease detection (vi) Face mask detection using CNN (vii) Emotion recognition from images (viii) Image classifier web app using Streamlit (ix) Transfer learning demo (basic)<br>[Suggested Tools & Technologies : Python, NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow / Keras, Google Colab] |
| **Reference Books** | 1. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 9780262035613<br>2. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson, 9780134610993<br>3. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, 9781098125944<br>4. Deep Learning with Python, François Chollet, Manning Publications, 9781617296864<br>5. Neural Networks and Deep Learning, Charu C. Aggarwal, Springer, 9783319944623<br>6. Practical Deep Learning for Cloud, Mobile, and Edge, Anirudh Koul, Siddha Ganju, Meher Kasam, O'Reilly Media, 9781492034861<br>7. Machine Learning Using Python, Manaranjan Pradhan, U. Dinesh Kumar, Wiley India, 9789350609167 *(Indian Publisher)*<br>8. Artificial Intelligence and Machine Learning, P. Radha Krishna, R. Rathipriya, P. Subbalakshmi, SciTech Publications (India), 9789388178480 *(Indian Publisher)*<br>9. Operationalizing Machine Learning Pipelines, Vishwajyoti Pandey, Shaleen Bengani, BPB Publications (India), 9789355510235 *(Indian Publisher)*<br>10. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, 9780387310732<br>11. Deep Learning for Computer Vision, Rajalingappaa Shanmugamani, Packt Publishing, 9781788295628<br>12. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer, 9781848829343 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment, Unit tests.<br>- Project Presentation and viva-voce<br>50% External assessment.<br>- Written Theory exam<br>- Practical and viva-voce |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 5)

## AI-506: Web Design and Development

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

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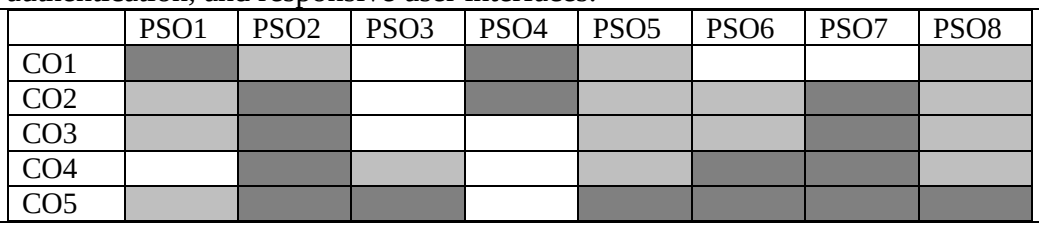
| **COURSE NANME** | **Web Design and Development** |
| **Semester** | **Vth** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **S.E.C. (Skill Enhancement Course)** |
| **Course Subtype** | **Skill based and Applied** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-506** |
| **Course Level** | **300-399** |
| **Course Title** | **Web Design and Development (WDD)** |
| **Credit** | **2 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1:** Understand and explain web application architecture, including the client–server model and the differences between static, dynamic, and data-driven web applications.<br>**CO2:** Apply jQuery to design interactive web pages using selectors, events, DOM manipulation, form handling, and animation effects.<br>**CO3:** Analyze and implement JSON-based data representation and AJAX communication to enable asynchronous data exchange between client and server.<br>**CO4:** Develop server-side web applications using PHP with SQLite database, performing CRUD operations and form processing.<br>**CO5:** Design and deploy a full-stack web application using the Laravel framework, implementing MVC architecture, database integration, authentication, and responsive user interfaces. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **UNIT – 1: Web & Application Fundamentals**<br>1.1 Web Application Architecture<br>1.1.1 Client–server model<br>1.1.2 Static vs dynamic vs data-driven apps<br>1.1.3 Traditional web stack vs Python-based app stack<br>1.2 Introduction to JQuery<br>1.2.1 Overview of jQuery<br>1.2.2 Need for jQuery in web development<br>1.2.3 jQuery vs JavaScript (why jQuery is used)<br>1.2.4 jQuery syntax and structure<br>1.2.5 Including jQuery in a web page |

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| | 1.3 Query Selectors<br>1.3.1 Element, ID and class selectors<br>1.3.2 Attribute and Hierarchy selectors<br>1.3.3 Practical examples on HTML forms and tables<br>1.4 jQuery Events<br>1.4.1 Common events: click, change, submit, hover<br>1.4.2 keyboard and mouse events<br>1.4.3 Event handling for form validation<br>1.5 jQuery DOM Manipulation<br>1.5.1 Reading and modifying HTML content<br>1.5.2 CSS manipulation using jQuery<br>1.5.3 Adding, removing, and toggling elements<br>1.5.4 Form value handling (textboxes, dropdowns, checkboxes)<br>1.5.5 hide(), show(), toggle(), fadeIn(), fadeOut(), slideUp(), slideDown()<br>1.5.6 Basic animation concepts<br>**Unit-2 : Fundamentals of JSON and AJAX**<br>2.1 Introduction to JSON<br>2.1.1 JSON concept and introduction<br>2.1.2 JSON syntax and data types<br>2.1.3 JSON objects and arrays<br>2.1.4 Working with JSON in JavaScript<br>2.1.5 Creating JSON objects, Accessing JSON data<br>2.1.6 Iterating through JSON arrays and Nested JSON structures<br>2.2 JSON with jQuery<br>2.2.1 Reading JSON using jQuery<br>2.2.2 Displaying JSON data dynamically on a web page<br>2.2.3 Form data representation using JSON<br>2.2.4 JSON in Web Applications<br>2.2.5 JSON as a data exchange format<br>2.3 Introduction to AJAX<br>2.3.1 AJAX Concepts<br>2.3.2 What is AJAX and why it is needed<br>2.3.3 Client–server communication model<br>2.3.4 Synchronous vs asynchronous requests<br>2.4 AJAX using jQuery<br>2.4.1 jQuery AJAX methods: $.ajax(), $.get(), $.post()<br>2.4.2 Sending and receiving data using JSON<br>**Unit-3 Backend Development using PHP and SQLite**<br>3.1 PHP Fundamentals<br>3.1.1 PHP syntax and variables<br>3.1.2 Control structures<br>3.1.3 Functions and form handling<br>3.2 Database using SQLite<br>3.2.1 SQLite concepts<br>3.2.2 Database schema design<br>3.2.3 CRUD operations<br>3.2.4 PHP–SQLite integration<br>3.3 Laravel Framework<br>3.3.1 MVC architecture<br>3.3.2 Routing and controllers<br>3.3.3 Blade templates<br>3.3.4 CRUD using Eloquent ORM<br>**Unit-4 Web Application Development using Laravel**<br>4.1 Introduction to MVC Architecture<br>4.1.1 What is MVC (Model–View–Controller) |

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| | 4.1.2 Advantages of using frameworks<br>4.1.3 Laravel overview and features<br>4.2 Getting Started with Laravel<br>4.2.1 Laravel installation and folder structure<br>4.2.2 Routes and controllers<br>4.2.3 Views using Blade templates<br>4.2.4 Environment configuration<br>4.3 Database Integration in Laravel<br>4.3.1 Models and migrations<br>4.3.2 Database connection with SQLite<br>4.3.3 Performing CRUD operations<br>4.3.4 Form handling and validation<br>4.4 Building a Small Dynamic Website<br>4.4.1 User interface using Bootstrap<br>4.4.2 Pages: Home, Login, Registration, Dashboard<br>4.4.3 Managing data (add, view, edit, delete)<br>4.4.4 Error handling and basic authentication |
| **Reference Books** | 1. Web Design with HTML, CSS, JavaScript and jQuery Set, Author: Jon Duckett, John Wiley & Sons Inc, ISBN: 9781118907443<br>**2.** JavaScript and jQuery: Interactive Front-End Web Development, Author: Jon Duckett, John Wiley & Sons Inc, ISBN: 9781118531648<br>3. Pro PHP and jQuery, Second Edition, Author: Jason Lengstorf & Keith Wald, Apress (Springer Nature), ISBN: 9781484212301<br>4. HTML5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, Author: DT Editorial Services, Dreamtech Press, ISBN: 9789351199076<br>5. Laravel Application Development Cookbook, Author: Terry Matula, Packt Publishing Limited, ISBN: 9781782162827<br>6. Web Designing and Publishing, Authors: Prof. Satish Jain & M. Geetha Iyer, Publisher: BPB Publications (India), ISBN: 9789389845747<br>7. Web-Designing (Part-1) (HTML & CSS), Authors: Prof. Asheesh Pandey, Dr. Madhumita & Dr. Himani Jain, Publisher: Iterative International Publishers (India), ISBN: 978-93-7020-393-8<br>8. Web Design And Development, Authors: Dr. G. Sekar & Dr. R. Anandhi, Publisher: VR1 Publications (India), ISBN: 978-93-91332-47-1<br>9. Web Technologies, Author: Dr. Shruti Kohli, Publisher: BPB Publications (India), ISBN: 978-81-8333-575-1<br>10. Web Designing and Development, Author: Tanweer Alam, Publisher: Khanna Book Publishing (India), ISBN: 9789380016875 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminar and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment,<br>- Project Presentation and viva-voce<br>50% External assessment.<br>- Practical and viva-voce |

# Structure of Program (Semester-wise)

| Course Category | Course Code | Course Title | Mark-sheet 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 | AI601-01 OR AI601-02 OR AI601-03 | E-Commerce & Cyber Security | E-Commerce & Cyber Security | 200-299 Intermediate Course | 4 | - | 2 | - | 4 | 50 | - | 50 | - | 100 |
| | | Concepts of IoT Devices | Concepts of IoT Devices | | 3 | 2 | 1 | 2 | | 25 | 25 | 25 | 25 | |
| | | Computer Graphics | Computer Graphics | | 4 | - | 2 | - | | 50 | - | 50 | - | |
| MAJOR | AI-602 | Agentic AI–Driven Business Intelligence | Agentic AI–Driven Business Intelligence | 400-499 Adv. Course | 3 | 1 | - | 2 | 4 | - | 50 | - | 50 | 100 |
| MAJOR | AI-603 | Autonomous & Artificial General Intelligence | Autonomous & Artificial General Intelligence | 400-499 Adv. Course | 2 | 4 | - | 2 | 4 | - | 50 | - | 50 | 100 |
| MAJOR | AI-604 | PROJECT | PROJECT | 400-499 Adv. Course | - | 8 | - | 2 | 4 | - | 50 | - | 50 | 100 |
| AEC [Ability Enhancement Course] | AI-605 | Project and Interview Presentation Soft Skills | Project and Interview Presentation Soft Skills | 100-199 Foundation Course | 1 | 2 | - | 2 | 2 | - | 25 | - | 25 | 50 |
| | AI-606 | INTERNSHIP | INTERNSHIP | 400-499 | Minimum 120 hours of Internship in Offline/Online/Hybrid mode | | | | 4 | - | 50 | - | 50 | 100 |

**For Practical and Project:**

- Batch Size: Maximum 40 students can be accommodated in a batch. Separate batch should be considered if the student strength exceeds 45 numbers.
- Practical includes Lab. sessions for course-602, 603 and course-604.
- Project hours include Lab. sessions of 2 Hours each for AI-602, AI-603, AI-604 and AI-605 per week. Students can work on project in-house/out-house as per their internal guide's guidance. Group of maximum three students can work on a project definition. One Internal Project guide will be allocated to each group. Each group is expected to work minimum 4 hours each on Projects per week. Out of which 2 hours will be in supervised mode and balance hours in un-supervised mode.
- The Practical journal/Project final reports must be certified by the concerned faculty and by the Head of the Department, failing which the student will not be allowed to appear for External Practical/Project Examination. Student will submit softcopy of Project duly certified by the internal guide.

**Internship:** A student who wish to exit after successfully completion of Third year (Semester-5 and Semester-6) without any backlog is required to obtain Students are required to obtain 4 credits through successful completion of Internship in offline/online/hybrid mode of minimum 120 hours work. Four credits at the end of the year either through the internship/field-work or university approved two skill based certificate courses(two courses of 2-credits each or one 4-credit course). Student is required to enrol for the certificate courses separately by paying the course fees as decided by the college/institute. For Internship, the Institute/college will grant the permission and evaluate the training outcomes. Based on satisfactory completion of the internship training, the Institute head will recommend to the university to grant four credits for summer training. [All expenses for the internship/skill course/field-work will be bear by the student.]

Minor/Major Practical based Subjects: Course AI-602, AI-603 AND AI-604 are 4-credit major courses . Students are expected to design, develop and implement capstone projects for Course AI-602 and AI-603.

For Course-AI-604 : 8 hours of Project work including 2 hours of supervised and 6 hours of unsupervised work per week.

Major courses carry 100 marks of exam weightage. External and Internal distribution of marks are in ratio of 50:50 respectively. Students are required to acquire minimum passing marks from theory and practical collectively.

External exams of AI-601-01, AI-601-02, AI-601-02: 50 marks of external theory exams.

External exams of AI-602 : 50 marks of Project viva-voce and presentation.

External exams of AI-603 : 50 marks of Project viva-voce and Presentation.

External exams of AI-604 : 50 marks of Project viva-voce and presentation.

External exams of AI-605 : Seminar and Presentation

External exams of AI-604 : Internship presentation and viva-voce

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-601-01: E-Commerce and Cyber Security

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

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|---|---|
| **COURSE NAME** | **E-Commerce and Cyber Security** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MINOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Minor Discipline Specific** |
| **Course Code** | **AI-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.<br>**CO2:** Explain the network infrastructure, payment methods, and associated security issues in e-Commerce.<br>**CO3:** Identify various types of cybercrimes and their technical aspects.<br>**CO4:** Describe key concepts, terminologies, and threats related to cyber security.<br>**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

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| | 2.4.2. Debit Card Based, Credit Card Based,. Risks & EPS<br>2.4.3. e-Cash, e-Cheque, e-wallet<br>2.5. Security on Web, SSL<br>**Unit-3: Introduction to Cyber Crimes:**<br>3.1 Category of Cyber Crimes<br>3.2 Technical Aspects of Cyber Crimes<br>3.2.1 Unauthorized access & Hacking<br>3.2.2 Trojan, Virus and Worm Attacks<br>3.2.3 E-Mail related Crimes: Spoofing, Spamming, Bombing<br>3.2.4 Denial of Service Attacks<br>3.2.5 Distributed Denial of Service Attack<br>3.3 Various crimes :<br>3.3.1 IPR Violations (Software piracy, Copyright Infringement, Trademarks Violations, Theft of Computer source code, Patent Violations)<br>3.3.2 Cyber Squatting, Cyber Smearing, Cyber Stacking<br>3.3.3 Financial Crimes: ( Banking, credit card, Debit card related)<br>**Unit-4: Cyber Security Fundamentals:**<br>4.1 Concepts of Cyber Security:<br>4.1.1 Types of Threats<br>4.1.2 Advantages of Cyber Security<br>4.2 Basic Terminologies:<br>4.2.1 IP Address, MAC Address<br>4.2.2 Domain name Server(DNS)<br>4.2.3 DHCP, Router, Bots<br>4.3 Common Types of Attacks:<br>4.3.1 Distributed Denial of Service<br>4.3.2 Man in the Middle, Email Attack<br>4.3.3 Password Attack, Malware<br>4.4 Hackers:<br>4.4.1 Various Vulnerabilities:<br>4.4.1.1 Injection attacks, Changes in security settings<br>4.4.1.2 Exposer of Sensitive Data<br>4.4.1.3 Breach in authentication protocol<br>4.4.2 Types of Hackers: White hat and Black hat<br>[All Units carry Equal Weightage] |
| **Reference Books** | 1. Frontiers of Electronic Commerce, Ravi Kalakota and Andrew Whinston, Addition Wesley<br>2. Electronic Commerce: A Managerial Perspective, Efraim turban, Jae Lee, David King, H. Michel Chung, Addition Wesley<br>3. E-Commerce: An Indian Perspective, Joseph, PHI<br>4. E-Mail Hacking, Ankit Fadia, Vikas Publishing House Pvt. Ltd.<br>5. e-Commerce Concept, Models Strategies, G.V.S. Murthy, Himalaya Publisher<br>6. Cyber Crime in India, Dr M Dasgupta, Centax Publications Pvt Ltd<br>7. Cyber Laws and Crimes, Barkha U, Rama Mohan, Universal Law Publishing Co. Pvt Ltd.<br>8. Cyber Crime, Bansal S.K., A.P.H. Publishing Corporation<br>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.<br>- Attendance, Class and home Assignment.<br>- Unit Tests<br>50% External assessment.<br>- Written Theory exam |

[Subject code for Theory-2711000906044004] [Subject code for Practical-2711000906044005]

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-601-02: Concepts of IoT Devices

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

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| **COURSE NAME** | **Concepts of IoT Devices** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MINOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Minor Discipline Specific** |
| **Course Code** | **AI-601-02** |
| **Course Level** | **300-399** |
| **Course Title** | **Concepts of IoT Devices** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO-1 Remembering:** Recall and define key concepts, history, and types of Artificial Intelligence and IoT technologies.<br>**CO-2 Understanding:** Explain the architecture, components, and connectivity methods of IoT systems used in AI applications.<br>**CO-3 Applying:** Apply AI algorithms to process real-time data collected from IoT devices for smart decision-making.<br>**CO-4 Analyzing:** Analyze challenges related to data quality, latency, power consumption, and security in AIoT systems.<br>**CO-5 Creating:** Design and present innovative AIoT solutions based on case studies and group collaboration. |
| **Mapping between Cos and PSOs** | |

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

**Course Content**

**Unit 1: Foundations of Artificial Intelligence and IoT**

1.1 Introduction to Internet of Things (IoT)
- 1.1.1 Definition and Characteristics of IoT
- 1.1.2 Evolution of IoT and Smart Systems

1.2 Relationship Between AI and IoT
- 1.2.1 Why AI is Needed in IoT Systems
- 1.2.2 From Connected Devices to Intelligent Systems

1.3 Overview of AIoT Applications
- 1.3.1 Smart Homes
- 1.3.2 Smart Cities
- 1.3.3 Healthcare and Agriculture

**Unit 2: IoT Devices Used in AI Applications**

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| | 2.1 Architecture of IoT Systems<br>2.1.1 Sensors<br>2.1.2 Actuators<br>2.1.3 Gateways<br>2.1.4 Cloud Platforms<br>2.2 Types of IoT Devices Useful in AI Projects<br>2.2.1 Environmental Sensors (Temperature, Humidity, Air Quality)<br>2.2.2 Motion and Position Sensors (Accelerometers, Gyroscopes, PIR)<br>2.2.3 Wearables and Smart Health Devices<br>2.2.4 Cameras and Microphones for Image and Voice Input<br>2.3 Basics of Connectivity Technologies<br>2.3.1 Wi-Fi<br>2.3.2 Bluetooth<br>2.3.3 Zigbee<br>2.3.4 LoRaWAN<br><br>**Unit 3: Advanced Integration of AI with IoT**<br>3.1 Introduction to AIoT (Artificial Intelligence of Things)<br>3.2 Real-Time Data Processing Using AI Algorithms<br>3.2.1 Stream Data Processing<br>3.2.2 Real-Time Prediction and Alerts<br>3.3 Edge Computing vs Cloud AI in IoT<br>3.3.1 Concept of Edge AI<br>3.3.2 Advantages and Limitations of Cloud-Based AI<br>3.4 Challenges in AIoT<br>3.4.1 Data Quality Issues<br>3.4.2 Latency and Network Constraints<br>3.4.3 Power Consumption in IoT Devices<br><br>**Unit 4: Case Studies**<br>4.1 Summary of Key Concepts from AI and IoT<br>4.2 Case Study 1: Smart Farming using IoT and AI<br>4.2.1 Sensor Deployment<br>4.2.2 AI-Based Crop Monitoring and Prediction<br>4.3 Case Study 2: AI-Powered Smart Home Automation<br>4.3.1 Intelligent Lighting and Climate Control<br>4.3.2 Voice-Based and Automated Decision Systems<br>[Seminar: Every student is expected to prepare a case study and presentation. Student is expected to give seminar at the end of the semester as part of the external examination] |
| **Reference Books** | 1. Artificial Intelligence-Based Internet of Things Systems, Souvik Pal, Debashis De & Rajkumar Buyya, Springer Cham, ISBN: 9783030870584<br>2. AI and IoT for Smart City Applications, Vincenzo Piuri, Rabindra Nath Shaw, Ankush Ghosh & Rabiul Islam, Springer Singapore, ISBN: 9789811674976<br>3. Internet of Things, Artificial Intelligence and Blockchain Technology, R. Lakshmana Kumar, Yichuan Wang, T. Poongodi & Agbotiname Lucky Imoize (eds.), Springer Nature, ISBN: 9783030741495<br>4. AIoT: Artificial Intelligence of Things, Arun Sekar Rajasekaran & Fadi Al-Turjman (eds.), Auerbach Publications, ISBN: 9781032773018<br>5. Artificial Intelligence and Internet of Things Applications in Smart Healthcare, Lalit Mohan Goyal, Tanzila Saba, Amjad Rehman & Souad Larabi-Marie-Sainte (eds.), CRC Press, ISBN: 9780367562946 |

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|---|---|
| | 6. Artificial Intelligence for Internet of Things: Design Principles and Applications, Suman Lata Thillaiarasu & Dhinakaran (eds.), CRC Press, ISBN: 9781003335801<br>7. Applications of Artificial Intelligence in the Internet of Things, (Editor names vary), Cambridge Scholars Publishing, ISBN: 9781036411060<br>8. Artificial Intelligence and The Internet of Things, Hussein N. Abd Ali, LAP LAMBERT Academic Publishing, ISBN: 9786206151845<br>9. Future Communication Systems Using Artificial Intelligence, Internet of Things and Data Science, Inam Ullah, Inam Ullah Khan, Mariya Ouaissa, Mariyam Ouaissa, Salma El Hajjami, CRC Press, ISBN: 9781040039533<br>10. AIoT and Smart Sensing: A Comprehensive Guide to the Next Generation of Smart Devices, Vaishali R. Kulkarni, Thompson Stephan, Punitha S., Fadi Al-Turjman, Thinagaran Perumal, CRC Press, ISBN: 9781032618104 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment.<br>- Unit Tests<br>- Seminar presentation on topic allocated by the Faculty member<br>50% External assessment.<br>- Written Theory exam<br>- Seminar and Presentation |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-601-03: Computer Graphics

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

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|---|---|
| **COURSE NAME** | **Computer Graphics** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MINOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Minor Discipline Specific** |
| **Course Code** | **AI-601-03** |
| **Course Level** | **200-299** |
| **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.<br>**CO2:**Understanding**:** Describe the architecture and functioning of various display devices, scan methods, and graphic object types.<br>**CO3:**Applying: Implement standard line drawing algorithms such as DDA and Bresenham for rendering basic graphic primitives.<br>**CO4:**Analyzing: Analyze the behavior and effects of geometric transformations like scaling, rotation, translation, reflection, and shearing on 2D objects.<br>**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

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| | 2.1.4. Direct View Storage Tube<br>2.2. Raster scan and Random Scan Display<br>2.3. Raster Graphics and Vector Graphics<br>2.4. Concepts of various objects: Point, Line, Circle, Ellipse and Polygons<br><br>**Unit 3. Line generation**<br>3.1. Geometry of line<br>3.2. Frame Buffer<br>3.3. Line Drawing Algorithms<br>3.3.1. DDA Algorithm<br>3.3.2. VECGEN<br>3.3.3. Bresnahan<br>3.4. Line Styles<br>3.4.1. Thick line<br>3.4.2. Line caps and joint<br><br>**Unit 4. Geometric Transformations**<br>4.1 Basic Transformations<br>4.1.1 Scaling<br>4.1.2 Translation<br>4.1.3 Rotation<br>4.1.3.1 Rotation about origin<br>4.1.3.2 Rotation about Homogeneous Coordinates<br>4.2 Other transformations<br>4.2.1 Reflection<br>4.2.2 Shearing<br><br>[All Units carry Equal Weightage] |
| **Reference Books** | 1. Computer Graphics - second edition, Donald Hearn & M. Pauline Baker – Tata McGraw Hill Pub.<br>2. Computer Graphics, Harrington S. -Tata McGraw Hill.<br>3. Computer Graphics, Desai A. A. –PHI.<br>4. Computer Graphics: Algorithms & Implementations, Mukherjee & Jana – PHI.<br>5. Interactive Computer Graphics, Giloi W. K. –Prentice Hall India.<br>6. Principles of Interactive Computer Graphics, New Man W. & Sproul P. F. –McGraw Hill<br>7. Procedural Elements for Computer Graphics, Rogers D. F. – McGraw Hill.<br>8. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson Education, 9780136053583<br>9. Computer Graphics: Principles and Practice, John F. Hughes, Andries van Dam, Morgan McGuire, David Sklar, Addison-Wesley, 9780321399526<br>10. Interactive Computer Graphics, Edward Angel, Dave Shreiner, Pearson Education, 9780132545235<br>11. Fundamentals of Computer Graphics, Peter Shirley, Steve Marschner, A K Peters / CRC Press, 9781482229394<br>12. Mathematical Elements for Computer Graphics, David F. Rogers, J. Alan Adams, McGraw-Hill Education, 9780070535293 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment.<br>- Unit Tests<br>50% External assessment.<br>- Written Theory exam |

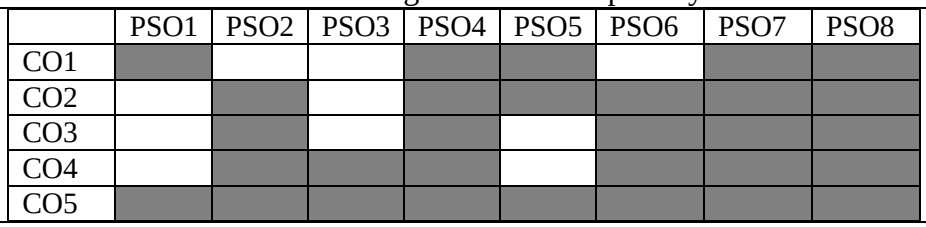
# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-602: Agentic AI–Driven Business Intelligence

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

| | |
|---|---|
| **COURSE NAME** | **Agentic AI–Driven Business Intelligence** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-602** |
| **Course Level** | **400-499** |
| **Course Title** | **Agentic AI–Driven Business Intelligence** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1** (Understand)**:** Explain the role of Large Language Models (LLMs) and Agentic AI in modern Business Intelligence systems, including conversational analytics and automated insight generation.<br>**CO2** (Apply)**:** Apply prompt engineering techniques to generate analytical queries, KPI explanations, and business narratives from structured business datasets.<br>**CO3** (Analyze)**:** Analyze business data and dashboard outputs using agentic AI systems to identify trends, anomalies, and root causes in real-world business scenarios.<br>**CO4** (Design)**:** Design and implement agent-driven Business Intelligence solutions by integrating BI tools (Power BI / Tableau), Python middleware, and LLM-based agents.<br>**CO5** (Create)**:** Create end-to-end AI-powered Business Intelligence applications that generate explainable insights, executive summaries, and decision-support recommendations while adhering to ethical and privacy considerations. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **UNIT 1: Basics of Business Intelligence tools integration**<br>1.1 Role of LLMs in Business Analytics<br>1.1.1 Natural Language to Analytics<br>1.1.2 Query generation (SQL / DAX concept)<br>1.1.3 Business reasoning using LLMs<br>1.1.4 Narrative intelligence (insight storytelling)<br>1.2 Architecture of Agentic BI Systems<br>1.2.1 Data layer (CSV, Excel, SQL, ERP data)<br>1.2.2 BI Visualization layer (Power BI / Tableau)<br>1.2.3 Agent layer (LLM + tools + memory) |

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| | 1.2.4 Output layer (insights, recommendations, actions)<br>1.3 Conversational Analytics Concepts<br>1.3.1 Natural language querying<br>1.3.2 Conversational dashboards<br>1.3.3 Prompt vs dashboard filter<br>1.3.4 Challenges in conversational BI<br>1.4 Prompt Engineering for BI<br>1.4.1 Business-focused prompt design<br>1.4.2 Analytical prompts vs explanatory prompts<br>1.5 Retrieval-Augmented BI Systems<br>1.5.1 Concept of RAG<br>1.5.2 Embedding and semantic search<br>1.5.3 Connecting business data with LLMs<br>1.5.4 Reducing hallucination in BI<br>**Unit 2: Conversational Business Intelligence using LLMs**<br>2.1 Business Use-Cases Overview and concepts<br>2.1.1 Sales performance analysis<br>2.1.2 Marketing analytics<br>2.1.3 Financial KPI monitoring<br>2.1.4 Operations and supply-chain analytics<br>2.2 KPI-driven Conversational BI Integration<br>2.2.1 Integrating LLMs with BI Tools<br>2.2.2 Power BI + LLM integration concept<br>2.2.3 Tableau + LLM integration concept<br>2.2.4 Using Python as middleware<br>2.2.5 Secure data access considerations<br>2.3 Automated Insight Generation<br>2.3.1 Explaining charts and KPIs<br>2.3.2 Trend and anomaly explanation<br>2.3.3 Business narrative generation<br>2.3.4 Executive summary automation<br>[Unit-2: Practical: (i) Create Power BI / Tableau dashboard from sales dataset (ii) Design prompts to explain KPIs (iii) Generate natural-language insights from charts (iv) Build a conversational Q&A assistant for dashboards]<br>**UNIT 3: Agentic AI for Advanced Business Analytics**<br>3.1 Agent Design for BI<br>3.1.1 Single-agent analytics system<br>3.1.2 Planner-executor architecture<br>3.1.3 Tool-calling agents for data queries<br>3.1.4 Memory in analytics agents<br>3.1.5 Human-in-the-loop validation for business decisions<br>3.2 Multi-Agent BI Systems<br>3.2.1 Analyst agent<br>3.2.2 Forecasting agent<br>3.2.3 Risk detection agent<br>3.2.4 Report generation agent<br>3.3 Predictive and Prescriptive Analytics<br>3.3.1 Trend analysis using agents<br>3.3.2 Forecast interpretation<br>3.3.3 Recommendation generation<br>3.3.4 Decision support workflows<br>3.4 Business Scenario Automation<br>3.4.1 Monthly performance review agent<br>3.4.2 Sales drop root-cause agent<br>3.4.3 Customer churn analysis agent<br>3.4.4 Inventory risk detection agent<br>[Unit-3: Practical: (i) Build a single-agent BI assistant (ii) Create a multi-agent workflow (planner + analyst) (iii) Automate root-cause analysis for |

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| | sales drop (iv) Generate predictive insights from historical data]<br>**UNIT 4: Production-Grade AI-Powered BI Applications**<br>4.1 Building BI-Centric AI Applications<br>4.1.1 Agent-powered analytics web app<br>4.1.2 Integrating dashboards with AI UI<br>4.1.3 User interaction design for BI agents<br>4.2 Deployment and Integration<br>4.2.1 Local deployment using Streamlit<br>4.2.2 Connecting BI outputs to AI apps<br>4.2.3 Performance and latency considerations<br>4.4 Ethics and Trust in AI-powered BI<br>4.3.1 Explainability of AI-generated business insights<br>4.3.2 Bias and data privacy considerations<br>4.4 Capstone Project<br>4.4.1 Problem identification from real business data<br>4.4.2 Dashboard creation<br>4.4.3 Agent design and implementation<br>4.4.4 Insight generation and presentation<br>4.4.5 Business recommendation report<br>[Unit-4: Practical: (i) Build an AI-powered BI assistant web app (ii) Integrate Power BI / Tableau dashboard with AI (iii) Generate automated executive reports (iv) Deploy end-to-end applied BI solution]<br>[Students are expected to develop one capstone project on any of the following suggested topics or similar business topic]:<br>1. Conversational Sales Analytics Agent<br>2. Financial KPI Explanation System<br>3. Marketing Campaign Performance Analyzer<br>4. Supply Chain Risk Detection Agent<br>5. Customer Churn Insight Generator<br>6. Automated Monthly Business Report Generator<br>7. Executive Decision-Support AI Assistant<br>[Suggested Tools & Technologies: (i) Power BI / Tableau (ii) Python, Pandas, NumPy (iii) LangChain (iv) Open-source LLMs (via local inference) (v) Streamlit / Gradio (vi) SQL / CSV / Excel datasets] |
| **Reference Books** | 1) Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 9780262035613<br>2) Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson, 9780134610993<br>3) Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, 9781098125944<br>4) Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, David Foster, O'Reilly Media, 9781492041949<br>5) Machine Learning Engineering with Python, Andrew P. McMahon, Packt Publishing, 9781837631964<br>6) Applied Artificial Intelligence, Adnan Masood, Apress, 9781484243061<br>7) AI and Machine Learning for Coders, Laurence Moroney, O'Reilly Media, 9781492078190<br>8) Power BI Cookbook, Brett Powell, Packt Publishing, 9781839210941<br>9) Practical Business Intelligence with SQL Server 2016, Brian Larson, Apress, 9781484219230<br>10) Machine Learning Using Python, Manaranjan Pradhan, U. Dinesh Kumar, Wiley India, 9789370609167 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Project work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment.<br>- Internal Project presentation and Unit Tests<br>50% External assessment.<br>- Project Presentation and viva-voce |

**[Subject code-2711000906022005]**

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

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

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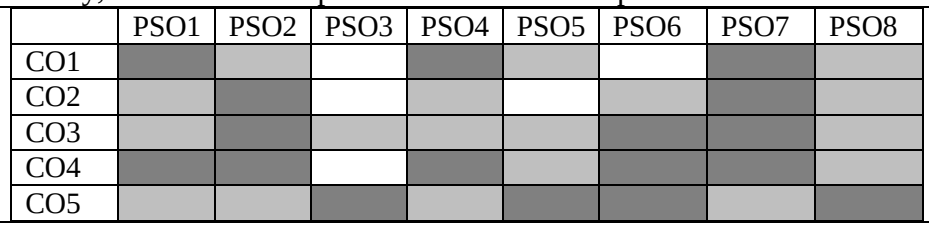
|---|---|
| **COURSE NAME** | **Autonomous & Artificial General Intelligence** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-603** |
| **Course Level** | **400-499** |
| **Course Title** | **Autonomous & Artificial General Intelligence** |
| **Credit** | **4 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **CO1** (Understand)**:** Explain the core concepts of Agentic AI, Large Language Models (LLMs), autonomous agents, and their role in modern AI-driven business systems.<br>**CO2** (Apply)**:** Design and implement agent-based AI workflows using LLMs, tools, APIs, and datasets for real-world problem solving.<br>**CO3** (Analyze)**:** Analyze business datasets using Agentic AI integrated with analytics and BI tools (such as Power BI/Tableau-style pipelines) to generate insights, narratives, and automated decisions.<br>**CO4** (Create)**:** Develop production-ready AI applications by combining Agentic AI, prompt engineering, orchestration frameworks, and deployment best practices.<br>**CO5** (Evaluate)**:** Evaluate AI systems for performance, scalability, reliability, ethics, security, and business impact in real-world enterprise scenarios. |
| **Mapping between Cos and PSOs** |  |
| **Course Content** | **UNIT–1: Foundations of Autonomous Intelligence**<br>1.1 Fundamentals of Autonomous AI<br>1.1.1 Transition from Agentic AI to Autonomous AI<br>1.1.2 Definition and characteristics of autonomous intelligence<br>1.1.3 Goal interpretation and task decomposition<br>1.1.4 Decision-making and execution loops<br>1.1.5 Human-in-the-loop vs Human-on-the-loop systems<br>1.2 Architecture of Autonomous Systems<br>1.2.1 Perception layer (inputs, data sources)<br>1.2.2 Reasoning and planning layer<br>1.2.3 Memory and knowledge layer |

1.2.4 Action and tool-execution layer
1.2.5 Feedback, monitoring, and control mechanisms
1.3 Introduction to Artificial General Intelligence (AGI)
1.3.1 Narrow AI vs General AI
1.3.2 Cognitive abilities required for AGI
1.3.3 Limitations of current AI systems
1.3.4 Practical AGI simulations using current tools
[Unit-1: Practical : (i) Design and implement a Goal → Plan → Execute → Reflect autonomous loop using Python (ii) Convert a prompt-based chatbot into a goal-driven agent]

**UNIT–2: Agentic Architectures & Multi-Agent Systems**

2.1 Intelligent Agent Design
2.1.1 Definition and components of an AI agent
2.1.2 Reactive agents vs deliberative agents
2.1.3 Task-oriented and role-based agents
2.1.4 Agent lifecycle and autonomy levels
2.2 Multi-Agent Systems (MAS)
2.2.1 Single-agent vs multi-agent architectures
2.2.2 Agent collaboration and coordination
2.2.3 Competitive and cooperative agent models
2.2.4 Role allocation and task distribution
2.3 Agent Communication & Reasoning
2.3.1 Message passing and shared memory
2.3.2 Coordination strategies and consensus mechanisms
2.3.3 Reasoning techniques:
2.3.3.1 Chain-of-Thought
2.3.3.2 Tree-of-Thought
2.3.3.3 ReAct (Reason + Act)
2.4 Open-Source Agent Frameworks
2.4.1 LangChain for agent orchestration
2.4.2 CrewAI for role-based agents
2.4.3 AutoGen for conversational agents
2.4.4 MetaGPT for AI software teams
[Unit-2: Practical: Build a multi-agent system with Planner, Executor, and Critic agents. (ii) Implement agent collaboration using open-source frameworks.]

**UNIT–3: Memory, Tool-Use & Self-Improving Agents**

3.1 Memory Systems in Autonomous AI
3.1.1 Short-term memory and context handling
3.1.2 Long-term memory and vector databases
3.1.3 Episodic and semantic memory models
3.1.4 Knowledge retrieval and reuse
3.2 Tool-Using Autonomous Agents
3.2.1 API and function calling
3.2.2 Web search and information retrieval
3.2.3 Code execution and data analysis
3.2.4 File handling and document processing
3.3 Self-Reflection and Self-Correction
3.3.1 Output evaluation mechanisms
3.3.2 Error detection and feedback loops
3.3.3 Iterative improvement strategies
3.3.4 Controlled self-learning
3.4 Retrieval-Augmented Autonomous Agents
3.4.1 RAG architecture for agents
3.4.2 Embedding and semantic retrieval
3.4.3 Grounding agent decisions with external knowledge

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| | 3.4.4 Reducing hallucinations in autonomous systems<br>[Unit-3: Practical : (i) Build an AI agent with persistent memory (ii) Create a tool-augmented agent for data analysis (iii) Implement self-reflection to improve outputs automatically. Suggested Supporting Open-source Tools : FAISS for memory storage, Chroma for Knowledge Retrieval, Ollama for local model execution.]<br>**UNIT–4: AGI Foundations, Safety & Responsible Autonomy**<br>4.1 Cognitive Foundations of AGI<br>4.1.1 Learning across domains<br>4.1.2 Knowledge transfer and abstraction<br>4.1.3 World models and general reasoning<br>4.2 Self-Improving and Recursive AI<br>4.2.1 Feedback-driven adaptation<br>4.2.2 Risks of uncontrolled self-improvement<br>4.2.3 Constraints and safety boundaries<br>4.3 AI Safety, Ethics & Governance<br>4.3.1 Alignment and control problems<br>4.3.2 Bias, hallucination, and reliability issues<br>4.3.3 Human oversight and accountability<br>4.3.4 Global AI regulations and standards<br>4.4 Human–AI Coexistence and Future Directions<br>4.4.1 Autonomous organizations and AI teams<br>4.4.2 AI-augmented decision making<br>4.4.3 Societal impact and future of work<br>[Unit-4: Project : Develop a CAPSTONE PROJECT: Design and implement an AGI-inspired Autonomous System incorporating: (i) Multi-agent collaboration (ii) Memory and tool-use Self-reflection and improvement (iii) Safety and ethical constraints] |
| **Reference Books** | 1. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson Education, ISBN: 9780134610993<br>2. Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Yoav Shoham, Kevin Leyton-Brown, Cambridge University Press, ISBN: 9780521899437<br>3. Designing Autonomous Agents, Pattie Maes, MIT Press, ISBN: 9780262631639<br>4. Reinforcement Learning: An Introduction, Richard S. Sutton, Andrew G. Barto, MIT Press, ISBN: 9780262039246<br>5. Human Compatible: Artificial Intelligence and the Problem of Control, Stuart Russell, Viking Press, ISBN: 9780525558613<br>6. Architects of Intelligence, Martin Ford, Packt Publishing, ISBN: 9781789131512<br>7. Artificial General Intelligence, Ben Goertzel, Cassio Pennachin, Springer, ISBN: 9783540237334<br>8. Machine Learning Engineering, Andriy Burkov, True Positive Inc., ISBN: 9781999579500<br>9. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, ISBN: 9780262035613<br>10. Ethics of Artificial Intelligence, Mark Coeckelbergh, MIT Press, ISBN: 9780262043793<br>11. Artificial Intelligence and Machine Learning**,** P. Radha Krishna, R. Rathipriya, P. Subbalakshmi, SciTech Publications (India), ISBN: 9789388178480<br>12. Machine Learning Using Python**,** Manaranjan Pradhan, U. Dinesh Kumar, Wiley India, ISBN: 9789370609167 |
| **Teaching Methodology** | Class Work, Discussion, Experimental work, Project work, Self-Study, Seminars and/or Assignments |
| **Evaluation Method** | 50% Internal assessment.<br>- Attendance, Class and home Assignment.<br>- Internal Project presentation and viva-voce<br>50% External assessment.<br>- Project Presentation and viva-voce |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-604: PROJECT

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

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| **COURSE NANME** | **PROJECT** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **MAJOR** |
| **Course Subtype** | **Employability And Skill oriented** |
| **Subject Type** | **Major Discipline Specific** |
| **Course Code** | **AI-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.<br>**CO2**:Create: Students will develop full-fledged applications using relevant web, mobile, or hybrid technologies.<br>**CO3**:Apply: Students will gain experience in applying the Software Development Life Cycle (SDLC) to real-world problems.<br>**CO4**:Create: Students will prepare and submit a comprehensive project report that meets academic and professional standards.<br>**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 | ■ | | | ■ | | ■ | ■ | ■ |

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| **Course Content** | **STEP-1: Project Planning and Definition**<br>1.1 Understanding Problem Statement<br>1.2 Feasibility Study and Requirement Analysis<br>1.3 Technology Stack Selection (Web, Mobile, Cloud, Database)<br>1.4 Project Scheduling and Team Role Allocation<br>**STEP-2: Project Design and Architecture**<br>2.1 System Design – High Level and Low Level<br>2.2 Database Design and ER Diagram<br>2.3 UI/UX Planning and Wireframing<br>2.4 Data Flow Diagram and Architecture Diagram<br>**STEP-3: Project Development**<br>3.1 Frontend Development<br>3.2 Backend Development<br>3.3 Integration with Database and External APIs |

<table>
<tr><td></td><td>3.4 Testing: Unit Testing, Integration Testing, User Acceptance Testing<br>STEP-4: Documentation and Deployment<br>4.1 Preparing Project Documentation: SRS, Design Document, User Manual<br>4.2 Deployment on Hosting Platforms (like Firebase, Heroku, GitHub Pages, etc.)<br>4.3 Project Report Writing in Standard Format<br>4.4 Preparing and Delivering Project Presentation<br>[Students will submit E-Document for Project report.<br>One internal guide will be allocated for every ten groups<br>All groups are required to contact their internal guides once a week to endorse their project progress work.]</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.<br>- Attendance and reporting to internal guides<br>- Internal project presentation and demonstration, project documentation.<br>50% External assessment.<br>- Project presentation and demonstration, viva-voce and e-project report.</td></tr>
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# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

# AI-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** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **AEC (Ability Enhancement Course)** |
| **Course Subtype** | **Soft Skills** |
| **Subject Type** | **Intra Disciplinary** |
| **Course Code** | **AI-605** |
| **Course Level** | **100-199** |
| **Course Title** | **Project and Interview Presentation Soft Skills** |
| **Credit** | **2 Credits** |
| **Effective From** | **Academic Year : 2026-2027** |
| **Course Outcomes** | **1)CO1:**(Understand)**:** Explain the essential components of professional project documentation and communication in the software and IT industry.<br>**2)CO2:**(Apply)**:** Demonstrate the ability to present project concepts clearly using structured presentation techniques and visual aids relevant to IT solutions.<br>**3)CO3:**(Analyze)**:** Evaluate the technical and soft skill requirements of various IT job roles and align personal project work and presentation accordingly.<br>**4)CO4:**(Create)**:** Develop a mini-project or prototype by integrating appropriate software tools and technologies and document it as per standard industry practices.<br>**5)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

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| | 1.3.2 Preparing Professional Reports and Documentation<br><br>**Unit 2: Project Documentation and Reporting**<br>2.1 Understanding Software Development Life Cycle (SDLC)<br>2.1.1 Role of Documentation at Each Phase<br>2.1.2 Agile Documentation vs Traditional Models<br>2.2 Technical Project Documentation<br>2.2.1 Problem Statement and Requirements<br>2.2.2 Design Diagrams: UML, ER Diagrams<br>2.2.3 Testing and Deployment Documentation<br>2.3 Final Report Writing and Formatting<br>2.3.1 Structuring a Complete Project Report<br>2.3.2 IEEE/ACM Style Guidelines and Referencing<br>2.3.3 Common Errors to Avoid in Technical Reports<br><br>**Unit 3: Interview Readiness and Soft Skills for Developers**<br>3.1 Resume and LinkedIn Profile Building<br>3.1.2 Components of a Tech Resume<br>3.1.3 Tailoring Resumes for Software Roles<br>3.2 Interviewing Skills for IT Roles<br>3.2.1 Understanding the Interview Process in Software Companies<br>3.2.2 Technical Round vs HR Round Expectations<br>3.2.3 STAR Method for Behavioural Interview Questions<br>3.3 Mock Interview Sessions<br>3.3.1 Self-Introduction Practice<br>3.3.2 Group Feedback and Interview Etiquette<br><br>**Unit 4: Final Project Presentation and Seminar**<br>4.1 Project Showcase Guidelines<br>4.1.1 Preparing for Project Presentation<br>4.1.2 Demonstrating Code, UI, and Deployment<br>4.2 Seminar and Peer Review<br>4.2.1 Presentation to Class and Faculty Panel<br>4.2.2 Peer Evaluation Criteria<br>4.3 Soft Skill Reflection and Final Assessment<br>4.3.1 Student Reflections on Soft Skills Gained<br>4.3.2 Final Grading and Suggestions for Improvement<br>[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<br>2) Soft Skills: Know Yourself and Know the World, Dr. Alex K., S. Chand Publishing, ISBN: 9789352534357<br>3) Communication Skills for Engineers, Sunita Mishra & C. Muralikrishna, Pearson Education India, ISBN: 9788131733844<br>4) Business Communication, P.D. Chaturvedi & Mukesh Chaturvedi, Pearson Education India, ISBN: 9788131733585<br>5) Developing Soft Skills, Gajendra Singh Chauhan, Wiley India, ISBN: 9788126577500<br>6) The Quick and Easy Way to Effective Speaking, Dale Carnegie, Simon & Schuster, ISBN: 9780743528322<br>7) Cracking the Coding Interview, Gayle Laakmann McDowell, CareerCup, ISBN: 9780984782857<br>8) Presentation Skills for Technical Professionals, Naomi Karten, Dorset House Publishing, ISBN: 9780932633585 |

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| | 9) Interviewing: Principles and Practices, Charles Stewart & William Cash Jr., McGraw-Hill Education, ISBN: 9780078036804<br>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.<br>- Attendance, Class and home Assignment, Unit Tests (Seminar).<br>- Internal presentations, documentation, viva-voce and Seminar<br>50% External assessment.<br>- Presentation, documentation and Viva-voce. |

# VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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

(SEM – 6)

## AI-606: INTERNSHIP

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

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| **COURSE NANME** | **INTERNSHIP** |
| **Semester** | **VI$^{th}$** |
| **NCrF Credit Level** | **Level-5.5** |
| **Course Type** | **Skill Enhancement and Employment Oriented** |
| **Course Subtype** | **Technical and Soft Skills** |
| **Subject Type** | **Subject Specific** |
| **Course Code** | **AI-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<br>(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.<br>2) To foster the application of academic knowledge in real-life work scenarios.<br>3) To enhance students' interpersonal, communication, and problem-solving skills.<br>4) To help students identify their strengths and areas of interest in professional domains.<br>5) To inculcate a sense of responsibility, discipline, and work ethics. |
| **Course Outcomes** | 1) **CO1 (Apply):** Apply programming, development, or analytical skills gained in the classroom to solve real-world computing problems during the internship.<br>2) **CO2 (Analyze):** Analyze the architecture, workflow, and practices of the host organization to understand the integration of computer systems in business or technical environments.<br>3) **CO3 (Evaluate):** Evaluate project requirements, software tools, and technologies used during the internship to recommend improvements or alternative approaches. |

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<tr><td></td><td>4) CO4 (Create): Create a structured technical report and project documentation summarizing the tasks, challenges, and outcomes of the internship.<br>5) 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<br>Mode: Offline / Online / Hybrid<br>Location: Industry, business firms, IT companies, local government offices, health organizations, media, artisan<br>s, etc.<br>Deliverables by Student:<br>1. Internship Joining Report<br>2. Weekly Progress Logbook<br>3. Project or Assignment Work (if applicable)<br>4. Final Internship Report (with photographs, certificates, etc.)<br>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)<br>Front Page<br>Title: Internship Report<br>Student Name:<br>Roll Number:<br>Program and Semester:<br>College Name and Department:<br>Name of Organization/Company:<br>Internship Duration (From – To):<br>Internship Guide Name (Industry and Faculty):<br>Submission Date:<br><br>1. Acknowledgment<br>A short paragraph acknowledging the guidance and support of the organization and faculty mentor.<br>2. Certificate<br>Internship Completion Certificate (copy from organization)<br>3. Declaration<br>Declaration by the student that the report is original and submitted for academic purposes.<br>4. Internship Details<br>Name and Address of Organization<br>Nature of Business/Services<br>Department/Team worked in<br>Name and Designation of Industry Supervisor<br>5. Objectives of Internship<br>What you aimed to learn and accomplish.<br>6. Description of Work Done<br>Overview of the tasks and responsibilities handled<br>Description of technologies/tools used<br>Screenshots, flowcharts, or diagrams (if applicable)</td></tr>
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| | **7. Learning Outcomes**<br>Skills developed, software or tools learned, industry exposure gained.<br>**8. Challenges and Solutions**<br>Mention any problems faced and how you solved them.<br>**9. Weekly Summary**<br>Brief of what was done in each week (can be derived from the logbook).<br>**10. Conclusion**<br>Summary of overall experience, learning, and impact on career development.<br>**11. References**<br>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. Incase of the online internship, the consolidated Logbook should be submitted at the end of the successful completion of the Internship.

## University Examinations

| Course Code | Course | Exam Component | Max. Marks |
|---|---|---|---|
| AI-601-01 (Minor-5-01) | E-Commerce and Cyber Security | **Theory** | **50** |
| AI-601-02 (Minor-5-02) | Concepts of IoT Devices | | |
| AI-601-03 (Minor-5-03) | Computer Graphics | | |
| AI-602 (Major-14) | Agentic AI–Driven Business Intelligence | **Capstone Project Presentation & Viva-voce** | **50** |
| AI-603 (Major-15) | Autonomous & Artificial General Intelligence | **Capstone Project Presentation & Viva-voce** | |
| AI-604 (Major-16) | PROJECT | **Project** | **50** |
| AI-605 (AEC-06) | Project and Interview Presentation Soft Skills | **Seminar/Presentation** | **50** |
| AI-606 (Major) | Internship | **Internship report/ presentation/ viva-voce** | **100** |

**[University theory exams for Course code: AI601-01/AI601-02/AI601-03, will be scheduled between 5th February to 11th February. Following to the theory exams, students will work on full time Projects and Internship. Project exams will be scheduled between 10th April to 20th April.]**