

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	MTech CSE (Cyber Security)
Course Code:	3CSDE352
Course Title:	Microservices Architecture and Programming
Course Type:	(<input type="checkbox"/> Core/ <input type="checkbox"/> Value Added Course / <input checked="" type="checkbox"/> Department Elective / <input type="checkbox"/> Institute Elective/ <input type="checkbox"/> University Elective/ <input type="checkbox"/> Open Elective / <input type="checkbox"/> Any other)
Year of Introduction:	2022-23

L	T	Practical Component				C
		LPW	PW	W	S	
3	-	2	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. infer the key advantages and complexities present in microservice architectures (BL2)
2. apply appropriate architectural approach for the design of microservices (BL3)
3. choose suitable techniques and technologies to develop the microservice applications effectively (BL5)
4. test the deployment of microservice applications on cloud platforms (BL6)

Syllabus:

Total Teaching hours: 45

Unit	Syllabus	Teaching hours
Unit-I	Introduction to Microservices: Monolithic architecture, Web Services and Service Oriented Architecture, SOA and Microservice architecture	03
Unit-II	Microservice Architecture Concepts: Microservice software architecture: patterns and techniques, Overall topology and core architecture components, Architectural characteristics, Service components and granularity, Bounded context, Data domains, API Ecosystem for Microservice, API layer design and implementation alternatives, API Gateway, Service discovery and registration, best practices of microservice architecture.	08
Unit-III	Messaging Middleware: IPC in microservice architecture, Synchronous and asynchronous messaging patterns, REST and gRPC based messaging, Service bus for commands and events, Message queuing systems, Message broker, JMS, Rabbit MQ and Kafka, Message driven micro service application	10
Unit-IV	Managing Databases for Microservices: Distributed databases, NoSQL based systems, CAP and BASE consistency models for microservices, CRUD operations, Shared databases and Database per microservice pattern, Scaling and replicating databases	06

224



Unit-V **Transactions and Data Streaming in Microservices:** Managing transactions with Sagas: choreographed, orchestrated, Event sourcing and CQRS Pattern, CDC with Transactional outbox pattern, Transaction log tailing, Streaming data in microservices, Streaming SQL, Data streaming approaches with Apache Spark and Kafka 08

Unit-VI **Hybrid Architectures and Deployment:** Event-driven architecture for microservices, Architectural modularity, Serverless microservices architecture pattern, Caching, Load balancing, Circuit Breaker, Deployment patterns and strategies with containers, Virtual machines and clusters, Container Orchestration Approaches, Microservices deployment on Public Cloud platforms, Microservices Testing, Health check and observability, Securing Microservices 10

Self-Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents

- Suggested Readings/References:
1. Chris Richardson, Microservices Patterns With examples in Java, Manning publication
 2. Binildas C, Practical Microservices Architectural Patterns, Apress
 3. Sam Newman, Building Microservices: Designing fine grained systems, O'Reilly Media
 4. Sam Newman, Monolith to Microservices, O'Reilly
 5. Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, Mike Amundsen, Microservice Architecture: Aligning Principles, Practices, and Culture, Shroff/O'Reilly
 6. Susan J. Fowler, Microservices in Production, O'Reilly Media
 7. Morgan Bruce, Paulo A. Pereira, Microservices in Action, Manning publication
 8. Vaughn Vernon, Implementing Domain-Driven Design, Addison-Wesley
 9. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, Head First Design Patterns: A Brain-Friendly Guide, Shroff/O'Reilly
 10. Jez Humble and David Farley, Continuous Delivery, Addison-Wesley Professional
 11. Bill Wagner, Mike Rousos, .NET Microservices: Architecture for containerized .Net applications, Microsoft Corporation

Suggested List of Experiments:

Sr. No.	Title	Hours
1	Experimenting with Docker Containers and Git - understanding its fundamentals with basic operations on it	04
2	Hands-on with cloud native language concepts	04
3	Designing gRPC based micro-service with Ballerina	04
4	Message queuing system based Micro-service application	06
5	Designing Distributed transaction based Micro-service application	04

- 6 Developing application having 4 Micro-services with internal communication mechanism and integration of API Gateway 04
- 7 Scalable and Resilient Micro-service design with security provisions for the service 04

nd