



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.

Tel : +91 - 261 - 2227141 to 2227148, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

સંદર્ભ:યુનિવર્સિટી કાર્યાલયનાં પરિપત્ર ક્રમાંક:ઓથો./પરિપત્ર/૧૦૦૪૧/૨૦૨૬,તા.૧૨/૦૫/૨૦૨૬

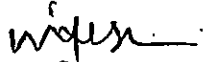
-: પરિપત્ર :-

યુનિવર્સિટી સંલગ્ન તમામ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬-૨૭થી અમલમાં આવનાર M.Sc. Computer Application Sem.-3 & 4નો પેટાસમિતિ દ્વારા NEP-2020ના માળખા અનુસાર તૈયાર કરવામાં આવેલ અભ્યાસક્રમ કોમ્પ્યુટર સાયન્સ વિષયની અભ્યાસ સમિતિ ની તા.૨૫/૦૩/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૦૮ થી મંજૂર કરી કોમ્પ્યુટર સાયન્સ ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ ફેકલ્ટીની તા.૨૬/૦૪/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૦૬ થી અને એકેડેમિક કાઉન્સિલની તા.૦૭/૦૫/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંક:૪૯ થી મંજૂર કરવામાં આવેલ પરંતુ અનુસ્નાતક કક્ષાએ NEP શૈક્ષણિક વર્ષ ૨૦૨૬-૨૭ થી અમલમાં આવેલ હોય M.Sc. Computer Application Sem.-3 & 4 નો Non-NEP ના માળખા અનુસાર નો અભ્યાસક્રમ આ સાથે સામેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

યુનિવર્સિટીના પરિપત્ર ક્રમાંક:ઓથો./પરિપત્ર/૧૦૦૪૧/૨૦૨૬,તા.૧૨/૦૫/૨૦૨૬ થી પ્રસિધ્ધ કરવામાં આવેલ અભ્યાસક્રમમાં કોઈ ફેરફાર કરવામાં આવેલ નથી. માત્ર માળખામાં સુધારો કરવામાં આવેલ છે. જેની નોંધ લેવી.

બિડાણ: ઉપર મુજબ

ક્રમાંક:ઓથો./પરિપત્ર/૨૦૮૭૬/૨૦૨૬
તા.૦૮/૦૮/૨૦૨૬


કુલસચિવ (અ)

પ્રતિ,

૧) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોના આચાર્યશ્રીઓ.

.....આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકો/વિદ્યાર્થીને જાણ કરી અમલ કરવા સારું.

૨) ઈ.ચા.ડી.નશ્રી, કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.

૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારું.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application)
Semester -3 and Semester-4

Name of Program	Masters of Science in Computer Application
Program Abbreviation	M.Sc.(Computer Application)
Duration	2 Years (4 semesters)
Eligibility Criteria	As per University Circular no:S/Syllabus/Paripatra/17650/2023 Dated:12/07/2022. (admission procedure and fees are as per these norms)
Pre-requisite	Graduation with the background of Computer application / Computer Science / IT / Computer relevant disciplines.
Medium of Instruction	English
Objective of Program	The M.Sc. (Computer Application) program aims to prepare postgraduate students with advanced theoretical knowledge, strong practical skills, and research orientation in the field of computer applications and emerging technologies. The objectives of the program are as follows: 1. To develop strong conceptual foundations in advanced areas of computer science such as algorithms, data structures, operating systems, databases, networks, and software engineering. 2. To equip students with practical and application-oriented skills in modern programming paradigms, web technologies, cloud computing, data analytics, artificial intelligence, and machine learning. 3. To enable students to design, develop, and deploy scalable software solutions using appropriate tools, frameworks, and industry best practices. 4. To foster analytical, problem-solving, and critical thinking abilities for addressing real-world computational and business problems. 5. To inculcate technical and applied aptitude and innovation mindset, enabling students to undertake research projects, develop and deploy problem areas and implement quality work with problem solving aptitude. 6. To prepare students for professional roles such as software developer, system analyst, data analyst, AI engineer, cloud architect, and IT consultant in industry and government sectors. 7. To promote ethical computing, professional responsibility, and lifelong learning, ensuring graduates adapt to rapid technological changes and contribute responsibly to society. 8. To encourage interdisciplinary learning and collaboration, integrating computing knowledge with domains such as business, healthcare, finance, education, and smart systems.
Program Outcome (PO)	PO1: Ability to analyze a problem, identify and define the Computing requirements appropriate to its solution. PO2: Foster creativity and innovation in students, encouraging them to develop novel solutions to real-world problem. Enhancing the problem solving, logical, reasoning and analysis capabilities of a problem and integrate the ability with the coding using specific computer programming languages. PO3: Develop student's ability to analyze, evaluate and solve complex problems in the field of computer applications, using critical thinking and problem-solving skills. PO4: Design, implement and evaluate a computer-based system, processing, component or program to meet desired goal with the help of various programming languages, application software, packages, tools, databases, data analytics and representation of data on various platforms.

	PO5: An ability to apply design and development principles in construction of software systems of varying complexity using various algorithmic principles, modeling, coding and design of computer-based systems. PO6: Prepare the aspiring students to become computer professionals in applied areas who can work in corporate/software industry at entry to advanced level as well as independent developers. Overall, the program outcomes aim to produce graduates who are: (a) competent in computer application, development and design. (b) Adapt to changing technology and industry trends. (c) Can make significant contributions to the software applications coding, designing, database managements, testing, deployments and ready to adapt any upcoming technologies.								
Program Specific Outcomes (PSO)	PSO1: Provide students with a strong understanding of programming languages, algorithms and data structures, and necessary for software development. PSO2: Equip with skills in database management, data modeling and data analysis to develop efficient and effective data-driven software solutions. PSO3: Develop expertise in field of software engineering, covering software design, testing and maintenance to ensure the production of high-quality software products. PSO4: Develop knowledge and skills in web development, including web design, client-side and server-side programming and web security. PSO5: Develop students to capabilities for self-learning, skill development through self-practicing and problem solving abilities. PSO6: Develop students to address and work on the real-world problems as an individual and as part of team. Understand the business problems and ability to work on their solutions by applying various software technologies. PSO7: To enhance development skills at various level including problem analysis, data analysis, logical and critical analysis of the problems and implementing the solutions by imparting various recent and upcoming technologies. PSO8: Enhance the passion among the students for updating knowledge, innovative ideas, upskilling and implementing the knowledge in applied areas and research areas by understanding the real world problems, addressing the real world problems and their possible solutions that lead to build a successful Professional career.								
Mapping between Pos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	PO1								
	PO2								
	PO3								
	PO4								
	PO5								
	PO6								

M.Sc.(Computer Application) (Semester-3)

Structure of Program

Course Code	Course Title	Marksheet Title in English	Teaching Hours/Week		Exam Duration		Credit	Internal Marks		External Marks		Total Marks
			TH	PR	TH	PR		TH	PR	TH	PR	
300	Professional Ethics and Responsible AI	Professional Ethics and Responsible AI	1	2	1	2	2	-	15	-	35	50
301	Data Intelligence and Visualization	Data Intelligence and Visualization	2	4	1	2	4	15	15	35	35	100
302	Robotic Process Automation (RPA)	Robotic Process Automation (RPA)	2	4	1	2	4	15	15	35	35	100
303-01	Server side scalable Application	Server side scalable Application	2	4	1	2	4	15	15	35	35	100
303-02	Android based Sensors handling	Android based Sensors handling										
303-03	Machine Learning Fundamentals	Machine Learning Fundamentals										
304-01	Application Development using UI	Application Development using UI	2	4	1	2	4	15	15	35	35	100
304-02	Cloud storage interaction using Android application	Cloud storage interaction using Android application										
304-03	AI oriented Programming using Python	AI oriented Programming using Python										
305	Big Data and Hadoop	Big Data and Hadoop	2	4	1	2	4	15	15	35	35	100

Program Name	M.Sc.(Computer Application)									
Semester	3									
Course Subtype	Nil									
Course Code	301									
Course Level	300-399									
Course Title	Professional Ethics and Responsible AI									
Credit	2 Credits									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Explain the fundamental principles of professional ethics, including ethical theories and ethical concepts from the Indian Knowledge System, and interpret their relevance to modern computing and AI professions. CO2: Analyze ethical issues and dilemmas in information technology and artificial intelligence by applying established ethical frameworks, professional codes of conduct, and ethical decision-making models. CO3: Evaluate the ethical, legal, and social implications of AI technologies with respect to data privacy, intellectual property, fairness, accountability, and societal impact. CO4: Apply Responsible AI principles such as transparency, explainability, human-in-the-loop control, and governance practices to assess real-world AI systems across domains like healthcare, finance, education, and public services. CO5: Design and present an ethical assessment of a real-world AI application by identifying risks, proposing mitigation strategies, and justifying responsible deployment practices in alignment with global and national AI ethics guidelines.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Unit-1: 1.1 Foundations of Professional Ethics 1.1.1 Meaning and importance of ethics in professional life 1.1.2 Meaning and importance of ethics as per the Indian knowledge system and Indian Philosophy. 1.1.3 Concepts of Ethics in Vedic Knowledge 1.2 Ethical Theories 1.2.1 Ethical theories: deontology, utilitarianism, virtue ethics (overview) 1.2.2 Professional ethics in computing and IT professions 1.2.3 Codes of ethics: ACM, IEEE, and software engineering ethics 1.2.4 Ethical decision-making models [Unit-1 Activity: Analysis of ethical dilemmas faced by software professionals] Unit-2: Introduction to Responsible Artificial Intelligence 2.1 Evolution of AI and ethical concerns									

	2.1.1. Principles of Responsible AI: fairness, accountability, transparency, privacy, safety 2.2 Explainable AI (XAI): need and significance . 2.2.1 Human-in-the-loop and human-cantered AI 2.2.2 Trustworthy AI frameworks (global overview) [Unit-2 Activity: Bias and fairness in AI-driven decision systems] Unit 3: 3.1 Legal, Social, and Policy Dimensions of AI 3.1.1 Data privacy and protection (GDPR, Indian DPDP Act – overview) 3.1.2 Intellectual property issues in AI-generated content 3.2 AI and societal impact: employment, surveillance, digital divide 3.2.1 Ethical challenges in facial recognition, autonomous systems, and social media algorithms 3.2.2 Responsible use of generative AI tools in academia and industry [Unit-3 Activity: Presentation on AI misuse, deepfakes, and ethical boundaries] Unit 4: 4.1 Applied Ethics & Responsible AI Practices 4.1.1 Ethical AI lifecycle: design, development, deployment, monitoring 4.1.2 Risk assessment and AI governance models 4.2 Responsible AI in healthcare, finance, education, and public services 4.2.1 Role of ethics committees and AI audits 4.2.2 Future directions: regulation, standards, and global cooperation in AI ethics [Unit-4 Activity: Prepare final presentation on Ethical assessment of a real-world AI application]
Reference Books	1. Ethics for the Information Age, Michael J. Quinn, Pearson Education, ISBN: 9780134296548 2. Computer Ethics, Deborah G. Johnson, Pearson Education, ISBN: 9780132855532 3. Moral Machines: Teaching Robots Right from Wrong, Wendell Wallach and Colin Allen, Oxford University Press, ISBN: 9780195374049 4. Ethics and Technology, Herman T. Tavani, Wiley, ISBN: 9781119061182 5. Artificial Intelligence Ethics, Mark Coeckelbergh, MIT Press, ISBN: 9780262043857 6. Responsible Artificial Intelligence, Virginia Dignum, Springer, ISBN: 9783030303030 7. Ethics of Artificial Intelligence, S. Matthew Liao (Ed.), Oxford University Press, ISBN: 9780190905033 8. Information Technology and Moral Philosophy, Jeroen van den Hoven and John Weckert, Cambridge University Press, ISBN: 9780521119463 9. The Ethics of Information, Luciano Floridi, Oxford University Press, ISBN: 9780199641321 10. AI Ethics, Mark Ryan, CRC Press (Taylor & Francis), ISBN: 9780367492137
Teaching Methodology	Interactive lectures / Case study discussions Group activities and debates / Short presentations Case study / reflective assignments
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance - Internal Presentation and viva-voce External Assessment : - 70% external evaluation based on

	- Seminar Presentation and viva-voce
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[Subject code for Theory-2611000503022002]
[Subject code for Practical-2611000503022003]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS
301:Data Intelligence and Visualization

Program Name	M.Sc.(Computer Application)									
Semester	3									
Course Subtype	Employability and Skill Development									
Subject Type	Discipline Specific									
Course Code	301									
Course Level	500-599									
Course Title	Data Intelligence and Visualization									
Credit	4 Credits									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Ability to create effective visualizations: Students will be able to create effective and impactful visualizations that communicate insights and information in a clear and concise manner. They will understand the principles of effective data visualization and be able to apply them to real-world scenarios. CO2: Mastery of Data visualization tools: Students will have a strong understanding of Power BI and its features, and be able to use the software to create interactive reports and dashboards. They will know how to connect to different data sources, transform and clean data, and create visualizations that can be shared across an organization. CO3: Data analysis skills: Students will develop skills in data analysis, including data wrangling, exploratory data analysis, and statistical analysis. They will understand how to identify trends, patterns, and insights in data, and use these insights to inform decision-making. CO4: Practical experience with real-world datasets: The course should provide practical, hands-on experience working with real-world datasets and scenarios. Students will apply the principles and skills learned in the course to solve real world problems, such as identifying trends in sales data, analyzing customer behaviour, or forecasting financial performance. CO5: Effective communication: Students will develop skills in effective communication with data.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Unit 1. Data Acquisition and Pre-processing: 1.1 Reading and writing data: 1.1.1 Data cleaning and pre-processing using Pandas and Numpy 1.1.2 Data transformation and normalization using Numpy 1.1.3 Exploratory Data Analysis 1.2 Data visualization using Matplotlib and Seaborn									

	1.2.1 Summary statistics and descriptive analysis 1.2.2 Outlier detection and treatment 1.3 Data Modelling and Analysis 1.3.1 Introduction to statistical models and inference 1.3.2 Linear regression and logistic regression 1.3.3 Time series analysis Unit 2. 2.1 Data visualization (using seaborn, matplotlib and bokeh) 2.1.1 Working with Scatter plot, line char, bar chart and histogram using matplotlib, seaborn and bokeh 2.1.2 Adding widgets using bokeh (Buttons, CheckboxGroup, RadioGroup, slider) 2.2 Introduction to Business Intelligence (BI) 2.1.1 Stages of business intelligence (BI) 2.1.2 Use cases of BI and various BI tools 2.1.3 Overview of Data warehouse & concepts 2.3 Introduction to Power BI 2.3.1 Introduction of Power BI and its Components 2.3.2 Building blocks and Architecture of Power BI 2.3.3 Introduction and installation of Power BI Desktop 2.4 Data sources in Power BI 2.4.1 Using files (excel, pdf, csv) as a data source 2.4.2 Extracting data from folders, and databases 2.4.3 Working with Cloud SQL database and database sources 2.4.4 Connecting to Analysis Services 3.4.5 Working with Other data sources (OData, web, SharePoint) 2.4 Python script in Power BI 2.5 Introduction of power query editor Unit 3. 3.1 Data Transformation (Shaping and Combining Data) 3.1.1 Formatting and Transformation of data 3.1.2 Understanding of Data types 3.1.3 Data profiling for data quality check 3.1.4 Merge, Append and Group by(Aggregate) Query 3.2 Query settings 3.2.1 Duplicate & Reference tables 3.2.2 Transpose of data 3.2.3 Pivot & Un-pivot of data 3.2.4 Custom columns, Conditional columns 3.2.5 Replacing data from the tables 3.2.6 Split columns values 3.3 Move columns & sorting of data 3.3.1 Detect data type, count rows & reverse rows 3.3.2 Promote rows as column headers 3.3.3 Hierarchies in Power BI 3.3.4 Concept of M Query Unit 4 4.1 DAX (Data Analysis Expression) 4.1.1 Introduction of DAX 4.1.2 DAX syntax 4.1.3 DAX functions 4.1.4 Context in DAX
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	4.2 Calculated columns using DAX 4.2.1 Measures using DAX 4.2.2 Calculated tables using DAX 4.2.3 Learning about table, information, logical, text, iterator, 4.2.4 Time intelligence functions (YTD, QTD, MTD) 4.2.5 Cumulative values, calculated tables, and ranking and rank over groups 4.3 Date and time functions 4.3.1 identify poorly performing measures, relationships, and visuals 4.4 Data visualization 4.4.1 Understanding Power View and Power Map 4.4.2 Data visualization techniques 4.4.3 Page layout & Formatting 4.4.4 Desktop visualization 4.4.4.1 Formatting and customizing visuals 4.4.4.2 Visualization interaction 4.4.4.3 Custom visualization 4.4.5 Top-down and bottom-up analytics 4.4.6 Drill down, Drill through, Slicer [All Units carry Equal Weightage]
Reference Books	1)"Data Visualization Made Simple: Insights into Becoming Visual" by Kristen Sosulski (ISBN: 9780367257055) 2)"Data Visualization with Power BI" by Dan Clark (ISBN: 9781788297233) 3)"Power BI Essentials: An Introduction to Microsoft Power BI" by Basictech Information Services (ISBN: 9781539702831) 4)"Data Visualization: A Practical Introduction" by Kieran Healy (ISBN: 9780691181622) 5)"Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence" by Brett Powell (ISBN: 9781788297233) 6)"Data Analytics Made Accessible" by Anil Maheshwari (ISBN: 9780367353191) 7)"Data Analytics: An Essential Beginner's Guide to Data Mining, Data Collection, Big Data Analytics for Business Intelligence and Data Science" by Herbert Jones (ISBN: 9781724015361) 8)"Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" by Wes McKinney (ISBN: 9781491957660) 9)"Data Smart: Using Data Science to Transform Information into Insight" by John W. Foreman (ISBN: 9781118661468) 10)"Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett (ISBN: 9781449361327)
Teaching Methodology	Interactive lectures / Case study discussions Group activities and debates / Short presentations Case study / reflective assignments
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

- 1.2.1 Overview of popular RPA tools (UiPath, Automation Anywhere and Blue Prism)
- 1.2.2 Key features and capabilities of RPA
- [Practical Applications of Unit-1: Case study of three popular RPA tools.]

Unit-2: UiPath

- 2.1 Overview of UiPath Studio and UiPath Orchestrator
- 2.2 Installing and setting up UiPath
 - 2.2.1 UiPath Studio
 - 2.2.2 User interface and features of UiPath Studio
- 2.3 Recording and editing automation workflows
- 2.4 Building automation workflows using UiPath activities and variables
- 2.5 Debugging and troubleshooting automation workflows
- 2.6 Ribbon
- 2.7 Universal Search Box
- 2.8 Activities Panel, Design Panel, Library Panel, Project Panel
- 2.9 Properties Panel, Outline Panel, Output Panel, Control Panel
- [Practical Applications of Unit-2: Working with UiPath studio and various panels]

Unit 3: Workflow and Selectors

- 3.1 Types of workflow: Sequences, Flowcharts, State Machines
- 3.2 Variables : DataTypes and Usage, Managing Arguments
 - 3.2.1 Using Data Scrapping with examples
 - 3.2.2 Recording : About Recording, Recording Types
 - 3.2.2.1 Automatic Recording with examples (basic and Desktop)
 - 3.2.2.2 Automatic Recording with Web
 - 3.2.2.3 Manual Recording
- 3.3 Selectors :
 - 3.3.1 Concepts of Selectors
 - 3.3.2 Selectors with Wildcards
 - 3.3.3 Full versus Partial Selectors
 - 3.3.4 UiPath Explorer

[Practical Applications of Unit-3: Using variables and selectors.]

Unit 4: Automation, Activities and UiPath Orchestrator:

- 4.1 Image and Text Automation
 - 4.1.1 Mouse and Keyboard Activities
 - 4.1.2 Text, OCR and Image Activities
- 4.2 Citrix Automation and Use case of Citrix Automation
- 4.3 Worksheet and Data Activities
 - 4.3.1 Data Extraction from PDF and PDF activities
 - 4.3.2 Email automation and Activities
- 4.4 Debug workflow and Error handling
- 4.5 UiPath Orchestrator
 - 4.5.1 User interface and features of UiPath Orchestrator
 - 4.5.2 Setting up and managing robots
 - 4.5.3 Creating and scheduling jobs
 - 4.5.4 Monitoring and analyzing automation performance
- 4.6 UiPath Development Best Practices
 - 4.6.1 Best practices for UiPath development
 - 4.6.2 Designing automation workflows for reusability and scalability
 - 4.6.3 Documenting automation workflows
 - 4.6.4 Testing and validating automation workflows
- 4.7 Real-world examples of UiPath in various industries (e.g. finance,

	healthcare, retail) [Practical Applications of Unit-4: Data extractions from PDF, Email and Worksheets, Use of UiPath Orchestrator and development of best practices]
Reference Books	1. "Robotic Process Automation: A Comprehensive Guide" by Ankur Kothari, Nandan Mullakara, and Raghu Nath, ISBN-10: 1838981082, Packt Publishing. 2. "Practical RPA: Moving Past the Hype to Realizing Business Value" by Edward Brooks, ISBN-10: 1484267653, Apress. 3. "Implementing Robotic Process Automation: A Practical Guide" by Neil Kolban, ISBN-10: 1801073650, Packt Publishing. 4. "The Enterprise Automation Playbook: A Playbook for RPA, Intelligent Automation, and Digital Transformation" by Sam Best, ISBN-10: 1119775739, Wiley. 5. "Mastering UiPath: Robotic Process Automation" by Martin Vayu, ISBN-10: 1801810927, Packt Publishing. 6. "UiPath RPA Developer: Build a Foundation in RPA" by Asha Kumar, ISBN-10: 1800563187, Packt Publishing. 7. "UiPath Cookbook: Over 130 actionable recipes to automate your enterprise processes with UiPath" by Alex Vaidya, ISBN-10: 1801817662, Packt Publishing. 8. "Mastering UiPath: Robotic Process Automation" by Martin Vayu, ISBN-10: 1801810927, Packt Publishing. 9. "UiPath Automation Projects: A beginner's guide to learning Robotic Process Automation with UiPath" by Rahul Mehta, ISBN-10: 1801073219, Packt Publishing. 10. "UiPath Process Mining: From Data to Value" by Marco Ramoni, Emanuele Cecchetti, and Andrew Spanyi, ISBN-10: 180107407X, Packt Publishing.
Teaching Methodology	Class Work, Lab Work, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS

303-01: Server side Scalable Application

Program Name	M.Sc.(Computer Application)									
Semester	3									
Course Type	Elective-1 (Student will select any one course under course code 303).									
Course Subtype	Employability and Skill Development									
Subject Type	Discipline Specific									
Course Code	303-01									
Course Level	500-599									
Course Title	Server side scalable Application									
Credit	4 Credits									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Learn to get user inputs via Command Line Arguments and store data using File system. Also learn how to create the applications using Express Framework, whereas manage and deploy them using PM2 and Nginx. CO2: learn how to develop asynchronous Node.js applications using Call stack, Callback queue and Event Loop mechanism. CO3: Understanding to Create dashboard application using ES6. CO4: Learning client-server interaction using socket.io CO5: Learning testing the UI and data interaction.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Unit-1: 1.1File System Module 1.1.1 Inputs from Users 1.1.2 Pass Multiple Arguments with Yargs 1.1.3 File System Module 1.1.4 Operations associated with File System Module 1.2 JSON Data, Http Server and Client 1.2.1 Sending and receiving events with EventEmitters 1.2.2 Express Framework Run a Web Server using Express Framework 1.2.3 Routes Deploy application using PM2 and Nginx 1.3 Call Stack Callbacks, Callback Queue and Event 1.3.1 Loop Callback Abstraction 1.3.2 Callback Chaining 1.4 Promises 1.4.1 Promise Chaining 1.4.2 Request Package									

- 1.4.3 Customizing HTTP Requests and Error handling with HTTP codes
- 1.4.4 Introduction to template engine (EJS)
- 1.5 Paragraph Development

[Practical Applications of Unit-1: Build an API using express, read file with FS module, and deploy application using PM2 and Nginx, HTML Page Using EJS Template and create an Application on retail store]

Unit-2: Application building using ES6

- 2.1. ES6 variables
 - 2.1.1 Functions with ES6
 - 2.1.2 Import and Export withES6
 - 2.1.3 Async/Await
- 2.2 Introduction to Babel
- 2.3 Rest API with ES6
 - 2.3.1 Browsing HTTP Requests with Fetch
 - 2.3.2 Processing Query String
- 2.4 Creating API using ES6
 - 2.4.1 Transpiration
 - 2.4.2 Building Dashboard API
 - 2.4.3 Creating dashboard UI with EJS
 - 2.4.4 ES6 Aside: Default Function Parameters
 - 2.4.5 Data Validation and Sanitization

[Practical Application of Unit-2: Building Dashboard application using ES6 concepts.]

Unit 3: Client-server interaction using socket.io

- 3.1 Concepts of Web Sockets
 - 3.1.1 Understanding Socket.io
 - 3.1.2 Broadcasting Events
 - 3.1.3 Sharing current Location
 - 3.1.4 Event Acknowledgements
- 3.2 Form and Button States
 - 3.2.1 Rendering Messages
 - 3.2.2 Working with Time
 - 3.2.3 Timestamps for determining Location of Messages
 - 3.2.4 Storing Users, Rendering User List
 - 3.2.5 Tracking Users Joining and Leaving
- 3.3 Deploying the Chat Application
- 3.4 Concepts of Redis and Building API with Redis

[Practical Application of Unit-3: Develop a Realtime Chat Application using Socket.io , Build an API using Redis.]

Unit 4: Testing Node.js application

- 4.1. Understanding mocha framework
- 4.2. Writing Tests and Assertions
 - 4.2.1 Testing Asynchronous Code
 - 4.2.2 Testing an Express Application
 - 4.2.3 Setup and Teardown
 - 4.2.4 Testing with Authentication
 - 4.2.5 Understanding chai.js
- 4.3 Advanced Assertions
- 4.4 Mocking Libraries
- 4.5 Wrapping up User Tests
- 4.6 Setup Task Test Suite

	4.7 Testing with Task Data [Practical Application of Unit-4: Using mocha and chai for testing the application.] [All Units carry Equal Weightage]
Reference Books	1."Node.js in Action" by Mike Cantelon, Marc Harter, TJ Holowaychuk, and Nathan Rajlich. ISBN-13: 978-1617292576. Publisher: Manning Publications. 2."Learning Node.js: A Hands-On Guide to Building Web Applications in JavaScript" by Marc Wandschneider. ISBN-13: 978-0134436540. Publisher: Addison-Wesley Professional. 3."Node.js Design Patterns: Master best practices to build modular and scalable server-side web applications" by Mario Casciaro. ISBN-13: 978-1785885587. Publisher: Packt Publishing. 4."Pro Node.js for Developers" by Colin J. Ihrig. ISBN-13: 978-1484219727. Publisher: Apress. 5."Node.js, MongoDB, and AngularJS Web Development" by Brad Dayley and Brendan Dayley. ISBN-13: 978-0134655536. Publisher: Addison-Wesley Professional. 6."Web Development with Node and Express: Leveraging the JavaScript Stack" by Ethan Brown. ISBN-13: 978-1491949306. Publisher: O'Reilly Media. 7."Hands-On Full Stack Web Development with Angular 6 and Laravel 5: Become fluent in both frontend and backend web development with Docker, Angular and Laravel" by Fernando Monteiro. ISBN-13: 978-1788833912. Publisher: Packt Publishing. 8."Beginning Node.js" by Basarat Ali Syed. ISBN-13: 978-1484201883. Publisher: Apress. 9."Node.js 8 the Right Way: Practical, Server-Side JavaScript That Scales" by Jim Wilson. ISBN-13: 978-1680501957. Publisher: Pragmatic Bookshelf. 10."Node.js for PHP Developers: Porting PHP to Node.js" by Daniel Howard. ISBN-13: 978-1491904430. Publisher: O'Reilly Media.
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments, Practical/Project
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS
303-02: Android based Sensors Handling

Program Name	M.Sc.(Computer Application)								
Semester	3								
Course Type	Elective-2 (Student will select any one course under course code 303).								
Course Subtype	Employability and Skill Development								
Subject Type	Discipline Specific								
Course Code	303-02								
Course Level	500-599								
Course Title	Android based Sensors handling								
Credit	4 Credits (2 Th + 4 Pr)								
Effective From	Academic Year : 2026-2027								
Course Outcomes	CO1: Understanding the basics of touch-based input on Android devices, including the different types of touch sensors and the Android touch event system. Use gesture recognition techniques to interpret complex touch-based inputs in Android applications. Apply best practices for designing touch-based interfaces in Android applications. CO2: Implement multi-window handling to allow multiple applications to be displayed on the screen at the same time. Implement multi-window handling to allow multiple applications to be displayed on the screen at the same time. CO3: Keep up-to-date with the latest trends and advancements in touch-based input, gesture recognition, and multi-window handling for Android devices. Understand the user experience implications of touch-based input, gesture recognition, and multi-window handling for Android applications. CO4: Apply best practices for touch-based interfaces including optimizing for different screen sizes and densities. Understand the differences between touch based and non-touch-based interfaces and the impact of touch-based interfaces on user experience. CO5: able to prepare apps for publication on Play Store by completing necessary requirements, such as signing apps, testing apps, and configuring app metadata.								
Mapping between Cos and PSOs		PSO1	PSO3	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
Course Content	Unit-1: Android Touch, Multi-touch and Gestures Detection 1.1. Android Touch and Multi-touch 1.1.1. Introduction to touch-based input on Android devices 1.1.2. Touch Events 1.1.3. The MotionEvent Object 1.1.4. Concepts of Touch Actions 1.1.5. Multiple Touches handling 1.1.6. Touch Event Listener implementation 1.2 Detecting Common Gestures using the Android Gesture Detector Class								

	1.2.1. Common Gesture Detection implementation 1.2.2. Implementing the Listener Class 1.2.3. Creating the GestureDetectorCompat Instance 1.2.4. Implementing the onTouchEvent() Method 1.3 The GestureOverlayView Class 1.4 Detecting Gestures 1.5 Identifying Specific Gestures 1.6 Building and Running the Gesture Builder Application Unit-2: Android Multi-Window Support 2.1. An Introduction to Android Multi-Window Support 2.1.1. Split-Screen, Freeform and Picture-in-Picture Modes 2.1.2. Entering Multi-Window Mode 2.2. Enabling Freeform Support 2.3. Enabling Multi-Window Support in an App 2.3.1. Specifying Multi-Window Attributes 2.3.2. Detecting Multi-Window Mode in an Activity 2.3.3. Receiving Multi-Window Notifications 2.4. Launching an Activity in Multi-Window Mode Unit 3: Android Fingerprint Authentication 3.1. An Android Fingerprint Authentication 3.2. Configuring Device Fingerprint Authentication 3.3. Adding the Fingerprint Permission to the Manifest File 3.4. Adding the Fingerprint Icon 3.5. Designing the User Interface 3.6. Accessing the Keyguard and Fingerprint Manager Services 3.7. Checking the Security Settings 3.8. Accessing the Android Keystore and KeyGenerator 3.9. Generating the Key 3.10. Implementing the Fingerprint Authentication Handler Class Unit 4: Android Application Release 4.1. Signing and Preparing an Android Application for Release 4.2. The Release Preparation Process 4.3. Register for a Google Play Developer Console Account 4.4. Configuring the App in the Console 4.5. Enabling Google Play App Signing 4.6. Enabling ProGuard 4.7. Creating a Keystore File 4.8. Creating the Application APK File 4.9. Uploading Instant App APK Files [All Units carry Equal Weightage]
Reference Books	1. Android Application Development (With Kitkat Support), Author: Pradeep Kothari, Publisher: DreamTech Press., ISBN: 978-9351194095 2. Android Studio 3.0 Development Essentials: Android 8 Edition Author – Neil Smyth, Publisher: Payload Media, ISBN – 13: 978 – 1977540096 3. Fundamentals of Android App Development : Android Development for Beginners to Learn Android Technology, SQLite, Firebase and Unity, Author: Sujit Kumar Mishra, Publisher: BPB Publication, ISBN: 978-93-89845-204 4. Starting with Android: Android application development guide 1st Edition, Author: Dr. M. M. Sharma, Publisher :BPB Publication, ISBN: 9789386551955 5. Android Programming for Beginners - Second Edition, Author: John Horton, Publisher: Image Short ISBN: 978-1789538502 6. Android 9 Development Cookbook, Author: Rick Boyer, Publisher: Packet Publishing, ISBN: 978-1788991216

	7. Professional Android – fourth Edition, Author: Reto Meier, Ian Lake, Publisher: Wrox, ISBN – 13:978-1118949528 8. Android Programming: Pushing the Limits 1st Edition, Author: Erik Hellman, Publisher: Wiley, ISBN – 13: 978-1118717370 9. Beginning Android Programming with Android Studio, Author: Jerome (J.F.) DiMarzio, Publisher: Wiley, ISBN: 9781118705598 10. Learning Android Application Development, Author: Wallace Jackson, Publisher: Apress, ISBN: 9781484217848
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments, Practical/Project
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS
303-03: Machine Learning Fundamentals

Program Name	M.Sc.(Computer Application)									
Semester	3									
Course Type	Elective-3 (Student will select any one course under course code 303).									
Course Subtype	Employability and Skill Development									
Subject Type	Discipline Specific									
Course Code	303-03									
Course Level	500-599									
Course Title	Machine Learning Fundamentals									
Credit	4 Credits (2 Th + 4 Pr)									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Describe the fundamental concepts of artificial intelligence and machine learning, including types, benefits, and life cycle. CO2: Explain the process and importance of exploratory data analysis, and differentiate between various types of data and distributions. CO3: Apply Python libraries such as Pandas, NumPy, and visualization tools to automate EDA tasks. CO4: Develop predictive models using simple linear and logistic regression techniques. CO5: Analyze the performance of machine learning models using appropriate evaluation metrics like R², MSE, Precision, and Recall. CO6: Justify the use of model tuning techniques like regularization and cross validation to avoid overfitting and underfitting.									
Mapping between Cos and PSOs		PSO1	PSO3	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
	CO6									
Course Content	Unit-1: Fundamentals of AI and Machine Learning 1.1 Concepts of Machine Learning 1.1.1 Understanding Machine Learning 1.1.2 Benefits of Machine Learning 1.1.3 Difference between AI, ML, and Deep Learning 1.2 Machine Learning Life Cycle 1.2.1 Stages of ML Life Cycle 1.2.2 Problem Definition to Model Monitoring 1.3 Exploratory Data Analysis (EDA) 1.3.1 Types of EDA 1.3.2 Univariate Analysis 1.3.3 Bivariate Analysis 1.3.4 Multivariate Analysis									

	1.3.5 Handling Missing Data
	1.3.6 Detecting and Handling Outliers
	1.4 Understanding the Data
	1.4.1 Quantitative Data
	1.4.1.1 Discrete Data
	1.4.1.2 Continuous Data
	1.4.2 Qualitative Data
	1.4.2.1 Nominal Data
	1.4.2.2 Ordinal Data
	1.5 Spread of Data
	1.5.1 Normal Distribution
	1.5.2 Skewed Distribution
	1.5.3 Skewness
	1.5.4 Kurtosis
	Unit-2: Automate EDA (Exploratory Data Analysis)
	2.1 Python Libraries to Automate EDA
	2.1.1 Pandas, NumPy, D-Tale
	2.1.2 Pandas Profiling
	2.1.3 Sweetviz AutoViz
	2.2 Regression Fundamentals
	2.2.1 Characteristics of Regression
	2.2.2 Dependent and Independent Variables
	2.2.3 Covariance
	2.2.4 Correlation
	2.3 Simple Linear Regression (SLR)
	2.3.1 Understanding SLR
	2.3.1.1 Fitting a Straight Line ($y = mx + b$)
	2.3.1.2 Identifying Dependent and Independent Variables
	2.3.2 Assumptions of SLR
	2.3.2.1 Linearity
	2.3.2.2 Independence of Errors
	2.3.2.3 Homoscedasticity
	2.3.2.4 Normality of Errors
	2.3.3 Goodness of Fit
	2.3.3.1 R^2 and Adjusted R^2
	2.3.3.2 Significance of R^2 Value
	2.3.3.3 Residual Sum of Squares (RSS)
	Unit-3: Understanding Machine Learning
	3.1 Types of Machine Learning
	3.1.1 Supervised Learning
	3.1.2 Unsupervised Learning
	3.1.3 Applications of Machine Learning
	3.2 Overview of Supervised Learning
	3.2.1 Concepts of Supervised Learning
	3.2.2 Classification vs. Regression
	3.3 Basic Terminologies
	3.3.1 Dataset
	3.3.2 Features and Labels
	3.3.3 Training, Testing, and Validation Data
	3.3.4 Overfitting and Underfitting
	3.4 Loss Functions
	3.4.1 Mean Squared Error (MSE)
	3.4.1.1 Definition of MSE

	3.4.1.2 Computation and Properties 3.4.2 Mean Absolute Error (MAE) 3.4.2.1 Definition of MAE 3.4.2.2 Computation and Properties Unit-4: Supervised Learning Algorithms 4.1 Linear Regression (Review and Model Evaluation) 4.1.1 Model Fitting using Ordinary Least Squares (OLS) 4.1.2 Model Evaluation Techniques 4.1.2.1 R-squared 4.1.2.2 Mean Squared Error 4.1.2.3 Root Mean Squared Error (RMSE) 4.2 Logistic Regression 4.2.1 Sigmoid Function and Binary Classification 4.2.2 Cost Function and Gradient Descent 4.2.3 Multiclass Classification using Logistic Regression 4.2.3.1 One-vs-Rest Strategy 4.2.3.2 Softmax Function 4.3 Model Performance and Generalization 4.3.1 Overfitting 4.3.2 Underfitting 4.3.3 Avoiding Overfitting/Underfitting 4.3.3.1 Regularization (L1 and L2) 4.3.3.2 Cross-Validation 4.3.4 Evaluation Metrics 4.3.4.1 Accuracy 4.3.4.2 Precision 4.3.4.3 Recall 4.3.4.4 F1 Score
Reference Books	1) Machine Learning, T.V. Vijay Kumar, BS Publications, ISBN:9789381075614 2) Fundamentals of Machine Learning for Predictive Data Analytics, K.P. Soman, R. Loganathan, V. Ajay, PHI Learning Pvt. Ltd., ISBN: 9788120350786 3) Programming in Python, Dr. Rakesh K. Jain, University Science Press (Laxmi Publications), ISBN:9789386768016 4) Data Analytics with Python, Suresh Samudrala, V. Rajaraman, PHI Learning Pvt. Ltd., ISBN:9789353062026 5) Introduction to Machine Learning, Alok Sharma, Narosa Publishing House, ISBN:9788184874535 6) Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer, ISBN:9780387310732 7) Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurélien Géron, O'Reilly Media, ISBN:9781098125974 8) Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, MIT Press, ISBN: 9780262018029 9) Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing, ISBN: 9781800567708 10) The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer, ISBN:9780387848570
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments, Practical/Project
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment :

	- 70% external evaluation based on - Theory examination - Practical and viva-voce
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS

304-01: Application Development using UI

Program Name	M.Sc.(Computer Application)								
Semester	3								
Course Type	Elective-1 (Student will select any one course among under course code 304).								
Course Subtype	Employability and Skill Development								
Subject Type	Discipline Specific								
Course Code	304-01								
Course Level	500-599								
Course Title	Application Development using UI								
Credit	4 Credits								
Effective From	Academic Year: 2026-2027								
Course Outcomes	CO1: Ability to build scalable and complex web applications: React.js is known for its ability to build reusable and scalable components, while Redux provides a predictable state management system. Learning both together can enable developers to build more complex and scalable web applications. CO2: Better management of application state: Redux provides a centralized store for application state, making it easier to manage and debug. By learning how to use Redux with React, developers can better manage the state of their application, leading to more maintainable and robust code. CO3: Understanding of functional programming principles: Redux follows functional programming principles, which can help developers write more concise and predictable code. Learning how to use Redux with React can help developers understand and apply these principles to their code. CO4: Improved debugging and error handling: Redux provides a clear separation between state and UI, making it easier to debug and handle errors in a React application. By learning how to use Redux with React, developers can improve their debugging and error handling skills. CO5: Knowledge of popular front-end frameworks and libraries: React and Redux are two of the most popular front-end frameworks and libraries, respectively. Learning how to use both together can provide developers with valuable knowledge and skills that can be applied to other front-end development projects.								
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
Course Content	Unit 1: Foundations of React and Web Application Development 1.1 Fundamentals of Web Development 1.1.1 Single-page and Multi-page Applications 1.1.2 Client-side Technologies 1.1.3 MVC Architecture								

- 1.1.4 ECMAScript (ES5 vs ES6)
- 1.1.5 NPM Modules and Package Management
- 1.2 Introduction to React
 - 1.2.1 Introduction to React and its Features
 - 1.2.2 Installation and Setup of React
 - 1.2.3 JSX and its Use Cases
 - 1.2.4 DOM and Virtual DOM (Working Mechanism)
- 1.3 React Components and Elements
 - 1.3.1 Render Function
 - 1.3.2 Class Components and Functional Components
 - 1.3.3 Component Constructor
 - 1.3.4 Multiple Components
- 1.4 Props, State and Lifecycle
 - 1.4.1 Props in Class-based Components
 - 1.4.2 Props in Function-based Components
 - 1.4.3 State Management
 - 1.4.4 Component Lifecycle
- 1.5 Events, Forms and Styling
 - 1.5.1 React Events
 - 1.5.2 React Forms and Form Concepts
 - 1.5.3 Styling in React and Inline Styling

[Practical Applications of Unit-1: Build Music shop application using Unit-1]

Unit 2: React Routing and API Integration

2.1 Routing in React

- 2.1.1 Introduction to react-router
- 2.1.2 Features of react-router
- 2.1.3 Configuration of Routing

2.2 Navigation Techniques

- 2.2.1 Navigation using Links
- 2.2.2 NavLink and Styling
- 2.2.3 URL Parameters
- 2.2.4 Nested Routes
- 2.2.5 404 (Not Found) Page

2.3 REST API Development and Integration

- 2.3.1 Building a REST API using json-server
- 2.3.2 API Consumption using Fetch Method
- 2.3.3 Dynamic Data Rendering in React

[Practical Application (Unit 2): Develop a Dynamic Music Store Application using Routing and API Connectivity.]

Unit 3: State Management with Redux and Middleware

- 3.1 Introduction to Redux
 - 3.1.1 Need and Architecture of Redux
 - 3.1.2 Redux Actions and Action Creators
 - 3.1.3 Redux Reducers
 - 3.1.4 Redux Store
 - 3.1.5 Principles and Advantages of Redux
 - 3.1.6 Required NPM Packages
- 3.2 Handling Asynchronous Operations

	3.2.1 Need for Async Operations 3.2.2 Async Workflow in Redux 3.2.3 Handling Async Actions via Reducers 3.3 Middleware in Redux 3.3.1 Introduction to Middleware 3.3.2 Redux-Saga and Generators 3.3.3 Saga Methods 3.3.4 Debugging using Redux DevTools 3.4 Application Development with Redux 3.4.1 Building a Food Items List Application 3.4.2 Building a News Application (Promise Middleware) 3.4.3 Building a Product List Application using Redux-Saga [Practical Application of Unit-3: Building an application to list the food items using React and Redux. Building News application using React, Redux, and promise middleware. Building a Product list application using Redux-Saga Middleware.] Unit 4: GraphQL, Testing and Deployment 4.1 Introduction to GraphQL 4.1.1 Limitations of REST and Advantages of GraphQL 4.1.2 Frontend–Backend Communication using GraphQL 4.1.3 GraphQL Type System and Data Types 4.1.4 Modifiers and Schemas 4.2 Building GraphQL Applications 4.2.1 GraphiQL Tool 4.2.2 Express Framework 4.2.3 NPM Libraries for Server-side GraphQL 4.2.4 Building a GraphQL API 4.3 Apollo Client 4.3.1 NPM Libraries for Client-side GraphQL 4.3.2 Setup and Configuration of Apollo Client 4.4 Testing and Deployment 4.4.1 Introduction to Jest 4.4.2 Setup Testing Environment 4.4.3 Snapshot Testing 4.4.4 Testing Reducers and Components 4.4.5 Version Control using Git 4.4.6 Understanding Nginx 4.4.7 Deploying React Application on Nginx 4.4.8 Dockerizing React Application [Practical Application of Unit-4: Build a GraphQL API and execute queries using GraphiQL tool Fetch Space Launch Data using Apollo-GraphQL. Also, develop Testing application using Jest Application and Deployment via Nginx and Docker]
Reference Books	1."React: Up & Running: Building Web Applications" by Stoyan Stefanov and Kirupa Chinnathambi, Publisher: O'Reilly Media, ISBN: 978-1491931820 2."Learning React: A Hands-On Guide to Building Web Applications Using React and Redux" by Kirupa Chinnathambi, Publisher: Addison-Wesley Professional, ISBN: 978-0134843551. 3."React Design Patterns and Best Practices" by Michele Bertoli, Publisher: Packt Publishing, ISBN: 978-1786464538. 4. "React Cookbook: Over 66 hands-on recipes that cover UI development, animations, component architecture, routing, databases, testing, and debugging with

	React" by Carlos Santana Roldán, Publisher: Packt Publishing, ISBN: 978-1783980727. 5."Full-Stack React Projects: Modern web development using React 16, Node, Express, and MongoDB" by Shama Hoque, Publisher: Packt Publishing, ISBN: 978-1788835534. 6. "Learning Redux" by Daniel Bugl, Publisher: Packt Publishing, ISBN: 978-1786462398. 7. "Hands-On Redux for React Native: A Practical Guide to Building Real-Time, Scalable Mobile Applications" by Spencer Carli, Publisher: Packt Publishing, ISBN: 978-1788997414. 8."Learning GraphQL: Declarative Data Fetching for Modern Web Apps" by Eve Porcello and Alex Banks, Publisher: O'Reilly Media, ISBN: 978-1492030713. 9."GraphQL API Design" by Matthew Mahoney, Publisher: Apress, ISBN: 978-1484242698. 10."Fullstack GraphQL Applications with GRANDstack: Modernize Legacy Systems and Build Scalable GraphQL APIs with GraphQL, React, Apollo, and Neo4j" by William Lyon, Publisher: O'Reilly Media, ISBN: 978-1492090909. 11."Testing JavaScript Applications: A Comprehensive Guide to the Jest Testing Framework" by Lucas da Costa and Felipe N. Moura, Publisher: Apress, ISBN: 978-1484250464, 12."Nginx: From Beginner to Pro" by Rahul Soni and Dipankar Sarkar, Publisher:Apress, ISBN: 978-1484216576, 13."Mastering Nginx: A complete guide to Nginx setup, configuration, and deployment" by Dimitri Aivaliotis and Tim Butler, Publisher: Packt Publishing, ISBN: 978-1786466174,
Teaching Methodology	Interactive lectures / Case study discussions Group activities and debates / Short presentations Case study / reflective assignments
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS

304-02: Cloud Storage Interaction using Android Application

Program Name	M.Sc.(Computer Application)									
Semester	3									
Course Type	Elective-2 (Student will select any one course among under course code 304).									
Course Subtype	Employability and Skill Development									
Subject Type	Discipline Specific									
Course Code	304-02									
Course Level	500-599									
Course Title	Cloud storage interaction using Android application									
Credit	4 Credits									
Effective From	Academic Year: 2026-2027									
Course Outcomes	CO1: Understand the concepts of cloud storage and how it is used in Android application development. Identify and use different cloud storage services available for Android development, such as Google Cloud Storage, Amazon S3, and Microsoft Azure. CO2: Implement cloud storage APIs in Android applications, including methods for uploading and downloading files, and managing data. CO3: Manage data in cloud storage, including organizing data, applying access controls, and managing data versions. Integrate cloud storage with mobile applications, including authenticating users, storing user data securely, and managing data synchronization between devices CO4: Learn how to upload, download and manage files in Google Cloud Storage using Android applications. Understand the differences between various storage options available in Google Cloud Storage and choose the best option for different types of data. CO5: Design and implement secure and scalable cloud storage solutions for Android applications. Implement cloud storage in Android applications using Google Cloud Platform.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Unit 1 1.1. Overview of cloud storage 1.1.1. Comparison of other storage solution with google cloud 1.1.2. Benefits of using Google cloud storage for mobile application data 1.2. Network infrastructure and architecture of Google cloud 1.3. IaaS, Paas and Saas 1.4. Signing with Google cloud 1.5. Google Cloud Resources 1.6. Google cloud Identity									

	Unit 2 2.1. Google cloud console 2.2. Installing and configuring cloud SDK 2.3. Cloud shell 2.4. Google cloud API 2.5. Cloud Console Mobile app 2.6. Google cloud compute 2.6.1. Exploring IaaS with cloud compute 2.6.2. Exploring PaaS with App Engine 2.7. Event driven programs with cloud function Unit 3 3.1. Cloud Storage options 3.2. Structured and Unstructured storage 3.3. Unstructured storage using Cloud Storage 3.4. SQL Managed Services 3.5. Exploring cloud SQL 3.6. NoSQL Managed Services 3.7. NoSQL Document storage on Cloud 3.8 Introduction to API 3.8.1. Purpose of API 3.8.2 Using Apigee 3.8.3 Using Google Cloud storage API to upload and Download data Unit 4 4.1. Accessing Cloud Storage using the Android Storage Access Framework 4.2. The Storage Access 4.3. Working with the Storage Access 4.4. Deploying application with google cloud 4.5. Handling Intent Results
Reference Books	1) Beginning Mobile Application Development in the Cloud, Author: Richard Rodger, Publisher: Wrox, ISBN: 978-1118034699 2) Exploring Cloud Computing, Author: Andreas Wittig and Michael Wittig, Publisher: Manning, ISBN: 978-1617294877 3) Visualizing Google Cloud: 101 Illustrated References for Cloud Engineers and Architects, Author: Priyanka Vergadia, Publisher: Wiley, ISBN: 978 1119816324 4) Android Application Development (With Kitkat Support), Author: Pradeep Kothari, Publisher: DreamTech Press.,ISBN:978-9351194095 5) Android Studio 3.0 Development Essentials: Android 8 Edition Author – Neil Smyth, Publisher: Payload Media, ISBN – 13: 978 – 1977540096 6) Google Cloud Platform All-In-One Guide, Author: Praveen Kukreti, Publisher: BPB Publication, ISBN: 978-9355513328 7) Google Cloud Platform for Architects, Author: Vitthal Srinivasan, Janani Ravi and Judy Raj, Publication: Packt, ISBN: 9781788834308 8) Professional Android – fourth Edition, Author: Reto Meier, Ian Lake, Publisher: Wrox, ISBN – 13:978-1118949528 9) Google Cloud Platform in Action, JJ Geewax, Manning Publications, ISBN: 9781617293526. 10) Google Cloud Platform for Developers, Ted Hunter, Steven Porter and Scott Baker, Packt Publishing, ISBN: 9781787280834. 11) Architecting Google Cloud Solutions, Kevin Mak, Packt Publishing, ISBN: 9781788834302.

	12) Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Ricardo Puttini and Zaigham Mahmood, Pearson Education, ISBN: 9780133387520. 13) Mastering Cloud Computing: Foundations and Applications Programming, Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, McGraw Hill Education (India), ISBN: 9781259029950.
Teaching Methodology	Interactive lectures / Case study discussions, Group activities and debates / Short presentations, Case study / reflective assignments, Practical and applied work in lab.
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

	Unit-2 Understanding Intelligence through Logic and Knowledge 2.1 Knowledge Representation Techniques 2.2 Propositional logic 2.3 First-order logic 2.1.1 Semantic networks and frames 2.4 Reasoning and Inference 2.4.1 Inference rules and resolution 2.4.2 Forward and backward chaining UNIT-3: Practical Applications of AI using Python 3.1 Rule-Based Expert Systems 3.1.1 Architecture of expert systems 3.1.2 Case study: MYCIN or any rule-based system 3.2 Implementing Search Algorithms using Python Libraries 3.2.1 BFS and DFS using Python 3.2.2 A* Search implementation 3.3 Implementing Logic and Rule-Based Systems 3.3.1 Creating a simple rule-based chatbot 3.3.2 Inference using forward chaining Unit-4: Creating a simple rule-based chatbot using Python 4.1 Demonstrating forward chaining using a rule engine (e.g., PyKnow) 4.2 Case Study on Real-World AI Tools 4.2.1 Case Study 1: ChatGPT and Google Gemini – Conversational AI overview and its working principles 4.2.2 Case Study 2: Teachable Machine by Google – Building custom image/sound classification model without code 4.2.3 Case Study 3: IBM Watson – Understanding applications in healthcare, customer service, and business analytics [Students are expected to work on a Mini Project during lab hours designing AI based application Considering follows guide-lines: (i) Define a problem (e.g., chatbot, recommender, image classifier) (ii) Design and implement using Python or any AI tool (iii) Submit report with screenshots and working demo]
Reference Books	1) Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, Pearson, ISBN: 978-0136042594 2) Python Programming: An Introduction to Computer Science, John Zelle, Franklin, Beedle & Associates Inc., ISBN: 978-1590282410 3) Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley, ISBN: 978-1118290279 4) Introduction to Artificial Intelligence and Expert Systems, Dan W. Patterson, Prentice Hall, ISBN: 978-0132550707 5) Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing, ISBN: 978-1789955750 6) Fundamentals of Artificial Intelligence, N. P. Padhy, Prentice Hall India, ISBN: 978 8120328805 7) Programming in Python 3, Mark Summerfield, Addison-Wesley, ISBN: 978 0321680563 8) Artificial Intelligence: Principles and Techniques, Nils J. Nilsson, Morgan Kaufmann, ISBN: 978-1558604674 9) Data Structures Using Python, Rance D. Necaise, Wiley, ISBN: 978-1118957321 10) Artificial Intelligence: A New Synthesis, Nils J. Nilsson, Morgan Kaufmann, ISBN: 978-1558604674

	11) Python for Data Analysis, Wes McKinney, O'Reilly Media, ISBN: 978-1491957660 12) Machine Learning Using Python, Manaranjan Pradhan, BPB Publications, ISBN: 978 9388519004
Teaching Methodology	Class Work, Discussion, Self-Study, Seminars and/or Assignments, Practical/Project
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-3)
SYLLABUS
305: Big Data and Hadoop

Program Name	M.Sc.(Computer Application)								
Semester	3								
Course Subtype	Employability and Skill Development								
Subject Type	Discipline Specific								
Course Code	305								
Course Level	500-599								
Course Title	Big Data and Hadoop								
Credit	4 Credits								
Effective From	Academic Year: 2026-2027								
Course Outcomes	CO1: Students should be able to demonstrate knowledge of big data and its underlying technologies, including Hadoop, MapReduce, and Hive. This includes understanding the various components of a Hadoop cluster, the MapReduce programming model, and the role of Hive in processing large datasets. CO2: Ability to design and implement solutions for processing and analyzing large datasets using Hadoop, MapReduce, and Hive. This includes designing data models, writing MapReduce programs, and creating Hive queries to analyze data. CO3: Understanding of Data Warehousing concepts and techniques, including data modelling, data integration, and data aggregation. They should also be able to apply these concepts in the context of big data solutions using Hadoop, MapReduce, and Hive. CO4: Ability to Work with Big Data Tools and Technologies including Hadoop Distributed File System (HDFS), Hadoop YARN, and Apache Pig. They should also be familiar with tools for data analysis and visualization, such as Apache Spark and Tableau. CO5: Collaboration and Communication Skills with others in a team environment, and communicate their ideas and solutions clearly and effectively to technical and non-technical stakeholders.								
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
	CO5								
Course Content	Unit 1: Introduction to Big Data and Hadoop 1.1 Introduction to Big Data 1.1.1 Overview of Big Data 1.1.2 Characteristics of Big Data 1.1.3 Big Data Technologies and Tool 1.2 Hadoop Architecture 1.3 Hadoop Ecosystem Components 1.4 Understanding Hadoop Distributed File System (HDFS) 1.5 Hadoop Installation and Configuration 1.5.1 Installing and Configuring Hadoop on a Cluster								

- 1.5.2 Configuring Hadoop Parameters
- 1.5.3 Monitoring Hadoop Cluster

Unit 2: Data Ingestion, Processing and Visualization

- 2.1 Introduction of NoSQL
 - 2.1.1 Concepts, purpose and types of NoSQL databases
 - 2.1.2 Advantages of NoSQL
 - 2.1.3 Comparison of SQL vs NoSQL
- 2.2 Introduction of MongoDB
 - 2.2.1 Concepts and architecture
 - 2.2.2 Using JSON
 - 2.2.3 Creating or generating a unique key
 - 2.2.4 Support for Dynamic Queries
 - 2.2.4.1 Storing Binary Data, Replication, Shading
 - 2.2.4.2 Updating information in –place
 - 2.2.4.3 Data types in Mongo DB
 - 2.2.5 MongoDB Query Language

Unit 3: MapReduce Programming Model

- 3.1 Understanding MapReduce Programming Model
- 3.2 MapReduce Programming Basics
 - 3.2.1 Input and Output Formats in MapReduce
 - 3.2.2 Mapper and Reducer Functions
 - 3.2.3 Combiner Functions
 - 3.2.4 Partitioners in MapReduce
- 3.3 Advanced MapReduce Programming Concepts
 - 3.3.1 Hadoop Streaming
 - 3.3.2 Multi-Stage MapReduce Jobs
 - 3.3.3 MapReduce Joins, Counters, Optimization
- 3.4 Data Locality in MapReduce
 - 3.4.1 MapReduce Compression
 - 3.4.2 MapReduce Sort and Shuffle

Unit 4: Hadoop Ecosystem Components:

- 4.1 Hive Architecture
 - 4.1.1 Comparison with Traditional RDBMS
 - 4.1.2 HiveQL Data Types
 - 4.1.3 Working with Tables and Databases
 - 4.1.4 HiveQL Operators and Functions
- 4.2 Data Loading and Manipulation
 - 4.2.1 Loading Data into Hive Tables
 - 4.2.2 Creating and Managing Partitioned Tables
 - 4.2.3 Altering and Dropping Tables
 - 4.2.4 Data Manipulation using HiveQL
- 4.3 Data Analysis using Hive
 - 4.1.1 Hive Optimization Techniques
 - 4.1.1 Hive Query Optimization
 - 4.1.2 Partitioning and Bucketing
 - 4.1.3 Indexing in Hive
 - 4.1.4 Joins and Subqueries Optimization
- 4.2 User-Defined Functions (UDFs)
 - 4.2.1 Overview of UDFs in Hive
 - 4.2.2 Developing and Using UDFs in Hive
 - 4.2.3 Hive Transactions and Concurrency
- 4.3 Concurrency Control in Hive

	4.4 Locking in Hive [All Units carry Equal Weightage]
Reference Books	1. Google Cloud Platform in Action, Author: J.J. Geewax, Publisher: Manning Publications, ISBN: 9781617293528 2. Google Compute Engine, Author: Marc Cohen, Kathryn Hurley, Paul Newson, Publisher: O'Reilly Media, ISBN: 9781449361488 3. Getting Started with Containers in Google Cloud Platform, Author: Shimon Ifrah, Publisher: Apress, ISBN: 9781484264690 4. Cloud Computing: Concepts and Technologies, Author: Gopal Shyam, Publisher: CRC Press (Taylor & Francis), ISBN: 9781000337952 5. Cloud Computing: Theory and Practice, Author: Dan C. Marinescu, Publisher: Morgan Kaufmann (Elsevier), ISBN: 9780124046276 6. Cloud Computing: Concepts, Technology & Architecture, Author: Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Publisher: Pearson Education, ISBN: 9780133387520 7. Cloud Computing Bible, Author: Barrie Sosinsky, Publisher: Wiley India / Wiley, ISBN: 9780470903568 8. Cloud Computing Black Book, Author: Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Publisher: Dreamtech Press, ISBN: 9789351194187 9. Cloud Computing, Author: Kailash Jayaswal, Jagannath Kallakurchi, Publisher: Dreamtech Press, ISBN: 9789351198222 10. Cloud Computing and Data Management: Techniques, Challenges and Best Practices, Author: N. Rajasekhar Reddy, Publisher: Deep Science Publishing, ISBN: 9789371859875
Teaching Methodology	Interactive lectures / Case study discussions, Group activities and debates / Short presentations, Case study / reflective assignments, Practical and applied work in lab.
Evaluation Method	Internal Assessment : - 30% Internal based on - Assignment, Class Attendance , continuous evaluation - Internal Practical and viva-voce External Assessment : - 70% external evaluation based on - Theory examination - Practical and viva-voce

M.Sc.(Computer Application) (Semester - 4)

Structure of Program

Course Code	Course Title	Marksheet Title in English	Teaching Hours/Week		Exam Duration		Credit	Internal Marks		External Marks		Total Marks
			TH	PR	TH	PR		TH	PR	TH	PR	
401	SEMINAR	SEMINAR	-	-	-	2 Hrs.	4	-	45	-	105	150
402	PROJECT	PROJECT	-	-	-	5 Hrs.	18	-	120	-	280	400

Program Name	M.Sc. (Computer Application)									
Semester	4									
Course Subtype	Employability and Skill Development									
Subject Type	Emerging Technology									
Course Code	401									
Course Level	500-599									
Course Title	SEMINAR									
Credit	4 credits									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Identify and analyze recent and emerging technologies in the field of Computer Applications by reviewing scholarly articles, technical reports, and industry white papers. CO2: Critically evaluate selected technologies in terms of architecture, applications, advantages, limitations, and future research directions. CO3: Organize and document technical content in a structured manner by preparing a comprehensive seminar report following standard academic and professional documentation practices. CO4: Design and deliver an effective seminar presentation using appropriate visualization tools, demonstrating clarity of thought, technical depth, and professional communication skills. CO5: Demonstrate independent learning, ethical conduct, and research aptitude while responding to questions and feedback during seminar evaluation and discussion sessions.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Purpose of Course: The Seminar course is designed to expose postgraduate students to emerging, advanced, and interdisciplinary technologies in the field of Computer Applications and allied domains. The course aims to develop students' research orientation, independent learning ability, analytical thinking, technical documentation skills, and professional presentation capabilities. Through this course, students are encouraged to explore state-of-the-art technologies, current industry practices, recent research trends, and real-world problem domains, thereby bridging the gap between academic learning and contemporary technological advancements. Course Objective : This course supports NEP-2020 objectives by: (i) Promoting self-directed learning (ii) Encouraging research aptitude and innovation (iii) Enhancing communication									

	and presentation skills (iv) Preparing students for higher studies, research, industry, and professional careers Course Instructions: - Each student shall select a seminar topic related to latest or emerging technologies in Computer Applications, subject to approval by the course instructor / seminar committee. - The selected topic should be: (i) Technically relevant (ii) Research-oriented or application-driven (iii) Aligned with current industry or academic trends - Students are required to: (i) Conduct independent study and literature review (ii) Refer research papers, technical articles, white papers, standards, and case studies (iii) Avoid plagiarism and follow ethical academic practices - The seminar shall include: (i) Technical report / documentation PowerPoint presentation (ii) Oral presentation and discussion before faculty members, peers, and examiners - Students must demonstrate: (i) Depth of understanding of the topic (ii) Ability to analyze and interpret technical information (iii) Clear and effective communication skills - The seminar evaluation shall be based on: (i) Topic relevance and novelty (ii) Quality of technical content (iii) Documentation and presentation (iv) Question handling and critical discussion (v) Overall professional approach Expected Outcomes of the Course: Upon successful completion of this course, students will be able to: - Identify and explore emerging technologies and research trends in computer applications. - Develop independent learning and research skills through self-study and technical exploration. - Analyze and critically evaluate modern tools, frameworks, architectures, and methodologies. - Prepare structured technical documentation following academic and professional standards. - Deliver confident, well-organized seminar presentations using appropriate visual aids. - Communicate complex technical concepts effectively to a diverse audience. - Demonstrate professional ethics, originality, and academic integrity. Nature of the Course: - Independent learning and research-oriented - No formal classroom lectures - Guided by faculty mentoring and review sessions Major Activities: (i) Topic selection and approval (ii) Literature survey and technology exploration (iii) Technical documentation preparation (iv) Seminar presentation and discussion (v) Peer interaction and expert feedback Suggested Seminar Areas (Indicative) Suggested Topics : (but not limited to): (i) Artificial Intelligence and Machine Learning (ii) Generative AI, Agentic AI, Autonomous Systems (iii) Data Analytics, Business Intelligence (iv) Full-stack development and deployment (v) Cloud Computing and DevOps (vi) Cyber Security and Blockchain (vii) Internet of Things (IoT) (viii) Edge Computing and Embedded Systems (ix) Software Engineering Trends (x) Ethical AI and Responsible Computing (xi) Any other emerging or interdisciplinary technology
Teaching Methodology	The teaching methodology emphasizes self-directed learning, experiential learning, and outcome-based education. Students undertake independent exploration of

	emerging technologies, supported through mentoring, presentations, and evaluations. The approach strengthens research aptitude, technical communication, and professional competencies.
Evaluation Method	Internal Assessment : - 30% Internal assessment based on : (i) Topic Selection & Proposal Quality (ii) Literature Survey & Technical Depth (iii) Seminar Report (iv) Continuous Progress & Mentoring Review and (v) Internal Presentation. External Assessment : - 70% External assessment based on: (i) Seminar Presentation (ii) Communication & Confidence (iii) Question–Answer & Technical knowledge (iv) Overall Impression & Professionalism

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
M.Sc.(Computer Application) (Semester-4)
402: PROJECT
SYLLABUS

Program Name	M.Sc. (Computer Application)									
Semester	4									
Course Subtype	Employability and Skill Development									
Subject Type	Discipline Specific									
Course Code	402									
Course Level	500-599									
Course Title	PROJECT									
Credit	18 credits									
Effective From	Academic Year : 2026-2027									
Course Outcomes	CO1: Identify, analyze, and define real-world problems from industry or societal contexts and translate them into clear project requirements for web or mobile technology solutions. CO2: Design and develop a complete end-to-end software solution using appropriate web or mobile technologies, following industry-standard software development practices. CO3 : Apply DevOps principles and tools for version control, build automation, testing, deployment, and monitoring to deliver a production-ready application. CO4: Demonstrate professional skills by working independently or as part of a team, managing project timelines, documentation, and effective technical communication. CO5: Evaluate project outcomes and reflect on learning, addressing scalability, security, ethics, and future enhancements, demonstrating readiness for industry or research roles.									
Mapping between Cos and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
	CO1									
	CO2									
	CO3									
	CO4									
	CO5									
Course Content	Purpose of the Course: The purpose of the Project course is to provide students with an opportunity to apply theoretical knowledge and practical skills acquired during the program to solve real-world problems. The course enables students to design, develop, and implement complete software solutions in the areas of web technology or mobile application development (Android/iOS), focusing on practical exposure, innovation, and professional competence. Course Objectives: The objectives of this course are to: (i) Enable students to identify, analyze, and define real-world or industry-relevant problems. (ii) Design and develop end-to-end software solutions using web or mobile technologies. (iii) Apply appropriate									

	development tools, frameworks, and software engineering practices (iv) Encourage independent learning, teamwork, and effective project management. (v) Develop professional skills including documentation, presentation, and technical reporting Course Instructions: (i) Students must undertake a full-time project, either on-site or off-site, individually or as part of a team. (ii) The project should preferably address a real-life problem, industry use case, or societal need. (iii) Projects may be developed using web technologies or mobile platforms (Android / iOS) or machine learning / Deep learning / application of Artificial intelligence. (iv) Adoption of software development best practices such as version control, testing, documentation, and deployment is expected. (v) Regular reviews, demonstrations, and progress presentations will be conducted. (vi) Final submission must include a project report, source code, implementation details, and presentation. Expected Learning Outcomes : On successful completion of the course, students will be able to: (i) Analyze real-world problems and convert them into well-defined project requirements. (ii) Design and implement functional and user-centric web or mobile applications. (iii) Apply appropriate tools and technologies to develop reliable software solutions. (iv) Work effectively as an individual or as a team member in a project environment. (v) Communicate technical ideas and project outcomes professionally. Expected Professional Outcomes: After completing this course, students are expected to: (i) Demonstrate industry-readiness for roles in software or application development. (ii) Apply problem-solving and analytical skills to practical scenarios. (iii) Follow ethical and professional practices during project execution. (iv) Adapt to emerging technologies and development platforms. (v) Build a strong foundation for employment, entrepreneurship, or higher studies. This course provides experiential learning through the design and development of real-world web or mobile software applications, fostering technical competence and professional readiness.
Teaching Methodology	The course follows a project-based learning approach supported by faculty mentoring, regular reviews, and industry-oriented development practices. Students work independently or in teams to design and implement real-world web or mobile applications. Emphasis is placed on practical skills, documentation, and professional presentation.
Evaluation Method	Internal Assessment : - 30% Internal assessment based on : (i) Problem Identification & Requirement Analysis (ii) Design & Implementation Progress (iii) Periodic Reviews & Milestones (iv) Documentation & Technical Report and (v) Professional Conduct & Teamwork. External Assessment : - 70% External assessment based on: (i) Final Project Demonstration (ii) Technical Depth & Innovation (iii) Viva-Voce Examination (iv) Final Presentation & Defense [The project evaluation consists of continuous internal assessment and final external examination. Assessment is based on problem identification, implementation, documentation, demonstration, and viva-voce. Emphasis is given to real-world applicability, technical competence, and professional skills.]