GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Industry Led Minor/Hons.
Level: UG
Branch: Full Stack Java Specialization
Course / Subject Code : BE05IAP011
Course / Subject Name : Cloud Native Application Development

w. e. f. Academic Year:	2026-27
Semester:	5
Category of the Course:	Core Course

Prerequisite: Basic programming knowledge recommended; familiarity with mathematics or logic will be helpful but not mandatory.

Rationale:	This program provides learners with a comprehensive understanding of programming, cloud computing, containerization, and machine learning, enabling them to develop industry-ready competencies. Beginning with Python fundamentals and progressing to serverless cloud application development, container orchestration with Docker and Kubernetes, and advanced topics in machine learning, the curriculum ensures a balanced blend of theory and practical application. By integrating these subjects, the program equips learners with the skills required to address contemporary challenges in software engineering, cloud-native development, and data-driven innovation.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Gain a solid foundation in Python programming, including the ability to write clean and efficient code, manipulate data, and apply Python to solve real-world problems. They will also explore open-source contributions through social good projects and learn how to deploy AI models, such as image classifiers, in a serverless environment.	**A**
02	Develop a strong understanding of cloud computing concepts and architectures, with hands-on experience in building and deploying serverless applications. They will be able to design lightweight, event-driven applications, connect cloud-hosted databases, and deploy scalable solutions using IBM Cloud and similar platforms.	**N**
03	This course will enable learners to understand containerization technologies and modern application deployment practices. Students will gain practical skills in creating and managing Docker containers, orchestrating workloads with Kubernetes, and deploying microservices-based applications on Kubernetes and OpenShift, preparing them for cloud-native development.	**C**
04	Will acquire a comprehensive understanding of machine learning principles, tools, and frameworks using R, Python, and Apache SystemML. They will be able to implement supervised and unsupervised learning models, apply dimensionality reduction techniques, and evaluate model performance across platforms, equipping them with practical data science and ML deployment skills.	**C**

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours/week)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
5	0	0	5	100	0	0	0	100

*Total Lecture Hrs. (L) =75	Total Practical Hrs. (PR) =00.	Total Hours =75 Hrs

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Applied Python Programming** This course introduces the core concepts of Python programming, covering syntax, data structures, functions, and file handling. Learners will apply Python to solve practical problems, work with data, and understand the role of open-source development in real-world applications. The course further explores applied AI by guiding learners to build and deploy a simple image classification model as a serverless application, giving them practical exposure to both programming and deployment.	30	40
2.	**Cloud Computing & Serverless Application Development** This course provides a foundation in cloud computing concepts, including service models, deployment models, and core cloud architectures. Learners will gain hands-on experience in building and deploying serverless applications using IBM Cloud Functions and similar platforms. The course also covers database integration through IBM Cloudant, enabling learners to design and deploy a full-stack cloud application that combines serverless functions with a cloud-hosted database.	15	20
3.	**Cloud-Native Development: Containers & Microservices** This course focuses on containerization and cloud-native deployment practices using Docker, Kubernetes, and OpenShift. Learners will acquire practical skills in creating and managing containers, orchestrating workloads in Kubernetes clusters, and deploying applications on enterprise-grade platforms. Special emphasis is placed on microservices architecture, where students will design, containerize, and deploy modular applications, preparing them for real-world cloud-native development environments.	15	20

4.	**Machine Learning: Algorithms, Tools & Dimensionality Reduction** This course introduces learners to machine learning concepts and practical implementations using R, Python, and Apache SystemML. It covers supervised and unsupervised learning algorithms, regression, classification, and clustering techniques. Learners will also explore dimensionality reduction methods such as Principal Component Analysis (PCA) to optimize model performance and visualization. Through hands-on projects, students will gain experience applying algorithms across multiple frameworks, comparing results, and solving real-world data-driven problems.	**15**	**20**
	Total	**75**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
5	**15**	**25**	**20**	**10**	**25**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. An Integrated Approach to Software Engineering – Pankaj Jalote
2. Introduction to Machine Learning – Ethem Alpaydin
3. Full Stack Development with Spring Boot and React – Juha Hinkula
4. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow – Aurélien Géron

(b) Open-source software and website:

1. **Python.org** – https://www.python.org/
2. **Docker** – https://www.docker.com/
3. **Kubernetes** – https://kubernetes.io/
4. **React.js Official** – https://react.dev/
5. **Node.js** – https://nodejs.org/
6. **Flask** – https://flask.palletsprojects.com/

Suggested Course Practical List: List of Laboratory/Learning Resources Required: IDE (IntelliJ/Eclipse/VS Code), JDK, Tomcat/Jetty, MySQL/PostgreSQL, Spring Boot, Hibernate, Maven/Gradle, GitHub, Postman, Browser DevTools, Docker.

List of Laboratory/Learning Resources Required: IntelliJ/Eclipse/VS Code, JDK 17/21, Tomcat/Jetty, MySQL/PostgreSQL (Workbench/pgAdmin), Spring Boot, Hibernate, Maven/Gradle, GitHub/GitLab, Postman/Swagger, Browser DevTools, Docker.

Suggested Project List: E-commerce site, Student/Job Portal, Blogging CMS, Online Banking, Food Delivery App, Social Media Platform, Hospital Management System.

Suggested Activities for Students: Coding challenges, hackathons, code reviews, open-source contributions, project demos, debugging practice, resume/GitHub building, cloud deployment.

Skill & Practical Activities to be carried out during Semester						
Important Note:- Please keep only applicable categories relevant to your offerings in this table and delete not applicable categories						
Sr. No.	**Category of Engagement**	**Describe the activities to be carried out by students in brief**	**Expected Frequency & Duration**	**Mode of Delivery (Online / Offline / Hybrid)**	**Tools / Platforms / Equipment / Machinery to be Used**	**Expected major Learning Outcomes in 2 or 3 bullet points**
1	Master Classes / Expert Lectures by Industry Professionals	Expert sessions on Microservices Architecture, Cloud Deployment (AWS/Azure), CI/CD Pipelines, and Enterprise-Level Full	2–3 sessions (2 hours	Online	MS Teams / Zoom, AWS Console, Docker, Kubernetes demo	• Understand cloud-native deployment practices. • Gain insights into scaling full-stack enterprise systems. • Learn real-world microservices implementation.

		Stack Systems.				
2	Quizzes / Competency-Based Evaluation	Quizzes covering Advanced Java, Spring Boot Microservices, ReactJS Hooks, JWT Authentication, REST APIs, and Database Optimization.	Every 2 weeks	Online	IBM LMS	• Strengthen conceptual knowledge of advanced full-stack topics. • Improve analytical and secure coding skills. • Track learning progression through frequent assessments.

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