

**Pokhara University**  
**Faculty of Science and Technology**

Course Code.: CMP 485 (3 Credits)	Full Marks: 100
Course Title: Web Services and Applications (3-0-3)	Pass Marks: 45
Nature of the Course: Theory/Practical	Total Lectures: 48 hours
Level: Bachelor   Year: IV / Semester: VII/VIII	Program: Bachelor of Computer Engineering

### **1. Course Description:**

This course introduces the fundamental principles, standards, and technologies behind Web Services and distributed applications. Students will learn how to design, develop, and deploy interoperable web-based services using protocols such as SOAP, REST, and JSON-based APIs. The course combines theoretical concepts with practical implementation using modern frameworks.

### **2. General Objectives:**

The general objectives of this course are as follows:

- Understand the architecture and principles of web services.
- Explain and implement SOAP-based and RESTful web services.
- Apply XML, JSON, and WSDL in service design.
- Integrate web services with client applications.
- Use security and authentication mechanisms for web services.
- Develop and deploy interoperable web applications.

### **3. Methods of Instruction:**

- Lecture and discussion
- Practical
- Demonstration
- Presentation
- Project

### **4. Course Contents:**

Specific Objectives	Contents	
<b>Unit 1: Introduction to Web Technologies</b>		<b>4 hours</b>

<ul style="list-style-type: none"> <li>● Describe the client-server architecture and the roles of web browsers and servers.</li> <li>● Explain basic web protocols, DNS, and the differences between client-side and server-side scripting languages</li> </ul>	<p>1.1 Evolution of the Web</p> <p>1.1.1 History of web</p> <p>1.1.2 WWW</p> <p>1.1.3 URL</p> <p>1.1.4 Version of web</p> <p>1.1.5 Search engine</p> <p>1.1.6 Website and Web application</p> <p>1.2 Client-Server Architecture</p>
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	<p>1.3 Overview of Web Browsers and Web Servers</p> <p>1.3.1 Web browse, cross browser compatibilities</p> <p>1.3.2 Web server</p> <p>1.4 Basic Protocols</p> <p>1.4.1 Short overview of basic protocols</p> <p>1.4.2 HTTP/HTTPS</p> <p>1.4.3 HTTP request and response</p> <p>1.5 DNS and its hierarchy</p> <p>1.6 Client side and server side scripting language</p>
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<b>Unit 2: Introduction to Web Services and security</b>	<b>6 hours</b>
<ul style="list-style-type: none"> <li>Setting up a web server and basic service demonstration</li> </ul>	<p>2.1 Evolution from distributed systems to web services</p> <p>2.2 Concepts: Service, Client, Message exchange patterns</p> <p>2.3 Service-Oriented Architecture (SOA)</p> <p>2.4 Web service standards stack (XML, SOAP, WSDL, UDDI)</p> <p>2.5 Advantages and applications of web services</p> <p>2.6 Web service security and countermeasures</p>
<b>Unit 3: XML and Data representation</b>	<b>4 hours</b>
<ul style="list-style-type: none"> <li>Creating XML and JSON schemas for a sample data model</li> </ul>	<p>3.1 XML syntax, structure, and namespaces</p> <p>3.2 XML Schema (XSD)</p> <p>3.3 JSON structure and schema</p> <p>3.4 Data interchange using XML and JSON</p>
<b>Unit 4: SOAP-based Web Services</b>	<b>8 hours</b>
<ul style="list-style-type: none"> <li>Develop a simple SOAP service using Java or PHP</li> <li>Consume SOAP service from a client application</li> </ul>	<p>4.1 Architecture and components of SOAP</p> <p>4.2 WSDL (Web Services Description Language)</p> <p>4.3 Building and consuming SOAP web services</p> <p>4.4 SOAP message format and processing</p> <p>4.5 Tools: Apache Axis2 / JAX-WS / PHP SoapClient and SoapServer</p>
<b>Unit 5: RESTful Web Services</b>	<b>10 hours</b>
<ul style="list-style-type: none"> <li>Build REST APIs using Node.js / Python Flask / PHP / PHP Laravel</li> <li>Consume REST APIs using JavaScript or Postman</li> </ul>	<p>5.1 REST architecture principles</p> <p>5.2 HTTP methods (GET, POST, PUT, DELETE, PATCH)</p> <p>5.3 URI design and resource modeling</p> <p>5.4 Statelessness and caching</p> <p>5.5 JSON-based REST APIs</p> <p>5.6 Comparison: SOAP vs. REST</p>
<b>Unit 6: Web Service Development Frameworks</b>	<b>6 hours</b>
<ul style="list-style-type: none"> <li>Create and document an API with Swagger</li> <li>Deploy a service using Docker</li> </ul>	<p>6.1 Overview of frameworks: Spring Boot, Flask, Laravel</p> <p>6.2 API versioning and documentation (Swagger / OpenAPI)</p> <p>6.3 Microservices overview</p>

	6.4 Integration and deployment using Docker																																																							
<b>Unit 7: Security and testing integration in Web Services</b>	<b>10 hours</b>																																																							
<ul style="list-style-type: none"> <li>Implement JWT-based authentication for a REST API</li> <li>Test SOAP and REST APIs using Postman and SoapUI</li> </ul>	7.1 Security challenges in web services 7.2 Authentication and Authorization (Basic Auth, OAuth 2.0, JWT) 7.3 HTTPS, SSL/TLS 7.4 API rate limiting and key management 7.5 Service testing tools: Postman, SoapUI 7.6 Continuous Integration/Delivery for APIs 7.7 Performance and load testing basics																																																							
<b>5. Practical Works:</b>																																																								
<b>12–15 hours of hands-on lab exercises</b> <b>Group project: Design and implement a mini application integrating REST/SOAP web services</b>																																																								
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<table border="1"> <thead> <tr> <th><b>Internal Evaluation</b></th> <th><b>Weight</b></th> <th><b>Marks</b></th> <th><b>External Evaluation</b></th> <th><b>Marks</b></th> </tr> </thead> <tbody> <tr> <td><b>Theory</b></td> <td></td> <td><b>30</b></td> <td rowspan="6"><b>Semester End examination</b></td> <td rowspan="6"><b>50</b></td> </tr> <tr> <td>Attendance / Class Participation</td> <td>10%</td> <td></td> </tr> <tr> <td>Assignments</td> <td>20%</td> <td></td> </tr> <tr> <td>Project Work/Presentations</td> <td>10%</td> <td></td> </tr> <tr> <td>Term Exam</td> <td>60%</td> <td></td> </tr> <tr> <td><b>Practical</b></td> <td></td> <td><b>20</b></td> </tr> <tr> <td>Attendance and Lab Participation</td> <td>10%</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Lab Report</td> <td>20%</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Lab Examination</td> <td>40%</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Viva Examination</td> <td>30%</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>Total Internal Marks</b></td> <td></td> <td><b>50</b></td> <td></td> <td></td> </tr> <tr> <td colspan="5" style="text-align: center;"><b>Full marks=50+50</b></td></tr> </tbody> </table>		<b>Internal Evaluation</b>	<b>Weight</b>	<b>Marks</b>	<b>External Evaluation</b>	<b>Marks</b>	<b>Theory</b>		<b>30</b>	<b>Semester End examination</b>	<b>50</b>	Attendance / Class Participation	10%		Assignments	20%		Project Work/Presentations	10%		Term Exam	60%		<b>Practical</b>		<b>20</b>	Attendance and Lab Participation	10%				Lab Report	20%				Lab Examination	40%				Viva Examination	30%				<b>Total Internal Marks</b>		<b>50</b>			<b>Full marks=50+50</b>				
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**7. Prescribed Books and References:**

1. Erl, Thomas. Service-Oriented Architecture: Concepts, Technology, and Design. Prentice Hall.
2. Alonso, Gustavo et al. Web Services: Concepts, Architectures and Applications. Springer.