BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES

COURSE HANDOUT

Part A: Content Design

Course Title	Middleware Technologies
Course No(s)	CSI ZG524/SE ZG589/SS ZG589
Credit Units	4
Course Author	Mr Ravi Kiran Mallidi, Prof. Shan Balasubramaniam
Version No	1.0
Date	

Course Description

Evolution of Middleware Technologies: Transaction Processing, Remote Procedure Calls, Message-Oriented-Middleware, Object Request Brokers, Web services and REST; Forms of Middleware: Enterprise Middleware, Web Middleware, and Cloud / Services Middleware; Middleware Elements: communication protocols, middleware protocols, data representation, server process control, naming and directory services, security, system management; Select case studies such as MS .NET, J2EE. Service Oriented Architecture: Loosely Coupled Systems, Business processes, Tiers, Architectural Choices; Resiliency in Middleware: resiliency techniques, hardware failures, communication failures, software failures; Performance and scalability in Middleware; Security in Middleware; Implementation Aspects: business process implementation, enterprise integration, web and database middleware (e.g. NoSQL middleware) change management. Case studies of Enterprise application architecture (EAI) - Eg. Tibco, Websphere

Course Objectives

No	Objectives
CO1	Describe the architecture and applications of CORBA and its elements such as IDLs, naming service, and demonstrate how to deploy an application on Application server such as JBoss
CO2	Demonstrate understanding of EAI concepts and deploy applications in Application Server such as Apache Camel / Fuse ESB
CO3	Demonstrate ability to apply 64 design patterns, Message Oriented Middleware and clustering of the application server (Apache Camel / Fuse ESB)
CO4	Compare different architectures in web based applications such as SOAP and REST, protocols in Middleware, and demonstrate ability to deploy applications on a Cloud platform (such as AWS)
CO5	Describe the fundamentals of NoSQL Database, its usage along with middleware and performance tuning of the application and server

Text Book(s)

No	Author(s), Title, Edition, Publishing House
T1	INTRODUCTIONTOMIDDLEWARE (Web Services, Object Components,and Cloud

	Computing) by Letha Hughes Etzkorn
T2	Java RMI (Designing & Building Distributed Applications) by William Grosso

Reference Book(s) & other resources

No	Author(s), Title, Edition, Publishing House
R1	Enterprise Integration Patterns by Bobby Woolf
R2	MongoDB in Action

Content Structure

No	Title of the Module	References
M1	Introduction and Evolution • Transaction Processing • Remote Procedure Calls (Marshalling, Stubs) • Messaging Middleware (Request Brokers) • CORBA as a standard • Remote Methods (Java RMI)	T1, T2 (4Hrs.)
M2	Enterprise Middleware • EAI,Enterprise Bus (e.g. TIBCO)and Publish-Subscribe Models • Real-time requirements • Security aspects • Business Processes and Middleware Implementations	T1, R1 (2Hrs.).
M3	Middleware Design and Patterns • Objects and Services vs. Messages and Requests • Lookup and Discovery – Registry and Broker Patterns • Message Formats and Protocols • Service Mediation • Failure and Resiliency – Availability, Recovery • Performance and Security	T1, R1 (10Hrs.)
M4	Middleware for Web-based Application and Cloud-based Applications • Tiered Architectures and • Loosely Coupled Systems - Services (WS, REST, SOA), Services Middleware • Deployment of applications on the cloud – middleware configurations • Cloud Middleware and usage (Load Balancers, Provisioning middleware, Hybrid Cloud Infrastructure, Multi-cloud Infrastructure).	T1 (10Hrs.)
M5	Specialized Middleware • Peer-to-Peer systems and Middleware (Overlays, SuperPeers) • Performance Middleware (Caching, Content Distribution) • Middleware for NoSQL databases	T1 (4Hrs.)

Learning Outcomes:

No	Learning Outcomes
LO1	Demonstrate understanding on CORBA and EJB's, and ability to deploy applications in Java servers
L02	Describe relevant integration concepts for middleware, integration patterns and usage, and demonstrate ability to deploy applications in middleware servers
LO4	Describe the various architecture styles and usages, deploy applications and enable integration between different systems by the application of the right protocol / communication between them
LO5	Describe the usage of NoSQL database in middleware, performance tuning and sizing of the application server based on Load (Java)

Part B: Contact Session Plan

Academic Term	Second Semester 2020-2021
Course Title	Middleware Technologies
Course No	CSI ZG524/SE ZG589/SS ZG589
Lead Instructor	RAVI KIRAN MALLIDI

Course Contents

Contact Session 1
M1: Introduction and Evolution

Time	Type		Description	Text/Ref Book/external resource
Pre CS	RL1.1	Introduction to Transactions		T1 – Chapter 1,8
	RL1.1	Sockets overview		
	RL1.1	Early middleware technologies		
During CS	CS 1	Cover the topics in detail		

Contact Session 2
M1: Introduction and Evolution

Time	Type		Description	Text/Ref Book/external resource
Pre CS	RL1.2	Cobra basics		T1 – Chapter 1,8
	RL1.2	IDL		
	RL1.2	IDL Addressing Naming		
During CS	CS 2	All the remaining topics of module 1		

Contact Session 3
M2: Enterprise Middleware

Time	Type		Description	Text/Ref Book/external resource
Pre CS	RL 2.1	Introduction to EAI-Message Channels		R1- Chapter 4 T1- Chapter 5
	RL 2.1	Middleware Security		
During CS	3	All remaining topics of module 2		

Contact Session 4,5
M3: Middleware Design and Patterns

Time	Type		Description	Text/Ref Book/external resource
Pre CS	RL 3.1	Integration styles		R1 – All Chapters, Apache

	RL 3.1	Messaging Systems		Camel (http://camel.apache.org), T1- Chapter 9, Apache JMeter (https://jmeter.apache.org)
	RL 3.1	Message Construction		
	RL 3.1	Message routing		
During CS	CS 4,5	All the remaining topics of module 3		

Contact Session 6: Review

Contact Session 7,8
M4: Middleware for Web-based Application and Cloud-based Applications

Time	Type		Description	Text/Ref Book/external resource
Pre CH	RL 4.1	Intro-Middleware-Web		T1 – Chapter 9, 10, 11 T1- Chapter 13, 14 https://aws.amazon.com/ https://github.com/aws-samples
	RL 4.1	Non-REST-WebServices		
	RL 4.1	REST-WebServices		
	RL 4.1	CloudMiddleware-AWS		
	RL 4.1	Hybrid-Multi-Cloud		
During CH	7, 8	All the remaining topics from module 4		

Contact Session 9
M5: Specialized Middleware

Time	Type		Description	Text/Ref Book/external resource
Pre CH	RL 5.1	No SQL		
	RL 5.1	Caching		
During CH	CS 9	All the remaining topics from module 5		

Contact Session 10: Review

Lab Details

Title	Access URL
Lab Setup Instructions	
Lab Capsules	
Additional References	

Select Topics and Case Studies from business for experiential learning

Topic No.	Select Topics in Syllabus for experiential learning	Access URL
M1	Echo Example using Java CORBA Exercises	T1 – Chapter 8, Section 8.2.9 and 8.9.10 T1 – Chapter 8 – CORBA Exercises
M3	Examples on Middleware (Apache Camel)	https://github.com/apache/camel/tree/master/examples
M3	Examples on Message Routing (Apache Camel) • POJO Routing • Spring Boot POJO	https://github.com/apache/camel/tree/master/examples
M3	Load Balancing Example using TCP / IP (Tomcat / Mina server)	https://github.com/apache/camel/tree/master/examples
M3	• Spring Security Example • Web Services Security Examples	https://github.com/apache/camel/tree/master/examples
M4	• SOAP Services Samples Execution	https://github.com/apache/camel/tree/master/examples
M4	• Rest Services Samples Execution	https://github.com/apache/camel/tree/master/examples
M4	• Application Samples on AWS environment • LAMBDA Samples • Example showing AWS-S3	https://github.com/apache/camel/tree/master/examples https://github.com/aws-samples
M5	• Example showing Camel using DataBase (NoSQL • Example showing Camel using JDBC	https://github.com/apache/camel/tree/master/examples

Topic No.	Select Topics in Syllabus for experiential learning	Access URL

Evaluation Scheme

Legend: EC = Evaluation Component

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC1	Quiz-1	20 questions, MCQ		5%	February 1-15, 2021
	Quiz-2	20 questions, MCQ		5%	March 1-15, 2021
	Quiz-3	20 questions, MCQ		10%	To be announced
EC2	Mid Semester Test	Open Book	2 Hours	35%	Saturday, 06/03/2021 (AN) 2 PM – 4 PM
EC3	Comprehensive Examination	Open Book	2 Hours	45%	Saturday, 01/05/2021 (AN) 2 PM – 4 PM

Note - *Evaluation components can be tailored depending on the proposed model.*

Important Information

Syllabus for Mid-Semester Test (Closed Book): Topics in Weeks 1-8

Syllabus for Comprehensive Exam (Open Book): All topics given in plan of study

Evaluation Guidelines:

1. EC-1 consists of either two Assignments or three Quizzes. Announcements regarding the same will be made in a timely manner.

2. For Closed Book tests: No books or reference material of any kind will be permitted. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.

3. For Open Book exams: Use of prescribed and reference text books, in original (not photocopies) is permitted. Class notes/slides as reference material in filed or bound form is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.

4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam. The genuineness of the reason for absence in the Regular Exam shall be assessed prior to giving permission to appear for the Make-up Exam. Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.