

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B.Tech. Computer Science and Engineering
Course Code:	2CSDE77
Course Title:	Microservice Architecture and Programming
Course Type:	Departmental Elective
Year of Introduction:	2021-22

Credit Scheme

L	T	Practical Component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLO):

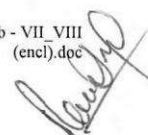
At the end of the course, students will be able to –

1. recognize the key advantages and complexities present in microservice architectures
2. apply appropriate architectural approach for the design of microservices
3. implement microservice applications effectively with the suitable techniques and technologies
4. test the deployment of microservice applications on cloud platforms

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
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, Healthcheck 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:	<ol style="list-style-type: none"> 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 Containers and understanding its fundamentals with basic operations on it	04
	2	Cloud Native Application Development Language: Hands-on Sessions for basic concepts learning	06
	3	Designing gRPC based Micro-service application	04
	4	Message queuing system based Micro-service application development	04
	5	Designing Distributed transaction (Saga) based Micro-service application	04
	6	Integrating various Micro-services with application of API Gateway	04
	7	Scalable and Resilient Micro-service application design with security provisions for the services	04

Suggested Case List: -NA-