Re-Accredited 'B++' 2.66 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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યુનિવર્સિટી સંલગ્ન તમામ M.Sc. (IT) પ્રોગ્રામ ચલાવતી કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭ થી અમલમાં આવનાર B.Sc. (IT) (Honours) Four Year Program Sem.-7 & 8 નો પેટા સમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ ઈન્ફોર્મેશન એન્ડ કોમ્યુનિકેશન ટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૪/૦૨/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૩ થી મંજૂર કરી કોમ્પ્યુટર સાયન્સ ફેકલ્ટીને કરેલ ભલામણ કોમ્પ્યુટર સાયન્સ ફેકલ્ટીની તા.૨૯/૦૪/૨૦૨૬ની સભાના ઠરાવ ક્રમાંકઃ૧૮ થી સમિતિને સુધારો કરવા રીફર કરેલ અભ્યાસક્રમ ઈન્ફોર્મેશન એન્ડ કોમ્યુનિકેશન ટેકનોલોજી વિષયની અભ્યાસ સમિતિના ચરેમેનશ્રીએ સુધારેલ અભ્યાસક્રમ અભ્યાસ સમિતિવતી અને કોમ્પ્યુટર સાયન્સ ફેકલ્ટીના ઈ.ચા.ડીનશ્રીએ ફેકલ્ટીવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૭/૦૫/૨૦૨૬ની સભાનાં ઠરાવ ક્રમાંકઃ૭૩ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/B.Sc.IT/૧૦૦૭૩/૨૦૨૬
તા.૦૧/૦૬/૨૦૨૬

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન તમામ M.Sc. (IT) પ્રોગ્રામ ચલાવતી કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રી..... .....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) ડીનશ્રી, કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

# Veer Narmad South Gujarat University, Surat

**Program Structure: M. Sc. (I .T.) (SEM – 7 and SEM – 8)**

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

**Bachelor of Science in Information Technology (B. Sc. (I. T.)) – Three Year Program**

**Bachelor of Science in Information Technology (B.Sc. (I.T.) (Hon.)) – Four Year Program**

**[ Honors Program Scheme ]**

## SEMESTER – 7

| Course Category | Course Code | Course Title | Marksheet Title in English | Level of Course | Teaching Hours/Week | | Exam Duration | | Credit | | Internal Marks | | External Marks | | Total Makrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TH | PR | TH | PR | TH | PR | TH | PR | TH | PR | TH | PR |
| MAJOR | 701 | Application Development using Full Stack | Application Development using Full Stack | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 702 | Advanced .NET | Advanced .NET | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 703 | Practical – 7 | Practical – 7 | 500-599 Advanced | – | 8 | – | 4 Hrs | – | 4 | – | 50 | – | 50 | – | 100 |
| MAJOR | 704 | Artificial Intelligence and Machine Learning | Artificial Intelligence and Machine Learning | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 705 | On Job Training * | On Job Training | 500-599 Advanced | – | – | – | – | – | 6 | – | 75 | – | 75 | – | 150 |

* OJT exam will be conducted as per the University rules and assessment will be conducted via viva voce.

# Veer Narmad South Gujarat University, Surat

## Program Structure: M. Sc. (I .T.) (SEM – 7 and SEM – 8)

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

**Bachelor of Science in Information Technology (B. Sc. (I. T.)) – Three Year Program**

**Bachelor of Science in Information Technology (B.Sc. (I.T.) (Hon.)) – Four Year Program**

**[ Honors Program Scheme ]**

## SEMESTER – 8

| Course Category | Course Code | Course Title | Marksheet Title in English | Level of Course | Teaching Hours/Week | | Exam Duration | | Credit | | Internal Marks | | External Marks | | Total Makrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | TH | PR | TH | PR | TH | PR | TH | PR | TH | PR | TH | PR |
| MAJOR | 801 | Enterprise Java | Enterprise Java | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 802 | Deep Learning | Deep Learning | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 803 | Practical-8 | Practical-8 | 500-599 Advanced | – | 8 | – | 4 Hrs | – | 4 | – | 50 | – | 50 | – | 100 |
| MAJOR | 804 | Blockchain Computing | Blockchain Computing | 500-599 Advanced | 4 | – | 2 Hrs | – | 4 | – | 50 | – | 50 | – | 100 | – |
| MAJOR | 805 | On Job Training * | On Job Training | 500-599 Advanced | – | – | – | – | – | 6 | – | 75 | – | 75 | – | 150 |

* OJT exam will be conducted as per the University rules and assessment will be conducted via viva voce.

# Veer Narmad South Gujarat University, Surat

**Program Structure: M. Sc. (I .T.) (SEM – 7 and SEM – 8)**

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

**Bachelor of Science in Information Technology (B. Sc. (I. T.)) – Three Year Program**

**Bachelor of Science in Information Technology (B.Sc. (I.T.) (Hon.)) – Four Year Program**

**[ Honors Program Scheme ]**

**Practical:**

- Batch Size – 30 Maximum (Desirable). Maximum 45 students can be accommodated in a batch. Separate batches should be considered if the student strength exceeds 45 numbers.

**On Job Training:** As per NEP (National Education Policy-2020), students are expected to complete a minimum of 180 hours of OJT, which can include internships with various organizations, including government and private sectors, to gain hands-on experience in their field of study.

# Veer Narmad South Gujarat University, Surat

**Program Structure: M. Sc. (I .T.) (SEM – 7 and SEM – 8)**

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

**Bachelor of Science in Information Technology (B. Sc. (I. T.)) – Three Year Program**

**Master of Science in Information Technology (M.Sc. (I.T.)) – Five Year Integrated Program**

**Practical:**

- Batch Size – 30 Maximum (Desirable). Maximum 45 students can be accommodated in a batch. Separate batches should be considered if the student strength exceeds 45 numbers.

**Project:** As per NEP (National Education Policy-2020), students are expected to complete a minimum of 180 hours of project work, which can include internships with various organizations, including government and private sectors, to gain hands-on experience in their field of study.

# Veer Narmad South Gujarat University, Surat

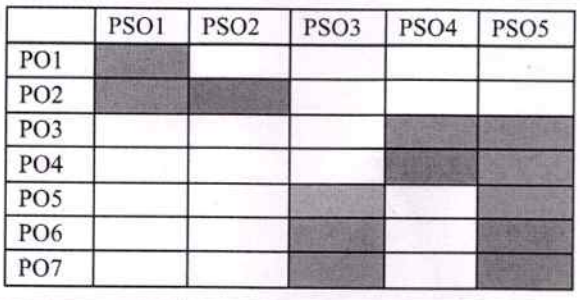
## Program Structure: M. Sc. (I .T.) (SEM – 7 and SEM – 8)

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

**Bachelor of Science in Information Technology (B. Sc. (I. T.)) – Three Year Program**

**Bachelor of Science in Information Technology (B.Sc. (I.T.) (Hon.)) – Four Year Program**

**[ Honors Program Scheme ]**

| | |
|---|---|
| Name of Program | Master of Science (Information Technology) |
| Abbreviation | M.Sc. (I.T.) |
| Eligibility | H S C / Equivalent Examination from Science Stream ( A / B / AB Group) or Vocational Stream or General Stream (Commerce) with English as one of the subject. |
| Objective of Program | The objective of the program is to transform students into I.T. professionals by providing them advanced technical knowledge and outstanding placement in reputed I.T. companies. |
| Program Outcome | **PO1 : Fundamental Knowledge Enrichment**<br>Program trains students with the core computer science and Information Technology (IT) knowledge domains. It also makes students capable of using core concepts in the conceptualization of domain specific application development.<br>**PO2 : Critical Thinking Development**<br>The program develops the skills of critical thinking, problem solving, evaluative learning of various techniques, and understanding the essence of the problem.<br>**PO3 : Advanced Emerging Technology Awareness**<br>The program trains students with the latest technologies that is being used in the industry. The continuous syllabi review adds value to the program for the outgoing students and make them ready to face challenging demands of the industry.<br>**PO4 : Advanced Tools Usage**<br>The program teaches the students to apply the advanced tools to solve real world problems.<br>**PO5 : Nurturing Project Planning and Management Capabilities**<br>The program trains students for designing and conceptualizing the software architecture, planning and managing the product development process of complex and live software projects. It also makes students understand the decision making for selection of an appropriate project management capabilities.<br>**PO6 : Real World Problem / Project Development**<br>Real world project provides the candidates exposure to work in the challenging and demanding environment of the industry. The project development training makes students employable and industry ready.<br>**PO7 : Team Work and Leadership Development**<br>Trains students to work in a team and also to take leadership of the of the project management team. |
| Program Specific Outcomes | **PSO1**: Students will learn to develop and strengthen the fundamental concepts that are required to solve complex programming problems.<br>**PSO2**: Students will develop the ability to identify, formulate and design solutions to face computational challenges.<br>**PSO3**: Students will be able to apply software engineering concepts to solve real world problems.<br>**PSO4**: Students will be able to learn emerging technologies and apply them for the development of Web applications, Mobile application, Desktop application, etc.<br>**PSO5**: Students will develop necessary Entrepreneur and Technical skills to start their own business in I.T domain. |
| Mapping between POs and PSOs |  |
| Medium of Instruction | English |
| **Program Passing Rules** | **As per University rules** |

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| PO1 | | | | | |
| PO2 | | | | | |
| PO3 | | | | | |
| PO4 | | | | | |
| PO5 | | | | | |
| PO6 | | | | | |
| PO7 | | | | | |

[Subject code-2611001107011001]

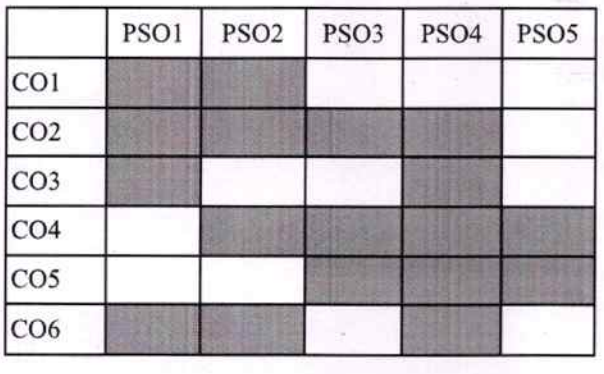
| VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT<br>SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **7** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **701** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Application Development using Full Stack** | | | | | |
| **Credit** | **Theory:** | **4** | **Practical:** | **-** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026-27** | | | | | |
| **Course Outcomes** | **CO1:** Analyze the Node.js architecture and implement asynchronous programming patterns to build efficient server-side logic.<br><br>**CO2:** Design and develop and test secure RESTful APIs using Express.js and Mongoose.<br><br>**CO3:** Build dynamic, component-based user interfaces using React.js and manage complex application states using modern concepts like Hooks and Redux.<br><br>**CO4:** Integrate frontend and backend components to develop full-stack MERN applications capable of performing complex CRUD operations.<br><br>**CO5:** Manage application versioning using version control (Git) and deploy production-ready applications.<br><br>**CO6:** Architect and deploy scalable, real-time web solutions using WebSockets and other event-driven programming to solve advanced computational communication challenges. | | | | | |
| **Course Content** | **Unit 1 : Introduction of Full Stack Architecture and Node.js Ecosystem**<br>1.1 Introduction to Full Stack Architecture<br>1.2 Components of Full Stack Architecture<br>1.3 Frontend, Backend<br>1.4 Architecture of Node.js Ecosystem<br>1.5 Familiarity with Advanced JavaScript Concepts (ES 6+)<br>1.5.1 Hoisting<br>1.5.2 Closures<br>1.5.3 Spread and Rest Operator<br>1.5.4 Destructuring | | | | | |

1.5.5 Optional Chaining
1.6 Installing Node.js
1.7 REPL
1.8 Module and npm
1.8.1 npm
1.8.2 package.json
1.8.3 The node_modules
1.8.4 require()
1.8.5 Create and use modules using CJS and ESM
1.8.6 Create and deploy packages
1.9 Node concepts
1.9.1 The Event Loop
1.9.2 Asynchronous Coding
1.9.3 Callback Functions
1.9.4 Calling Conventions
1.9.5 Exception Handling
1.9.6 Callback Hell
1.9.7 Event Emitters
1.9.8 Extending EventEmitter
1.9.9 Listening for Events
1.9.10 Promise
1.9.11 async .. await
1.10 Using TypeScript for Node.js programming
1.11 Core Modules
1.11.1 Command Line Arguments
1.11.2 Working with the File System
1.11.3 Global objects
1.11.4 File Systems and Streams
1.11.5 Utility Modules
1.11.6 http Module
1.11.7 Routes
1.11.8 Accessing Request Headers

**Unit 2 : Express**

2.1 Routing
2.2 HTTP Methods
2.3 URL Building
2.4 Middleware
2.5 Templating
2.6 Static Files
2.7 Form Data
2.8 Database
2.9 Cookies
2.10 Sessions
2.11 Authentication strategies
2.11.1 Difference between Authentication and Authorization
2.11.2 Password Hashing
2.11.3 Session-based Authentication
2.11.4 Keys and Token-based Authentication
2.11.5 Implementing Passport.js for OAuth 2.0
2.11.6 Role-Based Access Control

2.12 Working with NoSQL databases
2.12.1 NoSQL Databases Types

| | |
|---|---|
| | 2.12.2 Integrate MongoDB using Mongoose for Insert, Update, Delete and Select Data<br>2.13 RESTful API Development and Testing<br>2.14 API Security and application security<br>2.14.1 Input Validation and Sanitization<br>2.14.2 Implementing Rate Limiting<br>2.14.3 CORS Configuration<br>2.14.4 Secure HTTP Headers<br>2.14.5 Protecting against Injection<br>2.14.6 Managing Environment Variables<br>**Unit 3 : React.js**<br>3.1 React.js Introduction<br>3.2 React.js application architecture<br>3.3 Component<br>3.4 JSX Overview<br>3.5 Virtual DOM and Single Page Application<br>3.6 Components<br>3.6.1 Introduction to Class Components<br>3.6.2 Function Components<br>3.6.3 Nested Components<br>3.6.4 Conditional and Looping constructs<br>3.6.5 State<br>3.6.6 Props<br>3.7 Event Handling in Function Components<br>3.8 Introduction to Component Life Cycle Methods<br>3.9 React Hooks<br>3.10 Forms<br>3.11 Router, Protecting Routes<br>3.12 State Management<br>3.13 Redux<br>3.14 Calling Backend API<br>**Unit 4 : Web Tools, Technologies and Deployment**<br>4.1 Browser Tools<br>4.2 Version Control using Git and others Tools<br>4.3 Websocket Programming<br>4.4 Webhooks<br>4.5 Introduction to GraphQL<br>4.6 Application Deployment |
| **Mapping between COs and PSOs** |  |
| **Reference Books** | 1) React Key Concepts (2nd Edition) Dec 2022 Max Schwarzmüller Packt<br>2) Pro Mern Stack: Full Stack Web App Development with Mongo, Express, React, and Node Paperback – 13 May 2019 by Vasan Subramanian (Author) Apress |

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | ■ | ■ | | | |
| CO2 | ■ | ■ | ■ | ■ | |
| CO3 | ■ | | | ■ | |
| CO4 | | ■ | ■ | ■ | ■ |
| CO5 | | | ■ | ■ | ■ |
| CO6 | ■ | ■ | | ■ | |

| | |
|---|---|
| | 3) Efficient Node.js: A Beyond-the-Basics Guide (Grayscale Indian Edition) Paperback – 9 February 2025 by Samer Buna (Author), O'Reily<br><br>4) React in Depth 2024, by Morten Barklund, Manning<br><br>5) React Cookbook Paperback – 31 August 2021 by David Griffiths (Author), Dawn Griffiths (Author) , O'Reily<br><br>6) React: Up & Running: Building Web Applications Paperback – 21 December 2021 by Stoyan Stefanov (Author), O'Reily |
| **Teaching Methodology** | Class Room Teaching, Discussion and Assignment, Hands on sessions |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **7** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **702** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Advanced .NET** | | | | | |
| **Credit** | **Theory:** | **4** | **Practical:** | **0** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026 - 2027** | | | | | |
| **Course Outcomes** | **CO 1 – Master Modern C# Syntax & Performance**<br>Apply the latest C# features, including primary constructors, pattern matching, and asynchronous streaming, to write concise and memory-efficient enterprise code.<br>**CO 2 – Architect Scalable Web APIs**<br>Develop professional-grade RESTful services using both traditional Controller-based architectures and modern Minimal APIs, integrated with automated validation and OpenAPI documentation.<br>**CO 3 – Implement Advanced Identity & Security**<br>Implement industry-standard security protocols, including JWT with DPoP and passwordless Passkey (WebAuthn) authentication, while configuring robust CORS and CSRF protections.<br>**CO 4 – Construct Full-Stack Web Interfaces**<br>Construct dynamic, interactive web applications using the Blazor "United" architecture, mastering component-based design and real-time communication via SignalR.<br>**CO 5 – Create Cross-Platform Hybrid Applications**<br>Create native-quality mobile and desktop applications by leveraging Blazor Hybrid and MAUI shells to share a single UI codebase across Android, iOS, and Windows.<br>**CO 6 – Optimize Application Reliability & Observability**<br>Optimize software quality by integrating built-in Health Checks, advanced caching (HybridCache), and structured logging to monitor and troubleshoot production-ready applications. | | | | | | |
| **Course Content** | **Unit – 1 Advanced C# Foundations**<br>1.1 Modern Syntax: Primary Constructors, field keyword, Extension Members.<br>1.2 Clean Logic: Switch Expressions, List Patterns, Pattern Matching. | | | | | |

1.3 Data Modeling: Records (Positional), Tuples vs. Structs, Required Members.
1.4 Async & Data: async/await, Task.WhenAll, EF Core CRUD, JSON columns.
1.5 Optimization: LINQ Performance, IAsyncEnumerable streaming.

**Unit – 2 Web API & Backend Architecture**

2.1 Controller-Based APIs: Attribute Routing, Model Binding, API Controllers.
2.2 Minimal APIs: Route Groups, Endpoint Filters, AddValidation().
2.3 Server Architecture: Dependency Injection (Keyed), Middleware, IExceptionHandler.
2.4 API Standards: OpenAPI/Swagger, JSON Source Generators, Server-Sent Events (SSE).
2.5 Advanced Security: JWT + DPoP, Passkeys (WebAuthn), Policy-based Auth, CORS.

**Unit – 3 Full-Stack & Hybrid UI**

3.1 Blazor Core: Blazor United (Auto Mode), SSR vs. WASM.
3.2 Component Design: Razor Syntax, Cascading Parameters, EventCallbacks.
3.3 Forms & State: Data Binding, EditForm, FluentValidation, [PersistentState].
3.4 Hybrid Development: Blazor Hybrid (MAUI shell), Android/iOS/Windows sharing.
3.5 Real-time UI: SignalR Hubs, Live Dashboards, Collaborative UI.

**Unit – 4 Quality, Performance & Diagnostics**

4.1 Reliability: Health Checks, Cancellation Tokens, Global Error Handling.
4.2 Performance: Response Caching, HybridCache (L1/L2), Memory Profiling.
4.3 Observability: Structured Logging (ILogger), Correlation IDs, OpenTelemetry.
4.4 Maintenance: User Secrets, Self-Contained Publishing, BenchmarkDotNet.

**Mapping between Cos and PSOs**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | | | | | |
| CO2 | | | | | |
| CO3 | | | | | |
| CO4 | | | | | |
| CO5 | | | | | |
| CO6 | | | | | |

**Reference Books**


1. C# 14 and .NET 10 – Modern Cross-Platform Development Fundamentals (10th Edition) by Mark J. Price, Packt Publishing, 2025.
2. ASP.NET Core 10 in Action by Andrew Lock, Manning Publications/Dreamtech Press, 2026.
3. Blazor WebAssembly by Example (3rd Edition) by Itay Itzhaki, Packt Publishing, 2026.
4. Entity Framework Core 10 in Action by Jon Smith, Manning Publications/Dreamtech Press, 2026.
5. Pro ASP.NET Core 10 (11th Edition) by Adam Freeman, Apress/Springer Nature, 2026.
6. Apps and Services with .NET 10 by Mark J. Price, Packt Publishing, 2026.

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|---|---|
| | 7. Modernizing C# Code with .NET 10 by Jason Alls, Packt Publishing, 2025.<br>8. Clean Architecture in .NET (2nd Edition) by Jason Taylor, Pearson, 2025. |
| **Teaching Methodology** | Classroom Teaching, Discussion, Independent Study, Seminars and Assignments |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **7** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **703** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Practical - 7** | | | | | |
| **Credit** | **Theory:** | **0** | **Practical:** | **4** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026-2027** | | | | | |
| **Course Outcomes** | **CO1 - Architect and develop scalable Enterprise Java applications using JPA, EJB, and JSF.**<br>Utilize Jakarta Persistence API (JPA) for efficient object-relational mapping and data persistence. Implement business logic using Enterprise JavaBeans (EJB) and design interactive user interfaces with JavaServer Faces (JSF) to build robust enterprise-grade solutions.<br>**CO2 - Secure and expose interoperable RESTful web services using JAX-RS, JWT, and Auth0.**<br>Design and deploy standard JAX-RS APIs to enable cross-platform communication. Integrate modern security protocols by implementing JSON Web Tokens (JWT) and Auth0 for identity management, authentication, and authorization in distributed systems.<br>**CO3 - Construct dynamic, responsive user interfaces for Single Page Applications (SPAs) using the React library.**<br>Apply React concepts (Components, Hooks, State Management) to create fluid client-side applications. Design interactive frontend architectures that consume backend APIs effectively, ensuring a seamless user experience.<br>**CO4 - Develop and deploy full-stack web applications by integrating Node.js, Express.js, and MongoDB.**<br>Build scalable backend services using Node.js and Express.js to handle RESTful API requests.Implement NoSQL database solutions with MongoDB for flexible data storage and demonstrate end-to-end integration of the MERN stack.<br>**CO5 – Automate data processing tasks and control hardware interfaces using Python scripting.**<br>Write efficient Python scripts to solve computational problems and automate data handling workflows. Apply Python libraries to interface with | | | | | | |

<table>
<tr><td></td><td>IoT sensors and actuators, enabling data collection and device control in embedded environments.<br>CO6 – Design and simulate basic robotic systems integrating IoT sensors for real-world automation.<br>Synthesize knowledge of Robotics and IoT protocols to build functional prototypes. Demonstrate the application of control logic to manage hardware interactions and process sensor feedback for autonomous decision-making.</td></tr>
<tr><td>Course Content</td><td>Practical based on Paper No. 701, 702 and Paper No. 704.<br>Weightage:<br>40% based on Paper No 701<br>40% based on Paper No. 702<br>20% based on Paper No 704</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td>
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Reference Books</td><td>NA</td></tr>
<tr><td>Teaching Methodology</td><td>Lab Work and Assignments</td></tr>
<tr><td>Evaluation Method</td><td>Internal Assessment: 50 Marks<br>External Assessment: 50 Marks</td></tr>
</table>

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

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|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **7** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **704** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Artificial Intelligence and Machine Learning** | | | | | |
| **Credit** | **Theory:** | **4** | **Practical:** | **0** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026 - 2027** | | | | | |
| **Course Outcomes** | CO1 : Explain to the students fundamental concepts of Artificial Intelligence and it's applications.<br>CO2 : Students can analyze and perform Exploratory Data Analysis to understand the dataset and characterize the problem.<br>CO3 : Students will be able to demonstrate in-depth knowledge of supervised machine learning algorithms in the field of machine learning.<br>CO4 : Students will be able to demonstrate in-depth knowledge of unsupervised machine learning algorithms in the field of machine learning.<br>CO5 : Train students to utilize supervised and unsupervised machine learning algorithms on available public dataset.<br>CO6 : Train to students to prepare machine learning model for solving real world problems | | | | | |
| **Course Content** | **Unit 1 : Introduction to Artificial Intelligence**<br>1.1. Artificial Intelligence and it's Applications<br>1.2. Introduction to Knowledge Representation<br>1.3. Introduction to Expert System<br>1.4. Introduction to Reasoning<br>1.5. Introduction to Intelligent Agent<br>1.6. Introduction to NLP<br>**Unit 2 : Introduction to Machine Learning**<br>2.1 Overview of ML | | | | | |

2.2 Applications of ML
2.3 ML types
2.4 ML Tools
2.5 ML Steps
2.6 Characterization of Machine Learning Problems

**Unit 3 : Supervised Machine Learning**

3.1 Data set Preparation and Pre-processing
3.2 Classification Algorithms
3.2.1 Decision Tree
3.2.2 k-Nearest Neighbor - k-NN Concept and Intuition, Effect of k
3.2.3 Naïve Bayes and Bayes Classifier
3.2.4 Cross Validation
3.2.5 Accuracy and Confusion Matrix
3.2.6 Precision, Recall, F1-Score
3.3 Regression Algorithms
3.3.1 Simple and Multiple Regressions
3.3.2 Linear Regression
3.3.3 Polynomial Regression
3.3.4 Logistic Regression
3.4.5 AME, MSE, RMSE, R-Square

**Unit 4 : Unsupervised Machine Learning**

4.1 Types of Unsupervised ML
4.2 Introduction to Clustering
4.3 K-means clustering
4.4 Hierarchical clustering
4.5 Principle Component Analysis (PCA)
4.6 Case Study

**Mapping between Cos and PSOs**

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | | | | | |
| CO2 | | | | | |
| CO3 | | | | | |
| CO4 | | | | | |
| CO5 | | | | | |
| CO6 | | | | | |

**Reference Books**


1. Introduction to artificial intelligence, Akerkar. Raiend, PHI Leaning
2. A First Course in Artificial Intelligence, Deepak Khemani. MCGrawHilL Publication
3. Machine Learning by Tom M. Mitchell, MCGraw Hill
4. Machine Leaming using Python by DineshKumar Manaranjan Pradhan, Wiley India Publication
5. Real-World Machine Leaning by Henrik Brink, Joseph Richards, Mark Fetherolf, Manning Publications.
6. Introduction to Machine Leaning with Python: A Guide for Data Scientists by Andreas C. Muller, Sarah Guido, O'Reilly Publication


P. M. Dera

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|---|---|
| **Teaching Methodology** | Classroom Teaching, Discussion, Independent Study, Seminars and Assignments |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

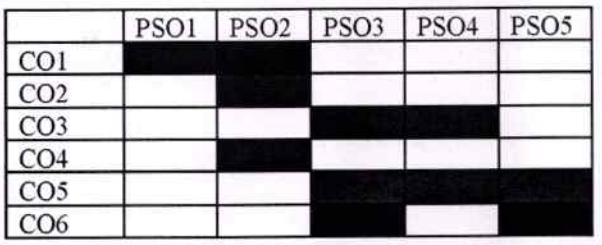
## SYLLABUS

| | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **7** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **705** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **On Job Training** | | | | | |
| **Credit** | **Theory:** | **0** | **Practical:** | **6** | **Total:** | **6** |
| **Effective Form** | **Academic Year: 2026-2027** | | | | | |
| **Course Outcomes** | **CO1 -** Apply core Information Technology concepts to develop, test, or support software and infrastructure solutions.<br>**CO2 -** Adhere to professional ethics, data privacy laws, and cybersecurity protocols within the workplace.<br>**CO3 -** Utilize modern development tools, frameworks, and version control systems to optimize workflows.<br>**CO4 -** Collaborate effectively within Agile or DevOps teams and communicate technical details clearly.<br>**CO5 –** Analyze the Software Development Life Cycle (SDLC) or IT Service Management (ITSM) processes in a live environment.<br>**CO6 –** Engage in continuous independent learning to adapt to emerging technologies and industry trends. | | | | | |
| **Course Content** | As per University norms. | | | | | |
| **Mapping between Cos and PSOs** | | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
| | CO1 | | | | | |
| | CO2 | | | | | |
| | CO3 | | | | | |
| | CO4 | | | | | |
| | CO5 | | | | | |
| | CO6 | | | | | |
| **Reference Books** | NA | | | | | |
| **Teaching Methodology** | NA | | | | | |
| **Evaluation Method** | Internal Assessment: 75 Marks<br>External Assessment: 75 Marks | | | | | |

*[Subject code-2711001108011001]*

| VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT<br>SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **8** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **801** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Enterprise Java** | | | | | |
| **Credit** | **Theory:** | **04** | **Practical:** | **-** | **Total:** | **04** |
| **Effective Form** | **Academic Year: 2026-2027** | | | | | |
| **Course Outcomes** | **CO1 -** Analyze the Enterprise Java (Jakarta EE) architecture and its evolution, including application servers, containers, and deployment models, to design scalable and maintainable enterprise applications.<br><br>**CO2 -** Design and develop enterprise-grade web and service-layer components using Servlets, JSP, JSF, and RESTful web services following industry best practices.<br><br>**CO3 -** Evaluate and implement enterprise persistence solutions using JPA, ORM frameworks, and advanced transaction management strategies to ensure data integrity and performance.<br><br>**CO4 -** Develop secure, distributed enterprise applications by applying Java EE security, authentication, authorization, and messaging technologies such as JMS and MicroProfile Security.<br><br>**CO5 –** Integrate and optimize enterprise services and microservices using CDI, EJB alternatives, MicroProfile APIs, and container-based deployment to achieve interoperability and scalability.<br><br>**CO6 –** Critically assess enterprise application performance, security, and maintainability, and propose architectural improvements or refactoring strategies aligned with real-world business requirements. | | | | | |
| **Course Content** | **Unit - 1 : Java Web Fundamentals**<br>1.1 Java EE Architecture<br>1.2 Introduction to Java Servlets | | | | | |

| | |
|---|---|
| | 1.3 The Java Servlet API<br>1.4 Servlet Life Cycle<br>1.4 Request and Response<br>1.5 Working with Databases<br>1.6 Dispatching and forwarding the request<br>1.7 Working with HTTP Headers<br>1.8 Session Tracking<br>1.9 ServletConfig and ServletContext<br>1.10 Servlet Filters<br>1.11 Servlet Web Listeners<br>1.12 Introduction to Java Server Pages(JSP)<br>1.13 Lifecycle of JSP<br>1.14 JSP Scripting Elements<br>1.15 Implicit Objects<br>1.16 JSP Directive Elements<br>1.17 Action Elements<br>1.18 JSTL/EL<br>**Unit 2: - Enterprise Java Beans**<br>2.1 Introduction to EJB<br>2.2 Stateless Session Bean<br>2.3 Statefull Session Bean<br>2.4 Java Messaging Service Architecture<br>2.5 Message Driven Beans<br>2.6 Singleton Beans<br>2.7 Timers and Schedulers,<br>2.8 Asynchronous Beans<br>2.9 JPA architecture<br>2.10 ORM with Entities<br>2.11 Working with Relationships<br>2.12 Named Queries<br>2.13 Dynamic Queries AND Native Queries<br>**Unit -3 JAVA REST API and SECURITY**<br>3.1 REST services with JAX-RS<br>3.2 Using HTTP Methods in REST<br>3.3 JERSEY Client for REST Services<br>3.4 The Need of Security ,<br>3.5 Security Threats,Realm,<br>3.6 Users, Group and Roles,<br>3.7 Java EE Security Model<br>3.8 Credentials and Identity Stores<br>3.9 Authentication and Authorization Mechanisms<br>3.10 Data Integrity and Confidentiality<br>3.11 Securing Enterprise Applications<br>3.12 JWT based Authorization<br>3.13 OAuth and OpenIdConnect<br>**Unit 4 : Java Server Faces** |

| | |
|---|---|
| | 4.1 Introduction to JSF<br>4.2 Request Processing Lifecycle<br>4.3 JSF Managed Beans<br>4.4 JSF UI Components<br>4.5 JSF Validators and Converters<br>4.6 Event Handling<br>4.7 Composite Components<br>4.8 Templating in JSF<br>4.9 Working with primefaces |
| **Mapping between Cos and PSOs** |  |
| **Reference Books** | 1. JDBC 4.2, Servlet 3.1, and JSP 2.3 Includes JSF 2.2 and Design Patterns, Black Book, 2ed - Santosh Kumar, Dreamtech Press<br>2. Servlet & JSP: A Beginner's Tutorial - Budi Kurniawan, Brainy Software<br>3. The Definitive Guide to JSF in Java EE 8: Building Web Applications with JavaServer Faces - Bauke Scholtz, Arjan Tijms – Apres<br>4. Mastering Enterprise JavaBeans and the Java 2 Platform, Enterprise Edition, *by Ed Roman*<br>5. Beginning Java™ EE 7 Platform with Payara™ 5: From Novice to Professional by Antonio Goncalves<br>6. Mastering JavaServer Faces 2.2 - Anghel Leonard - Packt Publishing<br>7. Spring in Action 4ed - Craig Walls – Manning<br>8. Getting Started With Spring Framework: A Hands-on Guide to Begin Developing Applications Using Spring Framework - Ashish Sarin, J Sharma - Createspace Independent Pub |
| **Teaching Methodology** | Class Room Teaching, Discussion and Assignment, Hands-on Sessions |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | ■ | ■ | | | |
| CO2 | | ■ | | | |
| CO3 | | | ■ | ■ | |
| CO4 | | ■ | | | |
| CO5 | | | ■ | ■ | ■ |
| CO6 | | | ■ | | ■ |

*[Subject code-2711001108022001]*

| VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT<br>SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **8** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **802** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Deep Learning** | | | | | |
| **Credit** | **Theory:** | **4** | **Practical:** | **-** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026-27** | | | | | |
| **Course Outcomes** | CO1 : Students will be able to understand the concepts of Artificial Intelligence and it's applications.<br>CO2 : Students will be able to demonstrate in-depth knowledge of supervised machine learning algorithms in the field of machine learning.<br>CO3 : Train the students to the working of Artificial Neural Network to the real world problems.<br>CO4 : Students will be able to learn and implement libraries used for CNN and RNN model development.<br>CO5 : Train Students to work with pre-trained deep learning models.<br>CO6 : Students will be able to the architecture of Transformer and Large Language models. | | | | | |
| **Course Content** | **Unit : 1 : Foundations of Deep Learning**<br>1.1 Overview of Supervised Learning<br>1.2 Fundamentals of Neural Network and Deep Learning<br>1.3 Vector, Matrix and Calculus<br>1.4 Biological neuron, Mc-Culloch Pitts Neuron, Perceptron, Perceptron Learning<br>1.5 Multilayer Perceptron: Linearly separable, linearly non-separable classes<br>1.6 Machine Learning vs. Deep Learning | | | | | |

P. Y. Desai

1.7 Applications of Deep Learning

1.8 Deep Learning libraries Keras, Tensorflow, Scipy, etc

**Unit : 2 : Working with Deep Neural Network**

2.1 Multi Layered Feed Forward Neural Network,

2.2 Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, etc…

2.3 Loss functions: Squared Error loss, Cross Entropy

2.4 Learning with back propagation

2.5 Optimization with Gradient Descent

2.6 Overview of Over fitting

2.7 Types of biases

2.8 Bias Variance Tradeoff

**Unit : 3 : Working With Convolution Neural Network(CNN)**

3.1 Convolution operation, Padding, Stride, Relation between input, output and filter size,

3.2 CNN architecture: Convolution layer, Pooling Layer, Flatten

3.3 Fully Connected NN vs CNN,

3.4 Variants of basic Convolution function

3.5 Applications of CNN

3.6 Introduction to Modern Deep Learning Architectures: LeNET, AlexNET, etc…

**Unit : 4 : Sequence Modeling and Advanced Deep Learning**

4.1 Introduction to Sequence Modeling

4.2 Recurrent Neural Network (RNN)

4.3 Vanishing and Exploding Gradients

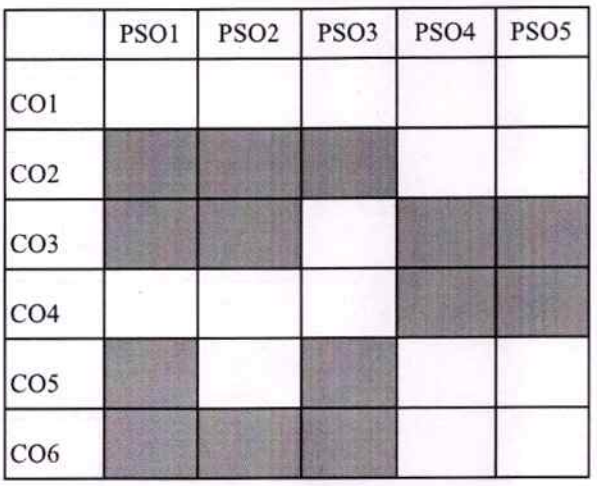
4.4 Long Short Term Memory (LSTM)

4.5 Applications of LSTM

4.6 Introduction to LLM: Transformers, BERT, etc…

4.7 Generative Adversarial Networks – Generator, Discriminator, Training, GAN variants

4.8 Auto Encoders -- Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoderss

| | |
|---|---|
| **Mapping between COs and PSOs** |  |
| **Reference Books** | 1. Neural Networks and Deep Learning: A Textbook By Charu C. Aggarwal, Springer publication<br>2. Deep Learning from the Basics By Koki Saitoh, Packt publication<br>3. Beginning Deep Learning with Tensorflow By Liangqu Long and Xiangaming Zeng, Apress publication<br>4. Fundamentals of Deep Learning By Nithin Buduma, Nikhil Buduma, and Joe Papa, O'Reilly publication<br>5. Deep Learning By Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press Publication<br>6. Deep Learning from Scratch By Seth Weidman, O'Reilly publication<br>7. Deep Learning: A Practitioner's Approach By Josh Patterson and Adam Gibson, O'Reilly publication |
| **Teaching Methodology** | Class Room Teaching, Discussion and Assignment, Hands on sessions |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |



P. Y. Desai

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

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|---|---|---|---|---|---|---|
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| **Semester** | **8** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **803** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **Practical - 8** | | | | | |
| **Credit** | **Theory:** | **0** | **Practical:** | **4** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026-2027** | | | | | |
| **Course Outcomes** | **CO1 - Implement robust data access layers and business logic using C# Generics, LINQ, and Entity Framework.** Utilize Generics and LINQ to write type-safe, efficient, and reusable code for complex data manipulation. Apply Entity Framework (EF) to manage database operations and perform Object-Relational Mapping (ORM) in enterprise applications.. **CO2 - Develop interactive full-stack web applications and lightweight services using ASP.NET Core MVC, Minimal APIs, and Blazor.** Construct scalable RESTful endpoints using Web API and Minimal API frameworks to support high-performance client requests. Design rich, interactive user interfaces using ASP.NET Core MVC and Blazor components for a seamless user experience. **CO3 - Architect scalable distributed systems by decomposing monolithic applications into loosely coupled Micro-services.** Analyze business domains to identify service boundaries and design independent Micro-services that adhere to the single responsibility principle. Evaluate different architectural patterns to ensure system scalability, fault tolerance, and maintainability. **CO4 - Construct and orchestrate communication between Micro-services using synchronous and asynchronous protocols.** Implement inter-service communication mechanisms (REST, gRPC, or Message Brokers) to enable seamless data exchange. Integrate API Gateways and service discovery mechanisms to manage traffic and secure micro-service endpoints effectively. **CO5 – Build and evaluate predictive models using standard Machine Learning algorithms to solve data-driven problems.** Preprocess datasets and apply supervised/unsupervised Machine Learning techniques (regression, classification, clustering) to extract actionable | | | | | | |

<table>
<tr><td></td><td>insights. Validate model performance using standard metrics to ensure accuracy and reliability in real-world scenarios.<br>CO6 – Design and optimize Deep Learning neural networks for complex pattern recognition and cognitive computing tasks.<br>Construct multi-layered Neural Networks (CNNs, RNNs) to solve complex problems such as image recognition or natural language processing. Tune hyperparameters and utilize optimization algorithms to enhance the efficiency and accuracy of Deep Learning models.</td></tr>
<tr><td>Course Content</td><td>Practical based on Paper No. 801, 802 and Paper No. 804.<br>Weightage:<br>36% based on Paper No 801<br>34% based on Paper No. 802<br>30% based on Paper No 804</td></tr>
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<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO6</td><td></td><td></td><td></td><td></td><td></td></tr>
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</td></tr>
<tr><td>Reference Books</td><td>NA</td></tr>
<tr><td>Teaching Methodology</td><td>Lab Work and Assignments</td></tr>
<tr><td>Evaluation Method</td><td>Internal Assessment: 50 Marks<br>External Assessment: 50 Marks</td></tr>
</table>

*[Subject code-2711001108044001]*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

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|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | 8 | | | | | |
| **NCrF Credit Level** | 6.5 | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | 804 | | | | | |
| **Course Level** | 7 | | | | | |
| **Course Title** | **Blockchain Computing** | | | | | |
| **Credit** | **Theory:** | **4** | **Practical:** | **0** | **Total:** | **4** |
| **Effective Form** | **Academic Year: 2026 - 2027** | | | | | |
| **Course Outcomes** | **CO1: Analyze Cryptographic Foundations**<br>Evaluate various cryptographic primitives, including symmetric/asymmetric encryption, hashing algorithms, and digital signatures, to ensure data integrity and security within a decentralized environment.<br>**CO2: Contrast Web Architectures and Decentralized Ledgers**<br>Distinguish between Web 2.0 and Web 3.0 paradigms and explain the architectural shift from centralized systems to Decentralized Applications (DApps) and Distributed Ledgers.<br>**CO3: Evaluate Consensus and Governance Mechanisms**<br>Compare and contrast various consensus protocols (PoW, PoS, DPoS, PBFT) and forking strategies to determine the most suitable mechanism for different blockchain use cases.<br>**CO4: Design and Implement Smart Contracts**<br>Develop, test, and deploy functional Smart Contracts using Solidity on the Ethereum platform, utilizing local tools like Ganache to validate contract logic and gas efficiency.<br>**CO5: Assess Enterprise Blockchain Frameworks**<br>Appraise the reference architecture of permissioned blockchains, specifically the Hyperledger Umbrella projects (Fabric, Besu, etc.), to solve complex enterprise-level business problems.<br>**CO6: Synthesize NFT Ecosystems and Ethical Impacts**<br>Formulate strategies for creating and managing Non-Fungible Tokens (NFTs) while critically analyzing their economic rights, market trends, and environmental implications. | | | | | |
| **Course Content** | **Unit – 1 Cryptography**<br>1.1 Introduction to cryptography<br>1.2 Types of cryptography<br>1.2.1 Symmetric cryptography | | | | | |

1.2.2 Asymmetric cryptography
1.2.3 Hash Algorithms
1.2.4 Digital Signature

**Unit – 2 Introduction to Blockchain**

2.1 Web 2.0 v/s Web 3.0
2.2 Decentralize Applications (DApps)
2.3 Decentralized Distributed Ledger
2.4 History and Growth of Blockchain Technology
2.5 Common Misconceptions
2.6 Introduction to NFT
2.6.1 DeFi v/s NFT
2.6.2 Types of NFT and Popular NFTs
2.6.3 NFT Usage and Rights
2.7 Impact of blockchain on environment

**Unit – 3 Building Blockchain**

3.1 Generic elements of Blockchain
3.2 Merkle Tree
3.3 Types of Blockchain
3.3.1 Permissionless Blockchain
3.3.2 Permissioned Blockchain
3.4 Consensus Mechanism
3.4.1 PoW
3.4.2 PoS
3.4.3 DPoS
3.4.4 PBFT
3.5 Forking in Blockchain
3.6 Introduction to Zero-Knowledge Proofs (zk-SNARK, zk-STARK)

**Unit – 4 Smart Contract based Blockchains**

4.1 Ethereum (Permissionless Blockchain)
4.1.1 Ethereum Structure
4.1.2 Ether, Gas, Fees and Incentive Stucture
4.1.3 Ethereum Wallets
4.1.4 Proof of Stack in Ethereum
4.1.5 Decentralized Autonomous Organization (DAO) and DAO Attack
4.1.6 Creating Smart contract in Ethereum using Solidity
4.1.7 Local deployment and validation of smart contracts using Ganache
4.2 Hyperledger: The Umbrella Project (Permissioned Blockchain Frameworks)
4.2.1 Introduction to Hyperledger umbrella project (Besu, Indy, Fabric, Sawtooth, Cactus, Iroha)
4.2.2 Reference architecture of Hyperledger Fabric

| | |
|---|---|
| **Mapping between Cos and PSOs** | |

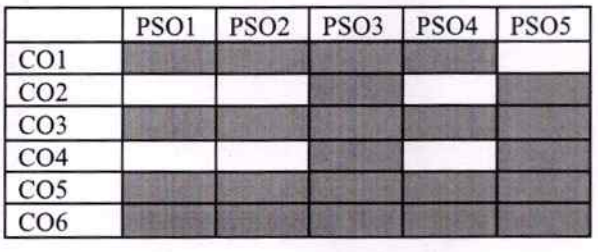
| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | | | | | |
| CO2 | | | | | |
| CO3 | | | | | |
| CO4 | | | | | |
| CO5 | | | | | |
| CO6 | | | | | |

| | |
|---|---|
| **Reference Books** | 1. Cryptography and Network Security – Principles and Practice – William Stallings- Seventh Edition- Pearson Publication<br>2. Cryptography and Network Security- Behrouz A. Forouzan – McGrawHill Publication<br>3. Modern Cryptography, Theory & Practice -Wenbo Mao-Pearson Education<br>4. Information Security: Theory and Practice – Dhiren R. Patel – PHI<br>5. Cryptography and Network Security – Atul Kahate - 4th Edition - McGrawHill Publication<br>6. Mastering Blockchain, fourth edition, Imran Bashir, Packt Publisher<br>7. Blockchain with Hyperledger Fabric, Second Edition, Nitin Gaur, Anthony O'Dowd, Petr Novotny, Luc Desrosiers, Venkataraman Ramakrishna, Salman A. Baset, Packt Publisher<br>8. Solidity Programming Essentials, second edition, Ritesh Modi, Packt Publisher<br>9. Mastering Ethereum: Implement advanced blockchain applications using Ethereum-supported tools, services, and protocols, Merunas Grincalaitis, Packt Publisher<br>10. The Essential Guide to Web3: Develop, deploy, and manage distributed applications on the Ethereum network, Vijay Krishnan, Packt Publisher<br>11. The NFT Handbook: How to Create, Sell and Buy Non-Fungible Tokens, QuHarrison Terry, Matt Fortnow, Wiley |
| **Teaching Methodology** | Classroom Teaching, Discussion, Independent Study, Seminars and Assignments |
| **Evaluation Method** | Internal Assessment: 50 Marks<br>External Assessment: 50 Marks |

*[Subject code-2711001108055002]*

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**

**SYLLABUS**

| | | | | | | |
|---|---|---|---|---|---|---|
| **Program Name** | **Bachelor of Science (Honours) Information Technology** | | | | | |
| **Semester** | **8** | | | | | |
| **NCrF Credit Level** | **6.5** | | | | | |
| **Course Type** | **Major** | | | | | |
| **Course Subtype** | **Employability** | | | | | |
| **Subject Type** | **Discipline Specific** | | | | | |
| **Course Code** | **805** | | | | | |
| **Course Level** | **7** | | | | | |
| **Course Title** | **On Job Training** | | | | | |
| **Credit** | **Theory:** | **0** | **Practical:** | **6** | **Total:** | **6** |
| **Effective Form** | **Academic Year: 2026-2027** | | | | | |
| **Course Outcomes** | **CO1 -** Apply core Information Technology concepts to develop, test, or support software and infrastructure solutions.<br>**CO2 -** Adhere to professional ethics, data privacy laws, and cybersecurity protocols within the workplace.<br>**CO3 -** Utilize modern development tools, frameworks, and version control systems to optimize workflows.<br>**CO4 -** Collaborate effectively within Agile or DevOps teams and communicate technical details clearly.<br>**CO5 –** Analyze the Software Development Life Cycle (SDLC) or IT Service Management (ITSM) processes in a live environment.<br>**CO6 –** Engage in continuous independent learning to adapt to emerging technologies and industry trends. | | | | | |
| **Course Content** | As per University norms. | | | | | |
| **Mapping between Cos and PSOs** |  | | | | | |
| **Reference Books** | NA | | | | | |
| **Teaching Methodology** | NA | | | | | |
| **Evaluation Method** | Internal Assessment: 75 Marks<br>External Assessment: 75 Marks | | | | | |

| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|
| CO1 | ■ | ■ | ■ | ■ | |
| CO2 | | | ■ | | ■ |
| CO3 | ■ | ■ | ■ | ■ | ■ |
| CO4 | | | ■ | | ■ |
| CO5 | ■ | ■ | ■ | ■ | ■ |
| CO6 | ■ | ■ | ■ | ■ | ■ |