



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-મગદલા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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-:પરિપત્ર:-

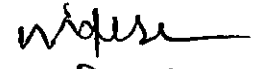
યુનિવર્સિટીના શૈક્ષણિક વિભાગના વડાશ્રીઓ અને યુનિવર્સિટી સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬-૨૭ થી અમલમાં આવનાર STEM અંગેના સર્ટિફિકેટ કોર્સ STEM વિષયની નિયુક્ત એડહોક બોર્ડ દ્વારા નિમણૂક કરેલ પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ નીચે મુજબના સર્ટિફિકેટ કોર્સ STEM વિષયની નિયુક્ત એડહોક અભ્યાસ સમિતિની તા.૧૮/૦૮/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૦૨ થી સુધારા વધારા સાથે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૨૪/૧૨/૨૦૨૪ ની સભાનાં ઠરાવ ક્રમાંક:૩૫૩ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે, જેની આથી જાણ કરવામાં આવે છે.

1. Certificate Course in Design Thinking & Innovation
2. Certificate Course in AI for Everyone
3. Certificate Course in Introduction to Bioinformatics
4. Certificate Course in Product Design and 3D Printing
5. Certificate Course in Data Science for Everyone
6. Certificate Course in Climate Change and Sustainability
7. Certificate Course in Introduction to Robotics
8. Certificate Course in Introduction to IoT
9. Certificate Course in Introduction to Drone Technology
10. Certificate Course in Biodiversity Photography
11. Certificate Course in Textile Design
12. Certificate Course in Digital Marketing and E-Commerce
13. Certificate Course in AI Based Content Creation
14. Certificate Course in Financial Analytics

બિડાણ: ઉપર મુજબ

ક્રમાંક:ઓથો./પરિપત્ર/૨૨૩૦૩/૨૦૨૬

તા.૨૪/૦૮/૨૦૨૬


કુલસચિવ

પ્રતિ,

- (૧) યુનિવર્સિટી ડિપાર્ટમેન્ટના વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો-ઓર્ડિનેટરશ્રીઓ.
- (૨) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ,
- (૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
- (૪) અનુસ્નાતક વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
- (૫) એકેડેમિક વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
- (૬) જોડાણ વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.

..... જાણ તથા ઘટતું થવા સારું.



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

Certificate Course in
Design Thinking and Innovation

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Certificate Course in Design Thinking and Innovation
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Eligibility Criteria	H.S.C. Passed (Any stream)
Course Description	This course provides a practical introduction to human-centered design, problem-framing, and empathy-driven research tools. Students will master rapid prototyping, iterative user testing, and innovation strategies to transform user insights into scalable, real-world solutions.
Medium of Instruction	English/Gujarati
Course Fee	Rs. 1800.00
Objective of Course	1. Understand human-centered design principles and empathy-driven research tools. 2. Master problem framing, ideation techniques, and lateral thinking to solve complex challenges. 3. Build practical skills in low-fidelity rapid prototyping, user feedback, and iterative testing. 4. Bridge design thinking with STEM applications to foster sustainable, scalable innovative solutions.
Pre-requisite	No prior technical knowledge required.
Course Outcomes	CO1: Conduct Empathy-Driven Research: Apply user observation, contextual inquiry, and persona mapping to identify latent user needs. CO2: Frame Complex Problems: Reframe research insights into actionable "How Might We" statements and Point-of-View problem definitions. CO3: Generate Creative Solutions: Utilize ideation tools like SCAMPER, brainstorming, and mind mapping to develop diverse concepts. CO4: Build Rapid Prototypes: Construct low-fidelity paper, physical, or digital wireframe models to test solutions quickly and cost-effectively. CO5: Test and Iterate: Execute user testing sessions using Feedback Capture Grids to refine prototypes and pitch innovative solutions.

Course Content		
	Description	Weight-age
	<u>Unit-1</u> <u>1. Introduction to Design Thinking & Empathy Building:</u> 1.1 Overview of Human-Centered Design and Design Thinking Framework 1.2 Mindsets of an Innovator: Curiosity, Bias to Action, Radical Collaboration 1.3 Empathy Building: User Observation, In-depth Interviews, Contextual Inquiry 1.4 Mapping Empathy: Personas, Empathy Maps, User Journey Mapping 1.5 Identifying User Needs, Extreme Users, and Unspoken Needs	25%
	<u>Unit-2</u> <u>2. Problem Framing & Ideation Strategies:</u> 2.1 Synthesis of Research Data: Clustering, Theme Generation, Insights Extraction 2.2 Reframing Problems: Defining 'How Might We' (HMW) Statements 2.3 Point-of-View (POV) Problem Statements	25%

	2.4 Ideation Techniques: Brainstorming, SCAMPER, Mind Mapping, Analogous Thinking 2.5 Convergent Thinking: Solution Selection Matrix and Storyboarding	
	<u>Unit - 3</u> <u>3. Rapid Prototyping & User Testing:</u> 3.1 Principles of Prototyping: Fail Fast, Fail Cheap, Learn Early 3.2 Types of Prototypes: Low-Fidelity vs. High-Fidelity, Paper Prototypes, Physical Mockups 3.3 Experience Prototyping, Wireframing, and Digital Mockups 3.4 Planning User Testing Sessions and Feedback Capture Grid 3.5 Iterative Design: Integrating Feedback, Refinement, and Pivoting	25%
	<u>Unit-4</u> <u>4. Innovation, STEM Integration & Implementation:</u> 4.1 Translating Design Thinking to STEM Innovations & Sustainability 4.2 Business Model Canvas (BMC) Basics for Innovators 4.3 Intellectual Property (IP) Basics: Patents, Trademarks, Designs 4.4 Pitching and Communication of Innovative Solutions 4.5 Case Studies of Real-World Interdisciplinary Technological Innovations	25%

PRACTICALS (if any)

1. Field Research & Empathy Mapping Workshop: Conduct real-world user interviews, observe daily challenges, and build comprehensive user personas and empathy maps.

2. Problem Framing & Ideation Sprint: Convert raw user feedback into actionable 'How Might We' (HMW) statements and apply SCAMPER/brainstorming tools to generate 20+ creative ideas.
3. Rapid Prototype Construction: Create low-fidelity physical prototypes (using simple craft/materials) or digital wireframes for a chosen problem solution.
4. User Testing Loop & Pitch Presentation: Conduct structured user testing using Feedback Capture Grids, refine prototypes based on user feedback, and present a 5-minute innovation pitch.

Reference Books	
1.	The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods - Michael Lewrick, Patrick Link & Larry Leifer, John Wiley & Sons, 2020.
2.	Designing Experiences - J. Robert Rossman & Mathew D. Duerden, Columbia University Press, 2019.
3.	Design Thinking: The Handbook - Falk Uebernickel, Li Jiang & Walter Brenner, World Scientific Publishing, 2020.
4.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation - Tim Brown, Harper Business, 2019.
5.	Creative Confidence: Unleashing the Creative Potential Within Us All - Tom Kelley & David Kelley, Crown Business, 2013.

Teaching Methodology	Interactive lectures, hands-on design sprints, group workshops, case study discussions, field observation exercises, low-fidelity model making, and project-based continuous learning.
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Practical Exam - Mode Of Examination 100% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical



**VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT**

Syllabus

**Certificate Course in
AI for Everyone**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	AI for Everyone
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs. OR 60 Hrs. (2 Credit Practical)
Credit	2
Course Description	To introduce undergraduate students to the fundamental concepts and practical applications of Artificial Intelligence and Generative AI.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English/Gujarati
Course Fee	Rs. 1800.00 1 credit Fees Rs. 1600/- Max.
Objective of Course	The course aims to introduce students at the 12+ level to the fundamental concepts, applications and responsible use of Artificial Intelligence through simple explanations, demonstrations, practical activities and real-life examples. The course provides students with an understanding of Artificial Intelligence, Machine Learning, Deep Learning, Generative AI and Large Language Models at a conceptual level without requiring programming or advanced mathematics. The course develops practical skills in interacting with Generative AI systems, writing effective prompts, generating and improving text and images, summarizing information, creating educational and creative content, solving problems using AI assistance and critically evaluating AI-generated responses. The course also develops awareness of important issues such as AI hallucination, bias, privacy, security, copyright, academic integrity, misinformation, deepfakes, employment and responsible use of Artificial Intelligence.

	The overall objective is to develop AI literacy, digital creativity, critical thinking, problem-solving ability and responsible AI usage among students.
Pre-requisite	No prior knowledge of Artificial Intelligence, programming or advanced mathematics is required
Course Outcomes	After successful completion of the course, students will be able to: CO1: Explain the fundamental concepts, evolution, types and everyday applications of Artificial Intelligence. CO2: Describe the basic concepts of data, Machine Learning, Deep Learning, Generative AI and Large Language Models. CO3: Use suitable Generative AI tools for learning, creativity, communication and everyday problem solving. CO4: Design effective prompts and improve AI-generated responses using appropriate prompting techniques. CO5: Create simple AI-assisted text, images, presentations and other digital content and evaluate their usefulness. CO6: Identify issues related to AI hallucination, bias, privacy, security, copyright, misinformation, deepfakes and responsible use of AI.

Course Content		
	Description	Weight-age
	UNIT I – UNDERSTANDING ARTIFICIAL INTELLIGENCE 1.1 Introduction to Artificial Intelligence	25%

- Meaning of Intelligence
- Meaning and definition of Artificial Intelligence
- AI in simple terms
- Objectives of AI
- Characteristics of AI
- Importance of AI
- Evolution and brief history of AI
- AI in everyday life

1.2 AI Around Us

- Search engines
- Recommendation systems
- Voice assistants
- Chatbots
- Face recognition
- Spam detection
- Navigation and route prediction
- Smartphones
- Social media
- Online shopping
- Smart devices

1.3 Types of Artificial Intelligence

- Narrow / Weak AI
- General AI – basic concept
- Super AI – future concept
- Reactive AI
- Limited-memory AI

1.4 AI, Machine Learning and Generative AI

- Artificial Intelligence
- Machine Learning
- Deep Learning
- Generative AI
- Relationship between AI, ML, Deep Learning and Generative AI

1.5 Basic AI Terminology

- Data
- Algorithm
- Model
- Training

	• Prediction • Automation • Prompt • Generative AI • AI system Practical Activities – Unit I 1. Identify AI applications used in everyday life. 2. Classify applications as AI / non-AI. 3. Investigate how Google Maps, YouTube or an online shopping platform uses AI. 4. Prepare an AI development timeline. 5. Compare Human Intelligence and Artificial Intelligence. 6. Conduct an AI-awareness quiz.	
	UNIT II – MACHINE LEARNING AND GENERATIVE AI 2.1 Understanding Data • Meaning of data • Importance of data in AI • Text data • Numerical data • Image data • Audio data • Video data • Structured and unstructured data • Dataset • Basic concept of features and labels 2.2 How AI Learns • Data and learning • Pattern recognition • Training data • Testing data • Model • Prediction • Accuracy • Error • Limitations of AI models	25%

2.3 Machine Learning

- Meaning of Machine Learning
- AI vs Machine Learning
- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning
- Real-world examples of Machine Learning

2.4 Deep Learning

- Meaning of Deep Learning
- Basic concept of neural networks
- Artificial neuron
- Input and output
- Image recognition
- Speech recognition
- Natural Language Processing

2.5 Generative AI

- Meaning of Generative AI
- Traditional AI vs Generative AI
- Text generation
- Image generation
- Audio generation
- Music generation
- Video generation
- Code generation

2.6 Large Language Models

- Meaning of Large Language Model
- Basic concept of LLM
- Training data
- Tokens – basic concept
- Context
- Input and output
- Strengths and limitations of LLMs

Practical Activities – Unit II

1. Classify different examples of data into text, image, audio, video and numerical data.
2. Perform a simple manual classification exercise to understand Machine Learning.

	3. Explore a Generative AI chatbot. 4. Generate a short story using Generative AI. 5. Generate a poem, essay or creative paragraph. 6. Generate a summary of a given text. 7. Generate an AI image using a text description. 8. Compare traditional search with Generative AI responses.	
	UNIT III – PROMPT ENGINEERING AND AI FOR CREATIVITY & PRODUCTIVITY 3.1 Introduction to Prompt Engineering • Meaning of prompt • Importance of prompts • Poor prompt vs effective prompt • Clear instructions • Context • Constraints • Expected output 3.2 Components of an Effective Prompt • Role • Task • Context • Constraints • Examples • Output format 3.3 Prompting Techniques • Basic prompting • Role prompting • Zero-shot prompting • Few-shot prompting • Step-by-step prompting • Context-based prompting • Summarization prompts • Comparison prompts • Structured-output prompts	25%

3.4 AI for Education

- Generating notes
- Summarization
- Question generation
- MCQ generation
- Revision
- Concept explanation
- Study planning
- Brainstorming

3.5 AI for Creativity

- Story writing
- Poetry
- Advertisement
- Poster ideas
- Image generation
- Video ideas
- Creative writing

3.6 AI for Productivity

- Email writing
- Letter writing
- Application writing
- To-do lists
- Planning
- Presentation content
- Reports
- Tables
- Brainstorming

Practical Activities – Unit III

1. Convert a poor prompt into a well-structured prompt.
2. Practice role-based prompting using roles such as teacher, scientist, career counsellor and interviewer.
3. Create an AI-based study assistant.
4. Generate notes from a selected topic.
5. Generate MCQs and short-answer questions from a topic.

	6. Prepare a study/revision plan using AI. 7. Create presentation content using AI. 8. Improve grammar and writing using AI. 9. Create a short story using AI and manually improve it. 10. Create an advertisement for a fictional product. 11. Generate an image using a carefully designed image prompt. 12. Compare the results obtained from two different prompts. 13. Create an AI-assisted career exploration activity. Conduct a prompt competition where students create the best prompt for a given task.	
	UNIT IV – RESPONSIBLE AI, AI SAFETY AND FUTURE OF AI 4.1 AI Hallucination • Meaning of AI hallucination • Why AI produces incorrect information • Confident but incorrect responses • Importance of verification • Reliable vs unreliable AI responses 4.2 AI Bias and Fairness • Meaning of AI bias • Sources of bias • Biased data • Examples of AI bias • Fairness • Human responsibility 4.3 Privacy and Security • Personal information • Passwords • Photographs • Location information	25%

- School/college information
- Confidential information
- Safe use of AI tools
- Information that should not be shared with AI systems

4.4 Copyright and Academic Integrity

- Copyright
- Intellectual property
- Plagiarism
- AI-generated content
- Academic honesty
- Responsible use of AI-generated content

4.5 Misinformation and Deepfakes

- AI-generated misinformation
- Fake images
- Fake audio
- Fake videos
- Deepfakes
- Social-media manipulation
- Fact-checking
- Critical evaluation of digital content

4.6 Future of AI

- AI in education
- AI in healthcare
- AI in science
- AI in business
- AI entrepreneurship
- AI in creative industries
- Artificial General Intelligence – basic concept
- Opportunities and challenges of future AI

Practical Activities – Unit IV

1. Identify errors in AI-generated answers.
2. Verify AI-generated information using reliable sources.
3. Analyze an example of possible AI bias.
4. Conduct a personal-data privacy classification exercise.

	5. Identify signs of AI-generated misinformation or manipulated media. 6. Conduct an AI ethics debate. 7. Prepare a “10 Rules for Responsible AI Use” guide for students.	
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Suggested Mini Project

AI Creativity and Problem-Solving Project

Students may work individually or in groups of 2–3.

Each group should identify a simple real-world problem and develop an AI-assisted solution.

Suggested Project Topics

1. AI Study Assistant
2. AI Homework Helper
3. AI Career Assistant
4. AI Travel Planner
5. AI Story Generator
6. AI Quiz Generator
7. AI School FAQ Assistant
8. AI Tourist Guide
9. AI Agriculture Information Assistant
10. AI Advertisement Generator
11. AI Poster Generator
12. AI Revision Planner
13. AI Language Learning Assistant
14. AI Interview Preparation Assistant
15. AI Presentation Assistant

Project Report Should Include

1. Problem identification
2. Proposed solution
3. Target users
4. AI tool(s) used
5. Prompts used
6. Generated output
7. Student’s own improvements
8. Verification of output
9. Ethical/privacy considerations
10. Final outcome
11. Future scope

Reference Books	
1.	Goswami, Saptarsi; Das, Amit Kumar; Chakrabarti, Amlan AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI) Pearson India, 2024. ISBN: 9789361591754
2.	Posthoff, Christian Artificial Intelligence for Everyone Springer, 1st Edition, 2024. Hardcover ISBN: 978-3-031-57207-4 eBook ISBN: 978-3-031-57208-1
3.	Mueller, John Paul; Massaron, Luca; Diamond, Stephanie Artificial Intelligence For Dummies 3rd Edition, Wiley, 2024. ISBN: 978-1-394-27071-2
4.	Kaplan, Jerry Generative Artificial Intelligence: What Everyone Needs to Know® Oxford University Press, 2024. Print ISBN: 9780197773536 Online ISBN: 9780197773574
5	Sabesan, Karthikeyan; Sivagamisundari; Dutta, Nilip Generative AI for Everyone BPB Publications, 2025. ISBN: 9789365897388

Teaching Methodology	Blended (Theory + Practical /Field Work/ Field Visit)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam Mode Of Examination 100% Practical OR 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance

	External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical - OR 40% Theory and 60% Practical
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**VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT**

Syllabus

Certificate Course in Introduction to Bioinformatics

(Under Skill / Value-Added Certificate Course Programme)

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN BIOINFORMATICS	
Name of Course	Certificate Course in Introduction to Bioinformatics
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2 (NCrF Level 4.5)
Course Description	Bioinformatics is an interdisciplinary field that applies computational and statistical methods to the storage, retrieval and analysis of biological data. This entry-level certificate course is designed for students who have completed H.S.C. (Science) and introduces them to biological databases, sequence and structure analysis, molecular phylogeny, protein structure prediction and computer-aided drug design. Sixty per cent of the course is hands-on: every theoretical concept is reinforced through a laboratory exercise carried out on free, web-based or open-source software, so that a learner with no programming background acquires an employable analytical skill set.
Eligibility Criteria	H.S.C. Passed (Science stream)
Medium of Instruction	English
Course Fee	Rs. 2400.00
Objective of Course	1. To introduce learners entering from the higher-secondary science stream to the basic concepts of molecular biology, biological data and the interdisciplinary scope of bioinformatics. 2. To develop the ability to locate, retrieve, interpret and manage nucleotide, protein and structural data from major public biological databases. 3. To impart working knowledge of sequence comparison, pairwise and multiple sequence alignment, database similarity searching (FASTA and BLAST) and molecular phylogenetic analysis.

	4. To build competence in protein sequence and structure analysis, secondary structure prediction and three-dimensional structure prediction through homology modelling. 5. To expose learners to the applied domains of bioinformatics — genomics, proteomics and computer-aided drug design — so as to create pathways for higher study and employment.
Pre-requisite	1. Passed H.S.C. (10+2) examination in the Science stream with Biology and/or Chemistry as one of the subjects. 2. Higher-secondary level understanding of the cell, biomolecules (DNA, RNA and protein) and the central dogma of molecular biology. 3. Elementary computer literacy operating a Windows/Linux desktop, basic file handling, use of a web browser and internet search. 4. No prior knowledge of programming or of any bioinformatics software is required; all tools used in the course are free or open-access.
Course Outcomes	On successful completion of the course the learner will be able to: CO1 : Explain the central dogma of molecular biology, the nature and types of biological data, and the organisation of primary, secondary and composite biological databases. (Bloom: Remember / Understand) CO2 : Retrieve, interpret and inter-convert nucleotide, protein and structural data from GenBank, UniProt, PIR, GenPept, PDB and MMDB using Entrez and EBI retrieval systems. (Bloom: Apply) CO3 : Perform pairwise and multiple sequence alignment, conduct FASTA and BLAST database searches, judge the statistical significance of hits, and construct and interpret phylogenetic trees from molecular marker genes. (Bloom: Apply / Analyse) CO4 : Analyse protein sequences and structures, predict secondary structure by Chou–Fasman, GOR and machine-learning methods, build a homology model and validate it. (Bloom: Analyse / Evaluate) CO5 : Describe the applications of bioinformatics in genomics, proteomics and drug discovery, and execute a basic molecular docking and drug-likeness screening workflow. (Bloom: Understand / Apply)

Course Content

Theory: 15 Hrs. (1 Credit). Each unit carries 25% weight-age in the theory examination.

Unit	Description	Weight-age
Unit-1 (04 Hrs.)	Introduction to Biological Data and Bioinformatics 1.1 Introduction to Bioinformatics: Definition, aims and scope of bioinformatics; brief history and landmark developments, interdisciplinary nature; major application areas and career avenues. 1.2 Central Dogma of Molecular Biology: Structure of DNA and RNA; genome, gene, exon and intron; DNA replication; transcription and post-transcriptional processing; the genetic code and translation; open reading frames (ORFs) and reading frames; organisation of prokaryotic versus eukaryotic genes 1.3 Data and Biological Data Concept of data and types of biological data- nucleotide sequence, protein sequence, three-dimensional structure & gene expression; exponential rate of biological data generation; common sequence file formats i.e. FASTA, GenBank/EMBL flat file, PDB, Clustal and GCG; accession number, version and GI number 1.4 Biological Databases and Nucleotide Sequence Databases — Concept of a database and a database management system; flat-file, relational and object-oriented architecture; classification of biological databases primary, secondary and composite/derived; database annotation and curation; NCBI-GenBank, EMBL-ENA and DDBJ; Genome browsers (NCBI Genome, Ensembl, UCSC); Sequence submission (BankIt/Sequin). 1.5 Protein, Structure and Specialised Databases; Data Retrieval Protein sequence databases- UniProtKB (Swiss-Prot), PIR and GenPept; family, domain and motif databases- Pfam and PROSITE; structure databases- PDB and MMDB; data-retrieval systems- NCBI Entrez, EBI Search and SRS; keyword-, accession- and field-based searching, Boolean operators and batch retrieval.	25%
Unit-2 (04 Hrs.)	Sequence Comparison, Alignment and Molecular Phylogeny 2.1 Fundamentals of Sequence Comparison Sequence similarity, identity and homology; orthologues, paralogues and xenologues; the concept of alignment (matches, mismatches, gaps and indels); substitution/scoring matrices- PAM and BLOSUM series, their construction and criteria for selection; gap-opening and gap-extension penalties; dot-matrix (dot plot) method of sequence comparison and detection of repeats and inversions. 2.2 Pairwise Sequence Alignment Global alignment by the Needleman–Wunsch & local alignment by the Smith–Waterman algorithm; comparison of global and local approaches with worked examples;	25%

	alignment score, percentage identity and query coverage; alignment score, bit score, E-value and P-value 2.3 Database Similarity Searching: FASTA and BLAST- FASTA & BLAST algorithm; blastn, blastp, blastx, tblastn, tblastx; reading and interpreting a BLAST report; comparison of FASTA and BLAST. 2.4 Multiple Sequence Alignment- Need for and applications of multiple sequence alignment; progressive alignment Clustal Omega; guide tree and profile concepts; consensus sequence, conserved blocks, sequence logos and motif detection 2.5 Molecular Phylogeny- Basic concepts phylogenetic tree types and structure & topology, OUT, clade, molecular markers used in phylogeny (16S rRNA, ITS) and the molecular clock hypothesis; UPGMA and Neighbour-Joining; assessment of tree reliability by bootstrapping; tools- MEGA; interpretation and presentation of trees.	
Unit-3 (04 Hrs.)	Protein Sequence, Structure Determination and Structure Prediction 3.1 Protein Sequencing and Primary Structure Analysis- Amino acids, polypeptide chain; protein sequencing by Edman degradation and by mass-spectrometry-based methods (principle only); deduction of protein sequence from nucleotide sequence; computation of physico-chemical parameters using ExPASy ProtParam- molecular weight, theoretical pI etc. 3.2 Protein Structure Organisation and Visualisation- Levels of protein structure; Ramachandran plot; forces stabilising the folded state; hierarchical structural classification in SCOP and CATH; molecular visualisation using RasMol 3.3 Experimental Determination of Protein Structure- Principle and application of X-ray crystallography; NMR spectroscopy and cryo-electron microscopy for structure determination; PDB file format and its principal records; quality indicators; structure validation using PROCHECK 3.4 Protein Secondary Structure Prediction- Principle of prediction from sequence; the statistical/propensity approach- the Chou-Fasman method; the information-theory approach- the GOR method; the contribution of evolutionary information through PSI-BLAST profiles 3.5 Tertiary Structure Prediction and Homology Modelling- Three approaches- comparative (homology) modelling, fold recognition/threading and ab initio prediction; evaluation of the model by Ramachandran analysis; tools- SWISS-MODEL and MODELLER; introduction to deep-learning-based structure prediction and the AlphaFold Protein Structure Database	25%
Unit-4 (03 Hrs.)	Applications of Bioinformatics and Drug Designing 4.1 Genomics and Comparative Genomics- Genome sequencing strategies Sanger sequencing, shotgun sequencing and an introduction to next-generation sequencing platforms; the Human Genome	25%

	Project; genome assembly, contigs and scaffolds; genome annotation; gene prediction 4.2 Transcriptomics and Proteomics- Gene expression analysis by DNA microarray and RNA-Seq principle and workflow; expression data repositories; proteomics- two-dimensional gel electrophoresis and mass-spectrometry-based protein identification (peptide mass fingerprinting, Mascot) 4.3 Drug Discovery and Computer-Aided Drug Design- The conventional drug-discovery pipeline and its constraints; target identification and validation; hit and lead identification and optimisation; drug-likeness- Lipinski's rule of five and ADMET properties; structure-based versus ligand-based drug design; pharmacophore modelling and an introduction to QSAR; chemical and drug databases; chemical file formats. 4.4 Molecular Docking and Virtual Screening- Receptor–ligand interaction, binding site and affinity; preparation of the receptor and the ligand; identification of the binding site; rigid, flexible and induced-fit docking; search algorithms and scoring functions; docking software; interpretation of binding energy and of interaction diagrams; virtual screening of compound libraries. 4.5 Applied and Emerging Areas, Ethics and Career Prospects — Bioinformatics in personalised medicine; computational vaccine design through epitope prediction; agricultural, environmental and forensic applications; biological data standards, reproducibility, data privacy and intellectual property/patenting issues; the open-source software culture and community databases; scope for higher study and employment in the bioinformatics industry.	
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Practicals

Practical: 30 Hrs. (1 Credit). All exercises are performed on free web-based servers or open-source software; no licensed package is required. Every student maintains a practical journal recording the objective, the tool and version used, the input, the output and the interpretation of each exercise.

Sr. No.	Title and Scope of the Practical	Hrs.
1	Navigation and retrieval from biological databases (Retrieval of nucleotide records from GenBank and of protein records from GenPept, UniProtKB (Swiss-Prot/TrEMBL) and PIR; retrieval of structure records from PDB and MMDB; searching by accession number, gene name and keyword using NCBI Entrez and EBI Search; reading and interpreting the fields of a GenBank flat file, a UniProt entry and a PDB header)	2
2	Sequence file formats, ORF identification and translation (Recognition and inter-conversion of FASTA, GenBank, EMBL, Clustal and PDB formats using EMBOSS seqret; identification of open reading frames with NCBI ORFfinder; six-frame translation of a nucleotide sequence with EMBOSS Transeq; extraction of the coding sequence and comparison with the annotated protein.)	2
3	Database similarity searching using BLAST and FASTA (Execution of blastn, blastp and blastx at NCBI against selected databases; variation of word size, matrix and filter and observation of the effect on output; interpretation of score, bit score, E-value, percentage identity and query coverage; execution of the same query through EBI FASTA/SSEARCH and tabular comparison of the two outputs.)	3
4	PCR primer design and specificity validation (Design of forward and reverse primers for a given gene using Primer3Plus; evaluation of length, melting temperature, GC content, self-complementarity, hairpin formation and amplicon size; verification of primer specificity by Primer-BLAST; documentation of the final primer pair.)	2
5	Pairwise sequence alignment by global and local methods (Global alignment by the Needleman–Wunsch algorithm (EMBOSS Needle) and local alignment by the Smith–Waterman algorithm (EMBOSS Water) for the same sequence pair)	3
6	Multiple sequence alignment and conserved motif analysis (Alignment of a set of homologous sequences using Clustal Omega; visualisation, colouring and manual editing of the alignment in Jalview; identification of conserved blocks and generation of a sequence logo; export of the alignment in CLUSTAL and PHYLIP formats.)	3
7	Construction of a phylogenetic tree from molecular marker genes (Retrieval of a molecular marker data set (16S rRNA) and its alignment; computation of the distance matrix under a selected evolutionary model; construction of trees by UPGMA and Neighbour-Joining in MEGA and by maximum parsimony)	3

8	Protein sequence analysis: physico-chemical properties, motifs and domains (Computation of molecular weight, theoretical pI, extinction coefficient, instability index, aliphatic index and GRAVY using ExPASy ProtParam; identification of domains, families and functional motifs using InterProScan and PROSITE)	2
9	Protein secondary structure prediction (Prediction of secondary structure for a given protein by the Chou–Fasman and GOR methods (NPS@/BioEdit))	3
10	Visualisation and validation of a three-dimensional protein structure (Download of a PDB entry and inspection of its records; visualisation in PyMOL/UCSF Chimera/Swiss-PdbViewer; colouring by chain, secondary structure and B-factor; measurement of distances and identification of the ligand-binding pocket; generation and interpretation of the Ramachandran plot using PROCHECK/MolProbity.)	2
11	Homology (comparative) modelling of a protein (Selection of a target sequence with no experimentally determined structure; identification of a suitable template by BLAST/HHpred; target–template alignment and model building using SWISS-MODEL/MODELLER; evaluation of the model by Ramachandran analysis; comparison with the corresponding AlphaFold DB model.)	3
12	Ligand retrieval, drug-likeness filtering and molecular docking (demonstration) (Retrieval of ligand structures from PubChem, and inter-conversion of SMILES, SDF and PDBQT formats using Open Babel; screening of a small compound set against Lipinski's rule of five and predicted ADMET properties (SwissADME); preparation of receptor and ligand, definition of the grid box and docking with AutoDock Vina/PyRx; ranking by binding energy and analysis of interactions using LigPlot+/Discovery Studio Visualizer.)	2
	Total Practical Hours	30

Reference Books (Prescribed)

Code	Reference
R1	Ghosh, Z., & Mallick, B. (2008). Bioinformatics: Principles and Applications. Oxford University Press. ISBN: 9780195692303
R2	Xiong, J. (2006). Essential Bioinformatics. Cambridge University Press. ISBN: 9780511806087
R3	Bosu, O., & Thukral, S. K. (2007). Bioinformatics: Databases, Tools and Algorithms. Oxford University Press. ISBN: 9780195676839
R4	Choudhuri, S. (2014). Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools. Academic Press. ISBN-13: 978-0124104716
R5	Christensen, H. (Ed.). (2018). Introduction to Bioinformatics in Microbiology. Springer. ISBN: 9783319992805
R6	Baxeavanis, A. D., & Ouellette, B. F. F. (2011). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley India. ISBN-10: 8126521929
R7	Lesk, A. M. (2019). Introduction to Bioinformatics (5th ed.). Oxford University Press. ISBN-10: 0198794142
R8	Mount, D. W. (2004). Bioinformatics: Sequence and Genome Analysis (2nd ed.). Cold Spring Harbor Laboratory Press. ISBN-13: 978-0879697129

Additional Reference Books Recommended

Code	Reference
N1	Pevsner, J. (2015). Bioinformatics and Functional Genomics (3rd ed.). Wiley-Blackwell. ISBN-13: 978-1118581780
N2	Zvelebil, M., & Baum, J. O. (2007). Understanding Bioinformatics. Garland Science. ISBN-13: 978-0815340249
N3	Gu, J., & Bourne, P. E. (Eds.). (2009). Structural Bioinformatics (2nd ed.). Wiley-Blackwell. ISBN-13: 978-0470181058
N4	Rastogi, S. C., Mendiratta, N., & Rastogi, P. (2022). Bioinformatics: Methods and Applications — Genomics, Proteomics and Drug Discovery (5th ed.). PHI Learning. ISBN-13: 978-9391818449
N5	Gore, M., & Jagtap, U. B. (Eds.). (2018). Computational Drug Discovery and Design (Methods in Molecular Biology, Vol. 1762). Humana Press / Springer. ISBN-13: 978-1493977550
N6	Ramsundar, B., Eastman, P., Walters, P., & Pande, V. (2019). Deep Learning for the Life Sciences. O'Reilly Media. ISBN-13: 978-1492039839

N7	Yuryev, A. (Ed.). (2007). PCR Primer Design (Methods in Molecular Biology, Vol. 402). Humana Press. ISBN-13: 978-1588296528
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Mapping of Units, Course Outcomes and Practicals

Unit	Course Outcome Addressed	Corresponding Practical(s)
Unit-1	CO1, CO2	Practicals 1, 2
Unit-2	CO3	Practicals 3, 4, 5, 6, 7
Unit-3	CO4	Practicals 8, 9, 10, 11
Unit-4	CO5	Practical 12

Suggested Web Resources and Software

Resource	Description / URL
NCBI	https://www.ncbi.nlm.nih.gov — Entrez, GenBank, RefSeq, BLAST, ORFfinder, Primer-BLAST, PubMed
EMBL-EBI	https://www.ebi.ac.uk — ENA, UniProt, InterPro, Clustal Omega, MUSCLE, MAFFT, EMBOSS, FASTA, AlphaFold DB, and free on-demand training courses
ExPASy	https://www.expasy.org — ProtParam, ProtScale, Translate, PROSITE, SWISS-MODEL
RCSB PDB	https://www.rcsb.org — structure retrieval, Molecule of the Month, PDB-101 educational resources
MEGA	https://www.megasoftware.net — free software for alignment and phylogenetic analysis
Open-source tools	Jalview, BioEdit, PyMOL (educational licence), UCSF Chimera/ChimeraX, Open Babel, AutoDock Vina, PyRx, LigPlot+, iTOL, SwissADME

Teaching Methodology and Evaluation

Teaching Methodology	Blended — Theory + Practical / Demonstration. - Classroom lectures supported by presentations and animations (15 Hrs.). - Hands-on computer laboratory sessions on web-based and open-source tools (30 Hrs.). - Live demonstration of tools followed by supervised individual practice.
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	• Case-study-based assignments, maintenance of a practical journal and a short mini-project or presentation.
Evaluation Method	Internal Assessment : 25 Marks • 15 Marks for Examination — Mode of Examination: 40% Theory and 60% Practical • 05 Marks for Journal / Assignment • 05 Marks for Attendance External Assessment : 25 Marks • Mode of Examination: 40% Theory and 60% Practical Total : 50 Marks. Minimum passing as per university norms.



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus
Certificate Course in
Product Design and 3D Printing

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN PRODUCT DESIGN AND 3D PRINTING		
Name of Course	Certificate Course in Product Design and 3D Printing	
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.	
Credit	2	
Course Description	This course introduces the fundamentals of product design using open-source Computer-Aided Design (CAD) software and the principles and practical workflow of 3D printing. It covers 2D drafting, 3D modelling, printable file preparation, 3D-printing technologies, materials, design considerations, slicing, printer calibration and basic printing operations. The course provides hands-on experience in developing a 3D product model and producing a physical prototype using 3D printing.	
Eligibility Criteria	H.S.C. Passed (Any stream)	
Medium of Instruction	English	
Course Fee	Rs. 3200.00 1 credit Fees: Rs. 1600/- Max.	
Objective of Course	1. To develop fundamental skills in 2D drafting and 3D product modelling using open-source CAD software. 2. To introduce the principles, technologies, materials and design considerations of 3D printing. 3. To develop practical understanding of 3D-printable file preparation, slicing, printer calibration and printing processes. 4. To enable students to design and produce a simple functional product or prototype using 3D printing.	
Pre-requisite	Basic knowledge of computer operation and digital file management is desirable. No prior knowledge of CAD or 3D printing is required.	
Course Outcomes	1. Apply CAD skills to create and modify 2D drawings and develop basic 3D product models using open-source CAD software. 2. Explain the basic principles, technologies and materials of 3D printing and identify suitable options for simple applications. 3. Prepare 3D models for printing using appropriate file formats, slicing software, print settings and support structures. 4. Operate and calibrate a 3D printer to produce a simple functional product or prototype and perform basic post-processing.	
Course Content		

PRACTICALS:

	Description	Weight-age
	<u>Unit-1 (4 Hrs.)</u> <u>CAD Fundamentals and 2D Drawing Using Open-Source CAD Software:</u> • Introduction to Computer-Aided Design (CAD) • Exploring the CAD software interface and workspace • Creating and managing CAD projects and files • Basic 2D drafting and sketching tools • Creating and modifying drawing objects • Using layers and organizing drawing elements • Applying dimensions and geometric constraints • Introduction to parametric sketching • Preparing and exporting technical drawings	25%
	<u>Unit-2 (4 Hrs.)</u> <u>3D Modelling and Visualization Using Open-Source CAD Software :</u> • Introduction to 3D modelling workspaces • Creating 3D sketches and basic models • Creating 3D solid models using basic modelling operations • Developing complex 3D solid models • Editing and transforming 3D objects • Applying parametric modelling techniques • Introduction to mesh and surface modelling • Visualizing and inspecting 3D models • Exporting 3D models for product development and printing	25%
	<u>Unit – 3 (4 Hrs.)</u> <u>3D Printing Technologies, Materials and Design Rules:</u> • Introduction to 3D printers and printable materials • Fused Deposition Modelling (FDM/FFF) and its working principle • Filament types, properties and applications • Resin-based printing technologies: SLA, DLP and LCD • Introduction to other 3D-printing technologies • Selective Laser Sintering (SLS) • Binder jetting and material jetting • 3D-printing workflow and software • Types of 3D-printable files and model file formats • Creating and preparing models using open-source CAD software	25%

	• Introduction to slicing software • Design rules for 3D printing: wall thickness, overhangs, clearances, tolerances and support requirements	
	Unit-4 (3 Hrs.) <u>3D Printer Operation, Calibration and Applications:</u> • Introduction to open-source slicing software and printer configuration • Slicing software interface and printer profiles • Configuring printer and slicing parameters • Print orientation, layer height, infill and build-plate adhesion • Print speed, temperature and material settings • Support structures and filament selection • G-code generation and print preparation • 3D-printer calibration and first-layer inspection • Basic operation and execution of a 3D print • Common applications of 3D printing in product design, prototyping, engineering and education • Basic troubleshooting and post-processing	25%

- 1. Basic 2D Drawing and Editing Using Open-Source CAD Software.**
 - Create and modify a basic 2D product drawing using drafting and sketching tools.
- 2. Layers, Dimensions and Parametric Drawing Using Open-Source CAD Software.**
 - Prepare a dimensioned 2D product drawing using layers, dimensions and geometric constraints.
- 3. Creation of 3D Solid Models Using Open-Source CAD Software**
 - Develop basic and complex 3D solid models using suitable modelling operations.
- 4. Editing and Visualization of 3D Models Using Open-Source CAD Software**
 - Edit, transform, inspect and visualize 3D models, including introductory mesh and surface modelling.
- 5. Design of a 3D-Printable Product Using Open-Source CAD Software**
 - Design a simple product model while considering wall thickness, overhangs, clearances and printability.
- 6. Preparation of a 3D Model for Printing and File Conversion**
 - Export the designed model into a suitable printable file format and inspect the model before slicing.
- 7. Slicing and Print-Setting Preparation Using Open-Source Slicing Software**
 - Import the model into slicing software, orient it, configure layer height, infill, supports, speed and temperature, and generate the sliced output.
- 8. 3D Printer Calibration and First Print**
 - Configure the printer, check calibration parameters, inspect the build platform and perform a first print.
- 9. 3D Printing, Support Removal and Post-processing**
 - Print the prepared model, remove it from the build platform, remove support structures and perform basic post-processing.
- 10. Design and 3D Printing of a Functional Product**
 - Design or select a simple product, prepare its printable file, slice it and manufacture a physical prototype using a 3D printer.

Reference Books	
1	Horvath, J. A., and Cameron, R. <i>Mastering 3D Printing: A Guide to Modeling, Printing, and Prototyping</i> , Second Edition, Apress, 2020.
2	Redwood, B., Schoffer, F., and Garret, B. <i>The 3D Printing Handbook: Technologies, Design and Applications, 3D Hubs</i> , 2017.
3	Horvath, J., and Cameron, R. <i>Mastering 3D Printing in the Classroom, Library, and Lab</i> . Apress, 2018.

Software Learning Resources:

Official documentation, user manuals and tutorials for suitable open-source CAD and slicing software may be used as learning resources.

Software Requirements:

The course shall utilize suitable open-source CAD and slicing software for 2D drafting, 3D modelling, product design and 3D-printing preparation, along with a compatible 3D printer. Software selection shall depend on laboratory facilities and course requirements.

Teaching Methodology	Blended (Theory + Practical)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam Mode Of Examination 100% Practical OR 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical OR 40% Theory and 60% Practical



**VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT**

Syllabus

Certificate Course in
Data Science for Everyone

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN DATA SCIENCE FOR EVERYONE	
Name of Course	Certificate Course in Data Science for Everyone
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Course Description	Data Science is an interdisciplinary field that combines data collection, statistics, programming, data visualization, analytical techniques and machine learning to extract useful knowledge from data. The Certificate Course in Data Science for Everyone is designed to provide students from different disciplines with a practical introduction to the complete data science lifecycle. The course emphasises learning by doing. Students will work with real-world datasets and learn how to collect, clean, analyse, visualise and interpret data using Python, NumPy, Pandas and Matplotlib/Seaborn. The course also introduces Exploratory Data Analysis (EDA), correlation and basic predictive analytics.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English
Course Fee	Rs. 1800.00
Objective of Course	1. Introduce the concepts, scope and applications of Data Science. 2. Explain the Data Science lifecycle and workflow. 3. Introduce different types and sources of data. 4. Develop practical skills in data collection and preparation. 5. Develop skills in NumPy and Pandas. 6. Develop data visualization and Exploratory Data Analysis skills.

	7. Introduce the basic concepts of machine learning. 8. Enable students to complete a small real-world data science project.
Pre-requisite	1. Basic Statistics and Basic computer literacy. 2. H.S.C. (10+2) passed in any stream. No prior programming experience is required. 3. Ability to operate a computer, handle files and folders and use a web browser.
Course Outcomes	CO1 : Explain the concepts, scope, applications and lifecycle of Data Science. CO2 : Identify, collect and organize different types of datasets. CO3 : Use Python and basic data science libraries for data analysis. CO4 : Clean, preprocess and transform datasets for analysis. CO5 : Apply basic statistical techniques and Exploratory Data Analysis. CO6 : Create and interpret appropriate data visualizations. CO7 : Explain the basic concepts and workflow of machine learning. CO8 : Develop and present a basic data science project using a real-world dataset.

Course Content

Theory: 15 Hrs. (1 Credit). Each unit carries 25% weight-age and is arranged into five sub-topics. All topics of the original syllabus are retained, in their original unit and order.

Unit	Description	Weight-age
UNIT-I (04 Hrs.)	<u>Introduction to Data Science</u> 1.1 Introduction to Data and Data Science • Introduction to Data • What is Data Science? • Characteristics of Data Science • Need for Data Science 1.2 Data Science and Related Fields • Data Science vs Data Analytics • Data Science vs Machine Learning • Data Science vs Artificial Intelligence 1.3 Role of a Data Scientist • Who is a data scientist • Skills and responsibilities of a data scientist • Career opportunities in Data Science 1.4 Data Science Lifecycle and Data-Driven Decision Making • Data Science lifecycle — problem definition, data collection, preparation, analysis, modelling, communication • Data-driven decision making • From data to information to decision 1.5 Applications of Data Science • Healthcare; Banking and finance; E-commerce • Education; Agriculture; Transportation • Sports; Social media; Business analytics • Government and public services	25%
UNIT-II (04 Hrs.)	<u>Data Collection, Types and Preprocessing</u> 2.1 Types of Data • Structured data; Semi-structured data; Unstructured data • Numerical data; Categorical data • Discrete and continuous data • Primary and secondary data 2.2 Structure of a Dataset • Dataset, records and attributes • Features and target variables 2.3 Sources and File Formats of Data • Sources of datasets • CSV, Excel and JSON files • Data collection methods 2.4 Data Quality and Data Cleaning • Data quality; need for data preprocessing • Missing values; Duplicate records; Incorrect values	25%

	• Inconsistent formats; Outliers 2.5 Data Transformation • Data type conversion • Encoding categorical data • Scaling and normalization — basic concept	
UNIT-III (04 Hrs.)	<u>Python for Data Science</u> 3.1 Introduction to Python • Introduction to Python and the working environment • Variables and data types • Operators 3.2 Python Data Structures • Lists, Tuples, Dictionaries 3.3 Control Flow and Functions • Conditional statements, Loops, Functions 3.4 Libraries and NumPy • Importing libraries; introduction to Data Science libraries • NumPy — arrays, indexing and basic operations 3.5 Pandas, Matplotlib and Seaborn • Pandas — Series and DataFrame, reading and handling a dataset • Matplotlib — basic plotting • Seaborn — statistical plots	25%
UNIT-IV (03 Hrs.)	<u>Statistics and Exploratory Data Analysis</u> 4.1 Statistics in Data Science • Importance of statistics in Data Science • Frequency distribution 4.2 Measures of Central Tendency • Mean, Median, Mode 4.3 Measures of Dispersion • Range, Variance, Standard deviation 4.4 Percentiles, Quartiles and Outliers • Percentiles, Quartiles; Interquartile range, Outliers 4.5 Relationships and Exploratory Data Analysis • Correlation; Covariance — basic concept • EDA — understanding dataset structure; summary statistics • EDA — distribution of variables; identifying patterns • EDA — identifying relationships; identifying unusual observations	25%

Practicals

Practical: 30 Hrs. (1 Credit). All practicals are performed in Jupyter Notebook or Google Colab using free software and freely available datasets. Each practical is first demonstrated by the teacher and then repeated by the student. Students maintain a practical journal containing the aim, the code, the output and a one-line conclusion.

Sr. No.	Title and Aim of the Practical
1	Exploring datasets and identifying types of data Aim: Open two or three sample datasets in CSV, Excel and JSON form; identify whether each is structured, semi-structured or unstructured, and mark the records, attributes, features and target variable.
2	Python environment and basic programming Aim: Set up Anaconda/Jupyter Notebook or Google Colab; write simple programs using variables, data types, operators and input–output statements.
3	Python data structures, control flow and functions Aim: Write programs using lists, tuples and dictionaries; apply conditional statements and loops; define and call a user-defined function.
4	Analysing a student marks array using NumPy Aim: Create a NumPy array of student marks; perform indexing and slicing; compute total, mean, maximum, minimum and standard deviation of the marks.
5	Analysing a student or employee dataset using Pandas Aim: Read a CSV file into a DataFrame; inspect it using head(), info() and describe(); select columns, filter rows, sort the data and group it to obtain simple summaries.
6	Data cleaning and preprocessing using Pandas Aim: Detect and treat missing values, remove duplicate records, correct inconsistent formats and wrong data types, and identify outliers in a given dataset.
7	Data transformation: encoding and scaling Aim: Convert a categorical column into numeric form by simple encoding, and apply basic scaling or normalization to a numeric column.
8	Descriptive statistics using Python Aim: Compute frequency distribution, mean, median, mode, range, variance, standard deviation, percentiles, quartiles and interquartile range for a given dataset.
9	Visualization of a sales dataset using Matplotlib Aim: Create appropriate visualizations for a sales dataset — bar chart, line graph, pie chart and histogram — with proper title, axis labels and legend.
10	Statistical plots and correlation using Seaborn Aim: Draw box plot, scatter plot and correlation heat map; interpret the spread, the outliers and the relationship between two variables.
11	Exploratory Data Analysis of a real dataset

	Aim: Perform a complete EDA on a downloaded dataset — examine its structure, obtain summary statistics, study the distribution of variables, and report the patterns, relationships and unusual observations found.
12	Mini project Aim: Carry out a small data analysis and visualization project on any one domain area (healthcare, education, agriculture, sports, e-commerce, transport or similar), and present the dataset, the cleaning steps, the analysis, the charts and the conclusion.
	Total Practical 30 Hours

The mini project (Practical 12) is carried out by the student outside the timetabled hours, alongside Practicals 8 to 11, and is presented in class at the end of the course.

Reference Books

No.	Reference
1.	Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media.
2.	Wes McKinney, Python for Data Analysis, O'Reilly Media.
3.	Jake VanderPlas, Python Data Science Handbook, O'Reilly Media.
4.	Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Media.
5.	David Cielen, Arno D. B. Meysman and Mohamed Ali, Introducing Data Science, Manning Publications.
6	Lloyd R. Jaisingh, Statistics for the Utterly Confused, 2nd Edition, McGraw-Hill, 2006
7	Sampler, Foundations of Data: Data Science, McGraw Hill, 2026

Free Software, Datasets and Websites

Purpose	Free Tools / Websites
Software	Anaconda with Jupyter Notebook, or Google Colab (needs only a browser and a Google account) — both free
Python libraries	NumPy, Pandas, Matplotlib and Seaborn — all included in Anaconda and pre-installed in Colab
Free datasets	Kaggle Datasets, UCI Machine Learning Repository, data.gov.in (Open Government Data Platform India), and the Seaborn built-in datasets
Spreadsheet	Microsoft Excel, LibreOffice Calc or Google Sheets — for viewing CSV and Excel files before importing
Practice and learning	Kaggle Learn, W3Schools Python tutorial and the official Pandas documentation — all free

Mapping of Units, Course Outcomes and Practicals

Unit	Course Outcome Addressed	Corresponding Practical(s)
UNIT-I	CO1, CO7	Practicals 1, 12
UNIT-II	CO2, CO4	Practicals 1, 6, 7
UNIT-III	CO3, CO6	Practicals 2, 3, 4, 5, 9, 10
UNIT-IV	CO5, CO6	Practicals 4, 8, 9, 10, 11
All units	CO8	Practical 12 (Mini project)

Teaching Methodology and Evaluation

Teaching Methodology	Blended (Theory + Practical) • Classroom sessions with everyday examples of data and data-driven decisions (15 Hrs.) • Computer-laboratory sessions in which the teacher demonstrates each step and the student repeats it (30 Hrs.) • A printed worksheet for every practical giving the aim, the dataset and the expected output • Maintenance of a practical journal with the code, the output and a one-line conclusion • A mini project carried out through the second half of the course and presented in class
Evaluation Method	Internal Assessment : 25 Marks • 15 Marks for Exam — Mode of Examination: 40% Theory and 60% Practical • 05 Marks for Journal / Assignment • 05 Marks for Attendance External Assessment : 25 Marks • Mode of Examination: 40% Theory and 60% Practical Total : 50 Marks.



**VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT**

Syllabus

Certificate Course in
Climate Change and Sustainability

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN CLIMATE CHANGE AND SUSTAINABILITY	
Name of Course	Climate Change and Sustainability
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	Total Credit: 02
Course Description	Climate change is an endless subject. This course therefore does not attempt to cover it fully. It gives a school pass-out student the basic idea only - what climate change is, why it is happening, who is causing it, what it is already doing to nature and to people, and what one person can actually do about it. Three units deal with climate change and one short unit with sustainability. The practical component is simple and computer-based: the student estimates a personal carbon, energy, water and waste footprint using free websites, and ends the course with a personal climate action plan. <i>Note on the level of the course: The course is at awareness level. Each unit is limited to four sub-topics of three points each, so that a full unit can be covered comfortably in four classroom hours. Climate modelling, radiative forcing, atmospheric chemistry, IPCC scenarios, climate economics, carbon markets, life-cycle assessment and corporate ESG reporting are kept outside its scope.</i>
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English / Gujarati
Course Fee	Rs. 1800.00
Objective of Course	1. To create basic awareness about climate change — what it is, why it is happening and why it matters to the student's own future.

	2. To explain the greenhouse effect, the major greenhouse gases and the simple evidence that the climate is changing. 3. To establish the fundamental idea that energy use and consumption are the real cause, and that all consumption is finally carbon emission. 4. To make the student aware of the main impacts of climate change on nature and human life, particularly in India and Gujarat. 5. To introduce the meaning and the need for sustainability and the Sustainable Development Goals. 6. To train the student in the AMG approach and the five TUPEE climate habits and to help each student prepare a simple personal climate action plan.
Pre-requisite	1. H.S.C. (10+2) passed in any stream. No science background is required. 2. General awareness of the environment as taught up to school level. 3. Basic ability to use a computer or smartphone — web browser and simple spreadsheet. 4. No knowledge of climate science, mathematics beyond school level or any special software is expected.
Course Outcomes	On successful completion of the course the learner will be able to: CO1 : Explain in simple words what weather, climate, the greenhouse effect, greenhouse gases and global warming are, and state the evidence that the climate is changing. CO2 : Describe the human causes of climate change and explain why energy use and consumption are the root cause. CO3 : Describe the main impacts of climate change on nature and human life, with examples from India and Gujarat. CO4 : Explain the meaning and need for sustainability, the Sustainable Development Goals, and basic sustainable practice in energy, water and waste. CO5 : Use simple free online tools to estimate a personal carbon, energy, water or waste footprint and interpret the result. CO6 : Apply the AMG approach and the TUPEE climate habits and prepare a personal climate action plan.

Course Content

Theory: 15 Hrs. (1 Credit). Each unit carries 25% weight-age and has four sub-topics of three points each. The teacher may expand or shorten any point according to the class. All topics are to be taught at an awareness level only.

Unit	Description	Weight-age
UNIT-I (04 Hrs.)	<u>Fundamentals of Climate Change</u> 1.1 Weather and Climate • Meaning of weather and meaning of climate • Difference between weather and climate • Earth's climate system sun, air, land and water 1.2 The Greenhouse Effect • Natural greenhouse effect - why the Earth is warm enough to live on • Enhanced greenhouse effect caused by human activity • Major greenhouse gases CO₂, CH₄, N₂O and fluorinated gases, and their sources 1.3 Global Warming and Climate Change • Meaning of global warming and of climate change; difference between natural and human-caused change • Rise in global temperature since the industrial age, and why the warming is speeding up • Common myths and misconceptions about climate change 1.4 Evidence of a Changing Climate • Rising temperature and heat waves • Melting glaciers and rising sea level • Irregular rainfall and extreme weather events	25%
UNIT-II (04 Hrs.)	<u>Causes and Impacts of Climate Change</u> 2.1 Ever-Increasing Energy Use - the Trigger • Growing demand for energy with population and changing lifestyle • Fossil fuels as the main source of emission • Deforestation, agriculture, industry and transport 2.2 All Consumption Is Carbon Emission; Who Causes It • Every product and every service carries hidden emission; carbon footprint - meaning only • Emission by different countries and income groups; per-capita emission and fairness • Responsibility of the individual 2.3 Impacts on Nature and Human Life • Loss of biodiversity; damage to forests, oceans and coral reefs • Health - heat stress, air pollution and spread of diseases • Food, water and livelihood insecurity 2.4 Climate Change in India and Gujarat • Rising temperature and heat waves in India	25%

	• Irregular monsoon, drought and flood • Coastal risk in Gujarat sea-level rise, cyclones and salinity ingress	
UNIT-III (04 Hrs.)	<u>Sustainability and Sustainable Development</u> 3.1 Meaning and Need for Sustainability • What the word “sustainable” means • Environmental, social and economic sustainability • Why sustainability has become a need today 3.2 Sustainable Development and the SDGs • Meeting present needs without harming future generations • Introduction to the 17 UN Sustainable Development Goals • SDG 7, SDG 12 and SDG 13 in brief 3.3 Sustainable Use of Energy and Water • Renewable and non-renewable sources; solar energy and energy self-reliance • Energy conservation at home and in the college • Water conservation and rainwater harvesting 3.4 Materials, Waste and Sustainable Living • Reduce, Reuse, Repair and Recycle; circular economy- basic idea • Waste segregation and composting; avoiding single-use plastic and safe handling of e-waste • Sustainable food and shopping habits	25%
UNIT-IV (03 Hrs.)	<u>Climate Correction and Action</u> 4.1 Why We Are Failing and How Much Time Is Left • Why technology, policy and economic growth alone have not solved the problem • The remaining carbon budget and the 1.5 °C limit- simple idea only • Mitigation and adaptation - the two responses, and the need for behaviour change 4.2 The Two Laws of Human Existence and the AMG Approach • The two laws of human existence as given in the prescribed book • AMG - Avoid, Minimise, Generate • Applying AMG to the use of energy and materials 4.3 TUPEE Climate Habits - Five Powerful Actions • T - Travel less; U - Use items wisely and avoid single-use items; P - Purchase cautiously; E - Eat carefully; E - Eliminate electricity waste 4.4 Two Roads to 2100 and Personal Action • A rough road to 2100 - the survival crisis • Vision for 2100 - a thriving world • Action at the level of the individual, the family and the college	25%

Practicals

Practical: 30 Hrs. (1 Credit). Every practical is simple and is performed on a free website or in a spreadsheet; no paid software is used. Each practical is first demonstrated by the teacher and then repeated by the student. Students maintain a practical journal recording the aim, the website or data used, the result and a one-line conclusion.

Sr. No.	Title and Aim of the Practical
1	Study of weather and climate data Aim: To collect the weather data of one week for the local area and compare it with the climate of the region.
2	Study of greenhouse gases and their sources Aim: To prepare a chart of the major greenhouse gases and their common sources in daily life.
3	Plotting a temperature trend graph Aim: To plot a line graph of global or Indian average temperature from free online data and identify the trend.
4	Assessment of household energy use Aim: To list the electrical appliances used at home and estimate the approximate monthly electricity consumption.
5	Calculation of personal carbon footprint Aim: To calculate the approximate personal carbon footprint using a free online calculator, and to compare the emission of walking, cycle, bus, two-wheeler and car for the same journey.
6	Study of a climate-related event in Gujarat Aim: To prepare a short report on one recent heat wave, flood, cyclone or drought event in Gujarat and its effect on people.
7	Study of the Sustainable Development Goals Aim: To study the 17 Sustainable Development Goals from the UN website and write a short note on SDG 7, SDG 12 and SDG 13.
8	Household water use and waste audit Aim: To estimate the daily water use of the household, record the waste generated in one week, and suggest simple measures for saving water and reducing waste.
9	Personal climate action plan Aim: To apply the AMG approach and the TUPEE climate habits to one's own daily routine and prepare a personal climate action plan listing five actions the student will follow.
	Total Practical 30 Hours

Reference Books (Prescribed)

Code	Reference
R1	Solanki, C. S. (2025). Climate Change 2100: Survive or Thrive? Global Warming, Sustainability and the Future of Humanity. Vintage Books / Penguin Random House India. ISBN-13: 978-0143477334
R2	Robertson, M. (2021). Sustainability Principles and Practice (3rd ed.). Routledge, Abingdon. ISBN-13: 978-0367365219
R3	IPCC (2023). Climate Change 2023: Synthesis Report. Intergovernmental Panel on Climate Change, Geneva. Free at https://www.ipcc.ch
R4	United Nations. The 17 Goals - Sustainable Development Goals. Free at https://sdgs.un.org
R5	Bharucha, E. Textbook of Environmental Studies for Undergraduate Courses. Universities Press (India), Hyderabad.

Additional Sources Required

The prescribed list covers the global picture but says very little about India and almost nothing about Gujarat, which sub-topic 2.4 requires. Both sources below are free to download.

Code	Source
N1	Krishnan, R., Sanjay, J., Gnanaseelan, C., Mujumdar, M., Kulkarni, A., & Chakraborty, S. (Eds.). (2020). Assessment of Climate Change over the Indian Region. Ministry of Earth Sciences, Government of India / Springer. Open access, free to download. ISBN-13: 978-9811543272
N2	Climate Change Department, Government of Gujarat. Gujarat State Action Plan on Climate Change. Free from the Department's website.

Free Online Tools and Websites for the Practicals

Purpose	Free Online Tools / Websites
Climate data	NASA GISS (data.giss.nasa.gov), NOAA Climate.gov, India Meteorological Department (mausam.imd.gov.in), Our World in Data
Carbon footprint	Any free online calculator, such as the UN ActNow app or the WWF Footprint Calculator
Energy	Bureau of Energy Efficiency, India (beeindia.gov.in) - star labels and appliance energy data
SDGs	https://sdgs.un.org - the 17 Goals with pictures and short descriptions
Charts and audits	Microsoft Excel, LibreOffice Calc or Google Sheets - for the temperature graph, water audit and waste audit

Mapping of Units, Course Outcomes and Practicals

Unit	Course Outcome Addressed	Corresponding Practical(s)
UNIT-I	CO1	Practicals 1, 2, 3
UNIT-II	CO2, CO3, CO5	Practicals 4, 5, 6
UNIT-III	CO4, CO5	Practicals 7, 8
UNIT-IV	CO6	Practical 9

Teaching Methodology and Evaluation

Teaching Methodology	Blended - Theory + Practical / Demonstration. • Short classroom lectures with local examples from Surat, Gujarat and India (15 Hrs.) • Videos, animations, pictures and simple graphs; one session on climate myths and facts • Guided computer-laboratory sessions for the practicals, demonstrated by the teacher first (30 Hrs.) • A printed one-page worksheet for every practical giving the aim, the website and the steps • Maintenance of a practical journal, ending with the personal climate action plan
Evaluation Method	Internal Assessment : 25 Marks • 10 Marks for Practical Examination • 10 Marks for Journal / Assignment • 05 Marks for Attendance External Assessment : 25 Marks • Mode of Examination: 40% Theory and 60% Practical

	Total : 50 Marks. <i>Nature of the question paper: The theory paper will contain objective questions, one-line answers, short notes and simple descriptive questions only. The practical examination will consist of performing one exercise from the list on the computer and writing the observation and conclusion, followed by viva-voce on the journal and the action plan.</i>
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VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus
Certificate Course in
Introduction to Robotics

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
CERTIFICATE COURSE IN INTRODUCTION TO ROBOTICS

Name of Course	Certificate Course in Introduction to Robotics
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Course Description	This course provides a basic Introduction to Robotics, the basic concepts of robots, their components, sensors, actuators, controllers, and programming. The course combines fundamental theory with hands-on practical activities. The emphasis is on practical skills, creativity, teamwork, and real-life applications.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English
Course Fee	Rs. 3200.00 1 credit Fees: Rs. 1600/- Max.
Objective of Course	1. Understand the basic concept and applications of robotics. 2. Identify major components of a robot. 3. Assemble simple robotic systems safely. 4. Use sensors and actuators in beginner-level projects. 5. Program robots using different development platform. 6. Work collaboratively to build and demonstrate a functional robotic project. 7. Appreciate ethical, social, and industrial applications of robotics.
Pre-requisite	Basic understanding of science and technology, basic knowledge of C programming language ; no prior knowledge or formal training in Robotics is required
Course Outcomes	1. Explain the basic concepts and applications of robotics. 2. Identify and assemble common robotic components. 3. Operate simple robots using programming. 4. Develop beginner-level robotic projects using sensors and motors. 5. Demonstrate teamwork, creativity, and problem-solving through practical projects.

Course Content		
	Description	Weight-age
	<u>Unit-1 (3 Hrs.) Introduction to Robotics</u> • Introduction of Robot • History of Robot • Robots in Daily Life • Types of Robots • Safety while working with robots • Future Careers in Robotics • Entrepreneurship opportunities	20%
	<u>Unit-2(4 Hrs.) introduction of Robot Components</u> • Parts of a Robot • introduction of Sensors • Chassis • Wheels • Motors • Servo Motor, DC Motor, stepper motor • Battery • Controller • LEDs • Buzzer • Connecting components	25%
	<u>Unit – 3(4 Hrs.)</u> <u>Sensors, hardware and Robot Movements fundamental</u> • What is a Sensor? • Obstacle Sensor • Light Sensor • Sound Sensor • Line Sensor • Ultrasonic Sensor (demonstration) • Servo Motor applications • DC motor applications • stepper motor applications • Decision making using sensors • introduction of arduino educational hardware platform • Introduction of different hardware platforms.	25%
	<u>Unit-4(4 Hrs.) Introduction to Programming</u> • What is Programming? • introduction of Logic Building • introduction of Flowcharts and its importance	30%

	• Input and Output • basics of Programming • Introduction of block programming/scratch programming concept • Introduction of sketch Programming concept for arduino platform. • Connecting robot to computer • Program Uploading process for different hardware platforms • introduction of programming software and platforms	
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PRACTICALS:

1. Identify different robots through videos/images
2. Demonstration of educational robots
3. Identification and Study of robotic Components
 - Identify and study the different type of robots, wheels, robot chassis, battery, motors, Basic hardware /controller,
4. Assemble tri wheel robot using chassis, sensors, battery, wheel and motors
5. Develop program on arduion / other programming platform to Blink LED
6. Develop program on arduion / other programming platform to perform Motor ON/OFF task
7. Develop program on arduion / other programming platform for Servo Motor Control
8. Develop program on arduion / other programming platform DC motor control
9. Develop program on arduion / other programming platform to Move Forward movement of tri wheel robot
10. Develop program on arduion / other programming platform to Move Backward movement of tri wheel robot
11. Develop program on arduion / other programming platform to Turn Left movement of tri wheel robot
12. Develop program on arduion / other programming platform to Turn Right movement of tri wheel robot
13. Develop program on arduion / other programming platform for Obstacle detection using ultrasonic sensor and IR sensor.
14. Develop program on arduion / other programming platform for light intensity detection using IR sensor/line sensor.
15. Develop program on arduion / other programming platform for Obstacle Avoiding Robot
16. Develop program on arduion / other programming platform for Line Following Robot
17. Develop program on arduion / other programming platform for Automatic Light sensing Robot.

Reference Books	
1.	“Practical Arduino Robotics” , Lukas Kaul, Packt publishing ltd., 2023, ISBN :978-1-80461-317-7
2.	“Robotics at home with Raspbery pi pico”,Dammy Staple, Packt publishing ltd ,2023,ISBN: 978-1-80234-607-9
3.	Arduino for Beginners: Essential Skills Every Maker Needs– John Boxall, No Starch

	Press publication,2021, ISBN: 978-1-71850-058-4.
4.	Robot Builder's Bonanza, Gordon McComb, McGraw-Hill Education, fourth edition,2011
5.	“Robotics Simplified”, Dr. Jisu Elsa Jacob, Manjunath N, BPB Publications, India,2022, ISBN: 978-93-91030-26-1
6	“Cookbook for Mobile Robotic Platform Control with Internet of Things and Ti Launch Pad:, Dr. Anita Gehlot, Dr. Rajesh Singh, Dr. Lovi Raj Gupta, Bhupendra Singh, BPB Publications, INDIA,2019,ISBN: 978-93-88511-67-4
7	Introduction to Block Based Programming With Scratch 2017, Hobbypress, Createspace Independent Publication,2017, ISBN-13 : 978-1545490327

Teaching Methodology	Blended (Theory + Practical)
Evaluation Method	Internal Assessment :25 Marks ➤ 15 Marks for Exam Mode Of Examination 100% Practical OR 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment :25 Marks ➤ Mode Of Examination 100% Practical OR 40% Theory and 60% Practical



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

Certificate Course in
Introduction to IoT

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Certificate Course in Introduction to IoT
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45
Credit	2
Course Description	The Certificate Course in IoT for Smart Living introduces students to the concepts, technologies and applications of the Internet of Things (IoT) in everyday life. The course emphasizes conceptual understanding, practical experimentation and application-oriented learning rather than advanced mathematics or electronics. Students will learn how sensors, actuators, microcontrollers, communication technologies and cloud/mobile applications work together to create smart systems. The course also introduces practical applications such as smart homes, smart agriculture, smart energy management, smart security, smart healthcare and environmental monitoring.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English
Course Fee	Rs. 3200.00 1 credit Fees Rs. 1600/- Max.
Objective of Course	1. Understand the fundamental concepts of IoT and smart living. 2. Identify commonly used IoT sensors, actuators and devices. 3. Understand the basic architecture and working of an IoT system. 4. Program a basic microcontroller such as Arduino/ESP32. 5. Interface sensors and actuators with a microcontroller. 6. Collect and monitor sensor data. 7. Understand basic IoT communication technologies. 8. Develop simple IoT applications for smart homes and everyday life.

Pre-requisite	Basic Computer Understanding
Course Outcomes	CO1 Explain the basic concepts, characteristics and applications of IoT. CO2 Identify and describe the functions of common IoT sensors, actuators and controllers. CO3 Develop simple programs for an IoT microcontroller. CO4 Interface sensors and actuators and acquire data from physical devices. CO5 Explain basic IoT communication, cloud connectivity and data visualization. CO6 Design and implement a basic IoT application for smart living

Course Content		
	Description	Weight-age
	Unit-1 Introduction to IoT and Smart Living: 1.1. Introduction to Internet of Things 1.2. Definition and characteristics of IoT 1.3. Evolution of IoT 1.4. Components of an IoT system 1.5. IoT device, sensor, actuator and controller 1.6. IoT architecture 1.7. Basic IoT communication 1.8. Examples of IoT in everyday life 1.9. Smart living concept	25%
	Unit-2 Sensors, Actuators and IoT Devices 2.1 Introduction to sensors 2.2 Digital and analog sensors 2.3 Common IoT sensors: 2.3.1 Temperature sensor	25%

	2.3.2 Humidity sensor 2.3.3 Light sensor 2.3.4 Motion sensor 2.3.5 Gas sensor 2.3.6 Distance sensor 2.3.7 Sound sensor 2.3.8 Soil moisture sensor 2.3.9 Pressure Censor 2.4 Introduction to actuators 2.5 LED 2.6 Buzzer 2.7 Relay 2.8 DC motor 2.9 Servo motor 2.10 Sensor-actuator interaction 2.11 Microcontrollers in IoT 2.12 Introduction to Arduino 2.13 Introduction to ESP8266 / ESP32	
	Unit – 3 IoT Connectivity, Cloud and Smart Applications 3.1 Need for communication in IoT 3.2 Basic communication technologies 3.3 Bluetooth 3.4 Wi-Fi 3.5 Zigbee – basic concept 3.6 RFID – basic concept 3.7 MQTT – introduction 3.8 Internet connectivity 3.9 Introduction to IoT cloud platforms 3.10 Sending sensor data to cloud 3.11 IoT dashboards 3.12 Mobile monitoring 3.13 Data visualization 3.14 Basic concept of IoT security	25%

	Unit-4 IoT for Smart Living: 4.1 Smart home concept 4.2 Smart lighting 4.3 Smart fan and appliance control 4.4 Smart security system 4.5 Smart door monitoring 4.6 Smart energy monitoring 4.7 Smart environmental monitoring 4.8 Smart agriculture 4.9 Smart water management 4.10 Smart parking 4.11 Smart waste management 4.12 Smart healthcare monitoring 4.13 Benefits and limitations of smart living	25%

PRACTICALS

1. Introduction to IoT Development Board
2. Temperature and Humidity Monitoring
3. Light Sensor and Automatic Lighting
4. Motion Detection
5. Distance Measurement
6. Relay and Appliance Control
7. Smart Street Light
8. Smart Water-Level Monitoring
9. Smart Parking System

Reference Books	
1.	Bahga, A., & Madiseti, V. — Internet of Things: A Hands-On Approach, Universities Press
2.	Raj Kamal — Internet of Things: Architecture and Design Principles, McGraw Hill Education
3.	Samuel Greengard — The Internet of Things, MIT Press
4.	B. K. Tripathy & J. Anuradha — Internet of Things (IoT): Technologies, Applications, Challenges and Solutions, CRC Press
5.	Maciej Kranz — Building the Internet of Things, Wiley
6.	Arduino and ESP32 official documentation

Teaching Methodology	Blended (Theory + Practical)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam Mode Of Examination 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 40% Theory and 60% Practical



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus
Certificate Course in
Introduction to Drone Technology

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN INTRODUCTION TO DRONE TECHNOLOGY	
Name of Course	Certificate Course in Introduction to Drone Technology
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Course Description	This course provides an introductory understanding of drone and multicopter technology, covering their components, working principles, sensors, flight control, navigation, safety, maintenance and applications. It also introduces artificial intelligence (AI) in drones, including autonomous navigation, object detection and real-time decision-making, along with hands-on practical experience in drone operation.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English
Course Fee	Rs. 3200.00 1 credit Fees: Rs. 1600/- Max.
Objective of Course	1. To develop a basic understanding of drone and multicopter technology, including their types, components and applications. 2. To understand the working principles of propulsion systems, sensors, flight controllers and basic drone control. 3. To develop basic practical skills in drone component identification, calibration, navigation, pre-flight inspection and supervised operation. 4. To introduce AI applications in drones, including autonomous navigation, object detection, recognition and real-time decision-making. 5. To familiarize learners with drone safety, maintenance, failsafe systems, responsible use and emerging applications.
Pre-requisite	Basic understanding of science and technology; no prior knowledge or formal training in drone technology is required
Course Outcomes	1. Identify and explain the major components and basic working principles of drones and multicopters. 2. Demonstrate basic operation of propulsion systems, sensors, flight controllers and remote-control systems. 3. Perform basic drone calibration, GPS based navigation, pre-flight inspection and supervised flight operations. 4. Explain and demonstrate the basic applications of AI in drones, including autonomous navigation, object detection and real-time decision-making. 5. Apply basic safety, maintenance, troubleshooting, failsafe and responsible use practices in drone operations.

Course Content		
	Description	Weight-age
	<u>Unit-1 (4 Hrs.)</u> <u>Introduction to Drones and Multicopter Components</u> • Introduction to drones and multicopters • Quadcopters and basic types of multicopters • Basic applications of drones • Basic composition of a multicopter • Airframe and structural components • Propulsion components: motor, propeller, ESC and battery • Command and control components: transmitter, receiver and flight controller • Basic introduction to GPS/GNSS and telemetry	25%
	<u>Unit-2 (4 Hrs.)</u> <u>Working Principle, Sensors and Basic Drone Control:</u> • Working principle of a multicopter • Motor, propeller and ESC operation • Battery and power system • Thrust and basic stability • Basic drone movements: take-off, hovering, movement, turning and landing • Sensors: accelerometer, gyroscope, magnetometer, barometer and GPS • Basic sensor calibration • Flight controller and basic stabilization • Basic controls: throttle, yaw, pitch and roll	25%
	<u>Unit – 3 (4 Hrs.)</u> <u>Drone Navigation, Autonomous Functions and Artificial Intelligence:</u> • Basic flight modes and assisted flight • GPS/GNSS-based position and navigation • Basic altitude, position and distance information • Introduction to waypoint navigation and autonomous functions • Introduction to Artificial Intelligence (AI) in drone technology • AI for autonomous navigation • Object detection and recognition • Real-time decision-making • Introduction to machine learning in drone applications • Examples of AI-enabled drone applications	25%
	<u>Unit-4 (3 Hrs.)</u> <u>Drone Safety, Maintenance and Applications:</u> • Pre-flight inspection and safety checks	25%

	• Battery, motor, ESC and propeller safety • Communication and sensor-related problems • Basic failsafe functions • Emergency procedures and safe landing • Post-flight inspection and basic maintenance • Basic troubleshooting • Applications of drones • Responsible and ethical use of drones • Basic awareness of drone safety regulations and operational guidelines	
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PRACTICALS:

1. Identification and Study of Drone Components

- Identify and study the airframe, motors, ESCs, propellers, battery, transmitter, receiver, flight controller, GPS and other major components.

2. Propeller, Motor and ESC Demonstration

- Identify propeller types and direction of rotation, demonstrate motor operation and study the basic function of the ESC.

3. Battery Voltage Measurement and Safety Inspection

- Measure battery voltage and perform basic battery handling, charging and safety inspection.

4. Study and Demonstration of Drone Sensors

- Identify and demonstrate the functions of the accelerometer, gyroscope, magnetometer and barometer.

5. GPS/GNSS Demonstration and Position Measurement

- Demonstrate GPS/GNSS operation and observe satellite information, position, altitude and distance data.

6. Flight Controller Demonstration and Calibration

- Study the functions of the flight controller and perform basic accelerometer, gyroscope and compass calibration where supported.

7. Remote Controller and Basic Drone Control

- Study the transmitter and receiver and demonstrate basic controls such as throttle, yaw, pitch and roll.

8. Basic Navigation, Flight Modes and Autonomous Functions

- Demonstrate basic flight modes and, where supported, altitude hold, position hold, return-to-home and waypoint navigation.

9. Introduction to AI-enabled Drone Functions

- Demonstrate or observe an available AI-enabled drone function, such as object detection/recognition or autonomous navigation, and discuss its role in drone operation.

10. Pre-flight, Basic Flight Operation and Post-flight Inspection

- Perform pre-flight safety checks and, under supervision, demonstrate take-off, hovering, basic movement and landing, followed by post-flight inspection and basic maintenance.

Reference Books	
1.	Mendoza-Mendoza, J. A., Gonzalez-Villela, V. J., Aguilar-Ibañez, C. F., and Fonseca-Ruiz, L. <i>Drones to Go: A Crash Course for Scientists and Makers</i> , Springer, 2021
2.	Quan, Q. <i>Introduction to Multicopter Design and Control</i> , Springer, 2017.
3.	Shinde, S. K., More, J. S., and Chaudhari, C. P. <i>Mastering Drone Technology with AI: A Comprehensive Guide to Drone Operations and Techniques</i> , BPB Publications, 2025.
4.	Kilby, T., and Kilby, B. <i>Make: Getting Started with Drones: Build and Customize Your Own Quadcopter</i> , Maker Media, 2015.

Teaching Methodology	Blended (Theory + Practical)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam Mode Of Examination 100% Practical OR 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical OR 40% Theory and 60% Practical



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

Certificate Course in
Biodiversity Photography

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT CERTIFICATE COURSE IN	
Name of Course	Biodiversity Photography
Duration	45 Hrs.
Credit	Total Credit: 02 Theory: 1 Credit (15 Hrs.) + Practical: 1 Credit (30 Hrs.) = Total 45 Hrs.
Course Description	A practical introduction to biodiversity photography , covering nature observation, basic photography, species documentation, field ethics, and digital image processing through classroom and field-based learning.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English/Gujarati
Course Fee	Rs. 3200.00
Objective of Course	1. Understand the role of photography in biodiversity documentation and conservation. 2. Develop fundamental skills in operating a smartphone, compact camera, DSLR or mirrorless camera. 3. Understand exposure, ISO, shutter speed, aperture, focus, white balance and depth of field. 4. Develop skills in photographing plants, birds, insects, butterflies, reptiles, mammals and landscapes. 5. Learn basic principles of composition, light, colour, perspective, patterns and visual storytelling. 6. Conduct simple field observations and maintain a biodiversity photographic record. 7. Understand ethical and responsible practices while photographing wildlife and sensitive habitats.
Pre-requisite	No specific prior qualification or subject specialization is required.
Course Outcomes	CO1: Explain basic concepts of biodiversity, ecosystems, species, and habitats.

	CO2: Demonstrate fundamental photographic skills using a smartphone or digital camera. CO3: Composition techniques for nature and biodiversity photography. CO4: Identify and photograph common biodiversity elements such as plants, birds, insects and other organisms. CO5: Document species and habitats systematically through photographs, field notes and metadata. CO6: Apply ethical principles and responsible practices during biodiversity photography. CO8: Prepare and present a small biodiversity photography portfolio.
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Course Content		
	Description	Weight-age
	UNIT I Introduction to Biodiversity and Photography Hours: 6 1.1 Basics of Biodiversity • Meaning and definition of biodiversity • Levels of biodiversity: ○ Genetic diversity ○ Species diversity ○ Ecosystem diversity • Flora and fauna • Native, endemic, exotic and invasive species • Common habitats and ecosystems • Importance of biodiversity 1.2 Photography as a Documentation Tool • Nature photography vs. biodiversity photography • Photography for: ○ Documentation ○ Education ○ Research	20%

	○ Conservation ○ Public awareness	
	UNIT II Fundamentals of Digital Photography 2.1 Camera and Smartphone Basics • Smartphone camera • Compact camera • DSLR • Mirrorless camera • Camera sensor • Lenses and focal length • Zoom and prime lenses • Macro lenses • Basic accessories 2.2 Exposure • Aperture • Shutter speed • ISO • Exposure triangle 2.3 Focus and Depth of Field • Autofocus and manual focus • Single and continuous autofocus • Focus point selection • Depth of field • Background separation • Motion freezing and motion blur	20%
	UNIT III Biodiversity Photography Techniques 3.1 Photographing Plants • Flowers • Leaves • Bark • Fruits and seeds • Trees and shrubs • Plant details for identification 3.2 Bird Photography	30%

	• Bird behavior and observation • Safe distance • Perching and flight photographs • Composition and background • Avoiding disturbance 3.3 Insect and Butterfly Photography • Macro photography • Close-up techniques • Focus and depth of field • Photographing insects without disturbing them 3.4 Reptiles, Amphibians and Small Fauna • Safe observation • Environmental context • Behavioral documentation • Habitat photographs 3.5 Habitat and Landscape Photography • Forest • Wetland • Grassland • River/pond • Urban ecosystem • Agricultural landscape 3.6 Composition • Rule of thirds • Leading lines • Framing • Symmetry • Patterns and textures • Negative space • Foreground–middle ground–background • Perspective and visual balance	
	<u>Unit-IV</u> Field Documentation, Ethics and Digital Processing 4.1 Field Documentation • Planning a biodiversity photography walk • Field notebook	25%

	• Date and time • Location • Habitat • Weather conditions • Species/common name • Photographer • Camera settings • Observation notes 4.2 Species Identification • Photographing diagnostic features • Using field guides • Comparing similar species • Scientific/common names • Introduction to photographic field guides and citizen-science documentation • 4.3 Ethics of Biodiversity Photography • Do not disturb wildlife • Maintain safe distance • Avoid handling animals for photographs • Do not destroy vegetation or habitat • Avoid nests and breeding sites • Avoid baiting or artificially attracting wildlife • Respect protected areas and local regulations • Responsible sharing of sensitive species/location information 4.4 Basic Image Processing • Selecting the best photographs • Cropping • Straightening • Exposure correction • Contrast • Colour and white balance • Sharpening • Noise reduction • Exporting images • File naming and folder organization 4.5 Biodiversity Storytelling • Photo captions • Photo essays • Before/after habitat documentation • Conservation messaging	
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Practical:

	Preparing photographs for exhibitions and digital presentations	
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1. Prepare a preliminary list of **10 biodiversity elements** found around the college campus/home.
2. Understand exposure triangle by experiment of ISO, Aperture & Shutter speed.
3. Photography by using DSLR camera and Mobile phone.
4. Photography on field: Plant / Birds / Animal / Butterfly etc.
5. Biodiversity walks.
6. Photo caption and Storytelling.
7. Biodiversity photography portfolio
8. Post processing of photographs.

Reference Books

1. Ali, S. *The Book of Indian Birds*. Oxford University Press.
2. Kehimkar, I. *The Book of Indian Butterflies*. Bombay Natural History Society.
3. Menon, V. *Indian Mammals: A Field Guide*. Hachette India.
4. Daniel, J. C. *The Book of Indian Reptiles and Amphibians*. Bombay Natural History Society/Oxford University Press.
5. Bharucha, E. *The Biodiversity of India*. Mapin Publishing.
6. Prater, S. H. *The Book of Indian Animals*. Bombay Natural History Society/Oxford University Press.
7. Freeman, M. *The Photographer's Eye*. Focal Press.
8. Peterson, B. *Understanding Exposure*. Amphoto Books.
9. Kelby, S. *The Digital Photography Book*. Peachpit Press.

Teaching Methodology	Blended (Theory + Practical+Field work etc.)
Evaluation Method	Internal Assessment : 25 Marks ➤ 10 Marks for Practical Exam ➤ 10 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination Portfolio Submission



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

Certificate Course in
Textile Design

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Textile Design
Duration	45 Hrs.
Credit	Total Credit: 02 Theory: 1 Credit (15 Hrs.) + Practical: 1 Credit (30 Hrs.) = Total 45 Hrs.
Course Discription	An introductory STEM-based course covering textile materials, fibre science, fabric construction, digital design, textile testing, smart textiles, and sustainable textile innovation through Classroom and practical learning.
Eligibility Criteria	H.S.C. Passed (Any stream)
Pre-requisite	
Medium of Instruction	English/ Gujarati
Course Fee	Rs. 3200.00
Objective of Course	1. Introduce students to the scientific, technological, and creative foundations of textile design. 2. Develop an understanding of textile fibres, polymers, yarns, and fabric structures. 3. Familiarise students with basic textile manufacturing processes. 4. Introduce colour science, geometric pattern development and digital textile-design methods. 5. Develop basic skills in textile-material identification and performance testing. 6. Introduce technical, functional, and smart textiles. 7. Develop awareness of sustainable fibres, textile waste, recycling, and circularity. 8. Enable students to apply observation, experimentation, measurement, and data analysis to textile development. 9. Encourage interdisciplinary thinking integrating Science, Technology, Engineering, Mathematics and Design.

	Enable students to develop and evaluate a basic textile prototype or textile innovation.
Pre-requisite	No prior knowledge of textile design is required.
Course Outcomes	CO1: Identify and classify major natural, regenerated, and synthetic textile fibres based on their physical and chemical characteristics. CO2: Explain the fundamental processes of fibre, yarn, and fabric formation. CO3: Analyse basic woven, knitted, and non-woven structures and relate construction to textile performance. CO4: Apply principles of colour science, geometry, symmetry, repetition, and pattern generation to textile design. CO6: Interpret basic textile performance parameters such as strength, abrasion, absorbency, shrinkage, and colourfastness. CO8: Apply sustainable and circular-design principles to develop a textile-design concept, sample, or prototype. CO9: Study of Indian textile craft and techniques.

Course Content		
	Description	Weight-age
	UNIT -I Textile Materials and Fibre Science 1. Introduction to Textile Design • Definition and scope • Textile design as an interdisciplinary field • Textile applications in fashion, interiors, products, healthcare, transportation and engineering • Historical development of textile technology 2. Textile Fibre Classification a. Natural fibres i. Cotton ii. Linen iii. Wool	25%

	iv. Silk v. Jute b. Regenerated fibres i. Viscose/rayon ii. Modal iii. Lyocell c. Synthetic fibres i. Polyester ii. Nylon iii. Acrylic iv. Polypropylene 3. Fibre Science a. Structural Properties i. Fibre morphology ii. Polymer and macromolecular structure iii. Fibre length and fineness b. Mechanical Properties i. Strength ii. Elasticity c. Physical Properties i. Moisture absorption ii. Thermal properties iii. Density d. Longevity i. Durability	
	UNIT II Yarn, Fabric Construction and Textile Manufacturing 1. Yarn Technology • Fibre-to-yarn process • Spinning principles • Yarn types • Yarn twist • Yarn count – basic concepts • Yarn properties 2. Fabric Formation • Woven fabrics • Warp and weft • Basic weave structures: ○ Plain ○ Twill ○ Satin • Knitted fabrics • Basic knitting principles	25%

	• Non-woven textiles 3. Fabric Engineering • Fabric density • Thickness • Weight/GSM • Construction • Relationship between structure and performance	
	<u>Unit - III</u> Colour Science, Geometry and Digital Textile Design 1. Colour Science • Light and colour • Colour perception • Hue, value and chroma • Additive and subtractive colour systems • RGB and CMYK • Colour harmony and colour schemes • 2. Mathematical and Geometric Principles • Geometry in textile design • Symmetry • Translation • Rotation • Reflection • Tessellation • Proportion • Scale • Repetition 3. Textile Pattern Development • Motif development • Grid systems • Straight repeat • Half-drop repeat • Mirror repeat • Border patterns • All-over patterns 4. Digital Textile Design • Raster and vector graphics	25%

	• Digital motif creation • Digital repeat development • Introduction to CAD for textiles • Digital textile printing	
	<u>Unit-IV</u> Sustainable Textile Technology and Innovation 1. Sustainable Textiles • Environmental impact of textile production • Water consumption • Energy consumption • Chemical processing • Textile waste • Microfibre pollution 2. Sustainable Materials • Organic fibres • Recycled fibres • Bio-based fibres • Biodegradable materials • Alternative textile materials 3. Circular Textile Design • Reduce • Reuse • Repair • Recycle • Upcycling • Design for disassembly • Design for durability • Closed-loop textile systems 4. Emerging Technologies • Bio-textiles • 3D-printed textiles • Computational textile design • AI-assisted textile design • Smart materials • Advanced manufacturing	25%

PRACTICALS:

1. Fibre identification and property analysis
2. Fabric structure analysis
3. Hands on training of Handi craft: Motifs / Block Print / Tangaliya / Zardosi / Embroidary etc.
4. Prepare a prototype
5. Field visit of Textile Unit / Processing Unit / Digital Printing Unit
6. Digital textile design
7. Experiment to innovate sustainable yarn and fabric

STEM Integration

STEM Area

Application in Textile Design

Science	Fibre chemistry, polymers, colour, material properties
Technology	CAD, digital printing, smart textiles, computational design
Engineering	Fabric construction, manufacturing, testing and optimisation
Mathematics	Geometry, symmetry, tessellation, measurement and data analysis
Design	Aesthetics, pattern, function, user requirements and innovation

Reference Books	
1.	Kadolph, S. J. — <i>Textiles</i> , Pearson.
2.	Gohl, E. P. G. & Vilensky, L. D. — <i>Textile Science</i> , CBS Publishers.
3.	Corbman, B. P. — <i>Textiles: Fiber to Fabric</i> , McGraw-Hill.
4.	Collier, B. J. & Tortora, P. G. — <i>Understanding Textiles</i> , Pearson.
5.	Briggs-Goode, A. — <i>Textile Design: Principles, Advances and Applications</i> , Woodhead Publishing.
6.	Udale, J. — <i>Textiles and Fashion</i> , Laurence King Publishing.
7.	Wolff, C. — <i>The Art of Manipulating Fabric</i> , Krause Publications
8.	Muthu, S. S. — <i>Sustainable Fibres and Textiles</i> , Woodhead Publishing.
9.	Muthu, S. S. — <i>Sustainable Innovations in Textile Fibres</i> , Springer.
10	Blackburn, R. S. — <i>Sustainable Textiles: Life Cycle and Environmental Impact</i> , Woodhead Publishing.

Teaching Methodology	Blended (Theory + Practical+Field work etc.)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Practical Exam Mode Of Examination 100% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical / Jury / Viva



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

**Certificate Course in Digital Marketing and
E-commerce**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Certificate Course in Digital Marketing and E-commerce
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Course Description	This course introduces the fundamental concepts, tools, and strategies of digital marketing and e-commerce. It covers website planning, SEO, social media, online advertising, email, and content marketing. Students learn about e-commerce models, platforms, payment systems, security, and fulfilment processes. Practical activities include campaign planning, content creation, website analysis, and online-store development. The course prepares students to design, implement, and evaluate digital marketing and e-commerce strategies.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English/Gujarati
Course Fee	Rs. 3200.00 1 credit Fees Rs. 1600/- Max.
Objective of Course	1. Introduce the concepts, components, and importance of digital marketing and e-commerce. 2. Explain customer behavior and the digital customer journey. 3. Develop practical skills in SEO, content marketing, social media, email marketing, and online advertising. 4. Familiarize students with e-commerce models, platforms, payment systems, security, and fulfilment. 5. Train students to use digital analytics and key performance indicators to evaluate campaigns.
Pre-requisite	Basic knowledge of digital marketing and E-com

Course Outcomes	CO1: Explain the fundamental concepts, channels, business models, and applications of digital marketing and e-commerce. CO2: Analyse online customer behaviour and develop customer personas and digital journey maps. CO3: Apply SEO, content marketing, social media marketing, email marketing, and online advertising techniques. CO4: Design a basic online store with appropriate products, payment options, security measures, and fulfilment processes. CO5: Measure digital marketing and e-commerce performance using analytics, KPIs, campaign tracking, and optimization techniques. CO6: Develop and present an integrated digital marketing and e-commerce plan for a selected business.
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Course Content		
	Description	Weight-age
	<u>Unit 1: Digital Marketing Fundamentals and Planning</u> 1.1 Internet and Web Fundamentals 1.1.1 Introduction to the Internet and World Wide Web 1.1.2 Websites, webpages, URLs and web browsers 1.1.3 Domain names and web hosting 1.1.4 Basic features of an effective and mobile-friendly website 1.2 Introduction to Digital Marketing 1.2.1 Meaning, scope and importance of digital marketing 1.2.2 Traditional marketing versus digital	25%

	marketing 1.2.3 Benefits and limitations of digital marketing 1.2.4 Paid, owned and earned media 1.2.5 Major digital marketing channels 1.3 Digital Marketing Planning 1.3.1 Components of a digital marketing plan 1.3.2 Target audience and customer personas 1.3.3 Market segmentation, targeting and positioning 1.3.4 Marketing funnel 1.3.5 SMART marketing objectives 1.3.6 Selection of digital marketing channels	
	<u>Unit 2: SEO, Content and Search Engine Marketing</u> 2.1 Search Engine Optimization 2.1.1 Introduction to search engines 2.1.2 Crawling, indexing and ranking 2.1.3 Meaning and importance of SEO 2.1.4 Search intent and Search Engine Results Pages 2.2 Keyword Research 2.2.1 Meaning and types of keywords 2.2.2 Short-tail and long-tail keywords 2.2.3 Search volume and competition 2.2.4 Keyword research tools and techniques 2.3 On-Page and Technical SEO 2.3.1 Title tags, meta descriptions and headings 2.3.2 SEO-friendly URLs and content optimization 2.3.3 Image optimization and alternative text 2.3.4 Internal linking 2.3.5 Website speed and mobile responsiveness 2.3.6 Sitemap, robots.txt and HTTPS – basic concepts 2.4 Content Marketing and SEM 2.4.1 Meaning and importance of content marketing 2.4.2 Types of digital content 2.4.3 SEO-friendly content writing	25%

	2.4.4 Introduction to Search Engine Marketing 2.4.5 Paid search and Pay-Per-Click advertising 2.4.6 Ad copy and landing pages	
	<u>Unit 3: Social Media, Email, Mobile Marketing and Analytics</u> 3.1 Social Media Marketing 3.1.1 Introduction to social media marketing 3.1.2 Major social media platforms 3.1.3 Selection of platforms according to target audience 3.1.4 Organic and paid social media marketing 3.1.5 Social media content formats 3.1.6 Hashtags, trends and user engagement 3.1.7 Content calendar and social media strategy 3.1.8 Basic social media advertising 3.2 Email and Mobile Marketing 3.2.1 Introduction and benefits of email marketing 3.2.2 Email list building and audience segmentation 3.2.3 Designing promotional emails and newsletters 3.2.4 Introduction to mobile marketing 3.2.5 SMS, messaging and mobile advertising 3.2.6 QR codes and mobile-friendly content 3.3 Digital Marketing Analytics 3.3.1 Introduction to web and social media analytics 3.3.2 Website traffic and user behaviour 3.3.3 Campaign tracking and UTM parameters 3.3.4 Key Performance Indicators: Reach, impressions, engagement, CTR and conversion rate 3.3.5 Cost per click, customer acquisition cost and ROI 3.3.6 Basic A/B testing and campaign optimization	25%
	Unit 4: E-Commerce Fundamentals and Applications 4.1 Introduction to E-Commerce	25%

	4.1.1 Meaning, scope and evolution of e-commerce 4.1.2 Advantages and limitations of e-commerce 4.1.3 Traditional commerce versus e-commerce 4.1.4 E-commerce versus e-business 4.1.5 Components of an e-commerce ecosystem 4.2 E-Commerce Business Models 4.2.1 Business-to-Business (B2B) 4.2.2 Business-to-Consumer (B2C) 4.2.3 Consumer-to-Consumer (C2C) 4.2.4 Consumer-to-Business (C2B) 4.2.5 Direct-to-Consumer (D2C) 4.3 Online Store and E-Commerce Operations 4.3.1 Components of an online store 4.3.2 E-commerce platforms and marketplaces 4.3.3 Product catalogue and product-page management 4.3.4 Shopping cart and checkout process 4.3.5 Inventory and order management 4.3.6 Shipping, delivery, returns and customer service 4.4 Electronic Payments, Security and Promotion 4.4.1 Electronic payment systems and payment gateways 4.4.2 UPI, cards, wallets and QR-code payments 4.4.3 Online transaction security and HTTPS 4.4.4 Phishing, fraud and identity theft 4.4.5 E-commerce promotion through SEO, social media and email 4.4.6 Basic e-commerce metrics and analytics	
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PRACTICALS

1. Explore websites, URLs, domain names, web hosting and different types of websites.
2. Analyse an existing business website and identify its digital marketing channels.
3. Prepare a basic digital marketing plan for a selected product or business.
4. Perform keyword research for a selected product or service using an appropriate keyword research tool.
5. Optimize a sample webpage using title, meta description, headings, keywords, URL, image alt text and internal links.
6. Create SEO-friendly content for a selected product, service or topic.

7. Create a social media business profile/page and prepare a one-week social media content calendar.
8. Design an email marketing campaign and create a promotional email/newsletter.
9. Create a basic e-commerce store/product catalogue with product details, images, prices, categories and shopping-cart/checkout flow.
10. Analyse a digital marketing or e-commerce campaign using basic metrics such as reach, impressions, engagement, CTR, conversion rate and ROI.

Reference Books	
1.	Big Book of Digital Marketing , Digital Firefly Marketing, 2019.
2.	Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation , 4th Edition, Damian Ryan & Calvin Jones, Kogan Page, 2022.
3.	Understanding Digital Marketing: Basics and Actions , Teresa Piñeiro-Otero & Xabier Martínez-Rolán, Springer International Publishing, 2016.
4.	Digital Marketing Strategy , Lyfe Marketing, 2018.
5.	The Essential Guide to Marketing in a Digital World , Rob Stokes, Quirk eMarketing, 2013.
6.	Digital Marketing For Dummies , 2nd Edition, Ryan Deiss & Russ Henneberry, Wiley, 2020.
7.	Advertising and Promotion: An Integrated Marketing Communications Perspective , 11th Edition, George E. Belch & Michael A. Belch, McGraw-Hill Education, 2020.
8.	Advertising Management , 5th Edition, Rajeev Batra, John G. Myers & David A. Aaker, Pearson Education, 1996.
9.	Advertising and Promotion: An Integrated Marketing Communications Perspective , George E. Belch & Michael A. Belch, Tata McGraw-Hill (TMH), Indian Edition, 2018.
10.	The Social Media Bible: Tactics, Tools & Strategies for Business Success , 3rd Edition, Lon Safko, Wiley, 2012.

Teaching Methodology	Blended (Theory + Practical /Field Work/ Field Visit)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam - Mode Of Examination 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance

	External Assessment : 25 Marks ➤ Mode Of Examination 40% Theory and 60% Practical
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VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

**Certificate Course in AI Based Content
Creation**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Certificate Course in AI Based Content Creation
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs. OR 60 Hrs. (2 Credit Practical)
Credit	2
Course Description	This course introduces students from all academic streams to the fundamentals of Artificial Intelligence and Generative AI with a special focus on digital content creation. Students will learn how AI can be used to create, edit and enhance text, images, presentations, audio and video content. The course emphasizes practical learning, prompt engineering, responsible AI usage, fact-checking, copyright, plagiarism, privacy and ethical considerations. Students will complete hands-on activities and a mini-project to develop practical AI-based content creation skills.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English/Gujarati
Course Fee	Rs. 3200.00 1 credit Fees Rs. 1600/- Max.
Objective of Course	1. Introduce students to the basic concepts of Artificial Intelligence and Generative AI. 2. Familiarize students with commonly used AI-based content creation tools. 3. Develop basic prompt-writing and prompt-engineering skills. 4. Enable students to create and improve text, images, presentations, audio and video using AI tools. 5. Develop creativity, digital communication and content creation skills. 6. Create awareness about AI-generated misinformation, plagiarism, copyright, privacy, bias and ethical issues. 7. Enable students to apply AI tools for academic, personal, entrepreneurial and professional purposes.
Pre-requisite	Basic computer literacy, basic Internet usage, and ability to use a web browser and common digital applications

Course Outcomes	CO1: Explain the basic concepts of Artificial Intelligence, Generative AI and AI-based content creation. CO2: Identify and select suitable AI tools for different content creation requirements. CO3: Create effective prompts for generating and modifying digital content. CO4: Create AI-assisted text, images, presentations, audio and video content. CO5: Evaluate AI-generated content for accuracy, relevance, quality and originality. CO6: Apply responsible and ethical practices while using AI tools. CO7: Develop and present a small AI-based digital content project.
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	Description	Weight-age
Course Content	Unit 1: Introduction to AI and Generative AI 1.1 Introduction to Artificial Intelligence 1.1.1 Meaning and definition of Artificial Intelligence 1.1.2 Need and applications of Artificial Intelligence 1.1.3 AI in everyday life 1.2 Types of Artificial Intelligence 1.2.1 Narrow AI 1.2.2 General AI – basic concept 1.2.3 Examples of AI systems 1.3 Introduction to Machine Learning 1.3.1 Meaning of Machine Learning 1.3.2 Learning from data – basic concept 1.3.3 Traditional Programming vs Machine Learning 1.4 Generative AI 1.4.1 Meaning of Generative AI 1.4.2 Traditional AI vs Generative AI 1.4.3 Text, image, audio and video generation 1.4.4 Applications of Generative AI 1.5 Large Language Models 1.5.1 Basic concept of Large Language Models 1.5.2 AI chatbots and assistants 1.5.3 Limitations of AI-generated responses	25%
	<u>Unit 2. Prompt Engineering and AI-Based Text Creation</u> 2.1 Introduction to Prompt Engineering	25%

	2.1.1 Meaning and importance of prompts 2.1.2 Simple and detailed prompts 2.2 Components of an Effective Prompt 2.2.1 Role 2.2.2 Context 2.2.3 Task 2.2.4 Instructions 2.2.5 Output format 2.3 Basic Prompting Techniques 2.3.1 Zero-shot prompting 2.3.2 Few-shot prompting 2.3.3 Role-based prompting 2.3.4 Iterative prompting 2.4 AI-Based Text Creation 2.4.1 Paragraph and article generation 2.4.2 Email and notice writing 2.4.3 Blog and social-media content 2.5 AI-Based Text Editing 2.5.1 Summarization 2.5.2 Rewriting 2.5.3 Grammar correction 2.5.4 Translation 2.5.5 Simplification	
	<u>Unit 3. AI-Based Image and Multimedia Creation</u> 3.1 AI Image Generation 3.1.1 Meaning of AI-generated images 3.1.2 Text-to-image concept 3.1.3 Applications and limitations 3.2 Image Generation Prompts 3.2.1 Subject 3.2.2 Background 3.2.3 Style 3.2.4 Lighting 3.2.5 Composition 3.3 AI-Assisted Graphic Design 3.3.1 Posters and banners 3.3.2 Advertisements 3.3.3 Social-media graphics 3.3.4 Educational illustrations 3.4 AI-Based Presentation Creation 3.4.1 Presentation outline 3.4.2 Slide content 3.4.3 AI-generated images 3.4.4 Presentation design 3.5 AI-Based Audio and Video	25%

	3.5.1 Text-to-Speech 3.5.2 AI voice-over 3.5.3 Text-to-video concept 3.5.4 Script and storyboard generation 3.5.5 Subtitles and captions	
	<u>Unit 4: Responsible and Ethical Use of AI</u> 4.1 Accuracy and Reliability 4.1.1 AI-generated errors 4.1.2 AI hallucination 4.1.3 Verification and fact-checking 4.2 Misinformation and Deepfakes 4.2.1 Fake information 4.2.2 AI-generated images 4.2.3 Deepfakes 4.2.4 Misleading content 4.3 Copyright and Plagiarism 4.3.1 Basic concept of copyright 4.3.2 Copyrighted digital content 4.3.3 Plagiarism 4.3.4 Proper acknowledgement of AI assistance 4.4 Privacy and Security 4.4.1 Personal and sensitive information 4.4.2 Risks of uploading private data 4.4.3 Safe use of AI platforms 4.5 Bias and Responsible AI 4.5.1 Basic concept of AI bias 4.5.2 Human judgement 4.5.3 Transparency 4.5.4 Responsible use of Generative AI	25%

PRACTICALS

1. Create and explore an AI chatbot account.
2. Ask basic questions and analyse AI-generated responses.
3. Compare AI-generated responses with Internet search results.
4. Write and test simple AI prompts.
5. Improve poorly written prompts by adding role, context, task and output format.
6. Demonstrate zero-shot, few-shot and role-based prompting.
7. Generate a paragraph, article, email or notice using AI.
8. Create social-media content or an advertisement using AI.
9. Summarize and rewrite content using AI.
10. Translate and simplify content using AI.
11. Generate an image using a text prompt.

12. Modify prompts to create different image variations.
13. Create a poster, banner or product advertisement using AI.
14. Create a social-media graphic or educational illustration using AI.
15. Generate an outline and create a 5–6 slide presentation using AI.
16. Generate presentation images and convert text into speech or voice-over.
17. Generate a short video script and storyboard using AI.
18. Create a short AI-assisted video with captions/subtitles.
19. Verify AI-generated content and identify errors, misinformation or misleading information.
20. Identify copyright, plagiarism and privacy issues and prepare a checklist for responsible AI use.

Reference Books	
1.	Ethan Mollick, Co-Intelligence: Living and Working with AI, Portfolio, 2024.
2.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson.
3.	Melanie Mitchell, Artificial Intelligence: A Guide for Thinking Humans, Farrar, Straus and Giroux.
4.	Bernard Marr, Generative AI: How It Will Change Everything, Wiley.
5.	Official documentation and learning resources of Generative AI and AI-based content creation platforms.
6.	UNESCO resources on Artificial Intelligence, education and ethics.
7.	Government and educational resources related to responsible and ethical use of Artificial Intelligence

Teaching Methodology	Blended (Theory + Practical /Field Work/ Field Visit)
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Exam Mode Of Examination 40% Theory and 60% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 40% Theory and 60% Practical



VEER NARMAD
SOUTH GUJARAT UNIVERSITY, SURAT

Syllabus

Certificate Course in
Financial Analytics

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

CERTIFICATE COURSE IN

Name of Course	Certificate Course in Financial Analytics
Duration	15 Hrs. (1 Credit Theory) + 30 Hrs. (1 Credit Practical) = Total 45 Hrs.
Credit	2
Course Description	This course provides hands-on expertise in combining financial analysis, risk modeling, and quantitative techniques using spreadsheets / Python / R. Students will learn to analyze financial statements, forecast cash flows, optimize investment portfolios, and apply FinTech analytics to real-world corporate data.
Eligibility Criteria	H.S.C. Passed (Any stream)
Medium of Instruction	English/Gujarati
Course Fee	Rs. 1800.00
Objective of Course	1. Understand core concepts of financial statement analysis, time value of money, and quantitative financial metrics. 2. Master spreadsheet and computational tools (Excel/Python) for data clean-up, financial modeling, and trend forecasting. 3. Develop risk modeling, portfolio optimization, and valuation analytics skills using statistical methods. 4. Apply data-driven decision-making to real-world corporate finance, market investment, and algorithmic trading scenarios.
Pre-requisite	Basic understanding of Mathematics/Statistics and elementary Spreadsheet usage.
Course Outcomes	CO1: Analyze Financial Statements: Evaluate company performance through liquidity, solvency, and profitability ratio analysis. CO2: Build Predictive Models: Construct financial models and evaluate capital budgeting metrics like NPV, IRR, and payback period. CO3: Optimize Portfolios: Measure risk metrics and construct optimal portfolios using Modern Portfolio Theory and CAPM. CO4: Apply FinTech & Trading Analytics: Utilize Python/R to backtest algorithmic trading strategies and implement predictive machine learning models. CO5: Perform Risk Assessment: Execute sensitivity analysis, scenario modeling, and Value at Risk (VaR) calculations for data-driven decisions.

Course Content		
	Description	Weight-age
	<u>Unit-1</u> <u>1. Fundamentals of Financial Data & Analysis:</u> 1.1 Overview of Financial Analytics and STEM in FinTech 1.2 Structure of Financial Statements: Balance Sheet, Income Statement, Cash Flow 1.3 Financial Ratio Analysis: Liquidity, Solvency, Profitability, and Efficiency Ratios 1.4 Time Value of Money (TVM): Present Value, Future Value, Annuities, Amortization 1.5 Data Sources: Financial APIs, Stock Market Data Retrieval, and Data Hygiene	25%
	<u>Unit-2</u> <u>2. Financial Modeling & Predictive Forecasting:</u> 2.1 Building Dynamic Financial Models in Excel/Spreadsheets 2.2 Time Series Analysis for Financial Trends: Moving Averages, Exponential Smoothing 2.3 Forecasting Revenue, Expenses, and Cashflows using Regression Techniques 2.4 Capital Budgeting Metrics: NPV, IRR, Payback Period, and MIRR	25%

	2.5 Scenario Analysis, Sensitivity Analysis, and Goal Seek Tools	
	<u>Unit - 3</u> 3. <u>Risk Modeling & Portfolio Optimization:</u> 3.1 Understanding Risk and Return: Variance, Standard Deviation, Covariance, Beta 3.2 Markowitz Modern Portfolio Theory (MPT) and Efficient Frontier 3.3 Capital Asset Pricing Model (CAPM) and Sharpe Ratio Calculation 3.4 Value at Risk (VaR) and Stress Testing Models 3.5 Credit Risk Scoring and Default Prediction Analytics	25%
	<u>Unit-4</u> 4. <u>Advanced Analytics, Algorithmic Concepts & FinTech:</u> 4.1 Introduction to Quantitative Trading and Technical Indicators (RMA, MACD, Bollinger Bands) 4.2 Python/R Essentials for Financial Data Visualization and Analytics 4.3 Machine Learning Applications in Fraud Detection and Credit Analytics 4.4 Blockchain, Cryptocurrencies, and Decentralized Finance (DeFi) Analytics 4.5 Ethical Considerations, Data Privacy, and Governance in Financial AI	25%

PRACTICALS (if any)

1. Financial Statement Analysis Lab: Extract real company financial data, compute key profitability/solvency ratios, and generate dynamic dashboard reports.
2. Financial Forecasting & Capital Budgeting Model: Build a multi-year cash flow forecast, perform Sensitivity/Scenario analysis, and evaluate NPV/IRR for STEM capital projects.

3. Risk & Portfolio Optimization Lab: Compute portfolio risk/return parameters, construct an Efficient Frontier, and calculate Sharpe Ratios using spreadsheet/Python routines.
4. Algorithmic Trading & Dashboard Sprint: Backtest a simple moving-average trading strategy on stock data and present a comprehensive financial analytics pitch.

Reference Books	
1.	Financial Analytics with R: Building Simulation and Optimization Models - Mark J. Bennett & Dirk L. Hugen, Cambridge University Press, 2016.
2.	Python for Finance: Mastering Data-Driven Finance - Yves Hilpisch, O'Reilly Media, 2018.
3.	Principles of Finance with Excel - Simon Benninga & Tal Mofkadi, Oxford University Press, 2021.
4.	Financial Modeling - Simon Benninga, MIT Press, 2014.
5.	Data Analytics for Corporate Finance - Thomas J. Boulton, Routledge, 2022.

Teaching Methodology	Interactive lectures, computer lab hands-on sessions, real-world stock market datasets analysis, financial modeling sprints, case study discussions, and project-based continuous assessment.
Evaluation Method	Internal Assessment : 25 Marks ➤ 15 Marks for Practical Exam - Mode Of Examination 100% Practical - OR 50% Theory and 50% Practical ➤ 05 Marks for Journal / Assignment ➤ 05 Marks for Attendance External Assessment : 25 Marks ➤ Mode Of Examination 100% Practical - OR 50% Theory and 50% Practical