Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Two Year M.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

CBCS Syllabus

M.Sc.(Computer Science) - II Sem- III

For Department of Computer Science

Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati

Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati, (Autonomous)

M.Sc.(Computer Science)Academic Year 2019-2020

M.Sc. (Computer Science) I - Credit Structure

Subject	Semester I	Semester II	Total
Paper – I	4	4	8
Paper – II	4	4	8
Paper – III	4	4	8
Paper - IV	4	4	8
Paper – V	4	4	8
Practical	4	4	8
Practical (Project)	---	4	4
Intro. to Cyber Security – I& II	2	2	4
Human Rights	2	--	2
Certificate Course- I	--	**2**	**2**
Total ====	**28**	**32**	**60**

M.Sc. (Computer Science) II - Credit Structure

Subject	Semester III	Semester IV	Total
Paper – I	4	**Industrial Training Project / Internship (IT) 16**	4
Paper – II	4		4
Paper – III	4		4
Paper - IV	4		8
Paper – V	4		8
Practical / Paper VI (Sem IV)	4		8
Practical (Project)	4		8
Certificate Course- II	2	-------	2
Skill Development I & II	2	2	4
			2
Total ====	**32**	**18**	**50**

Extra Credits:

1	Human Rights	2 Credits
2	Cyber Security Module I & II	4 Credits
3	Certificate Courses I & II	4 Credits
4	Skill Development I & II	4 Credits
Total Extra Credits =		14 Credits

Total Credits: Academic Credits (24+28+28+16 = 96) + Extra Credits (14) =110

Paper wise Course Structure For M.Sc. (Computer Science) (2019 Pattern)

No	Class	Sem	Code	Paper	Paper Title	Credit	Exam	Marks
1	M.Sc. - I	I	COMP4101	Theory	Principles of Programming Languages (C)	4	I / E	60 + 40
2			COMP4102	Theory	Cryptography and Network Security (C)	4	I / E	60 + 40
3			COMP4103	Theory	Database Technologies (C)	4	I / E	60 + 40
4			COMP4104	Theory	Design and Analysis of Algorithms (C)	4	I / E	60 + 40
5			COMP4105	Theory	Programming with DOT NET (C)	4	I / E	60 + 40
6			COMP4106	Pract.	Lab Course on DOT NET, PPL & Database Technologies (C)	4	I / E	60 + 40
7			HR-101	----	Human Rights – I	2	----	----
8			CYS-101	----	Introduction to Cyber Security – I	2	----	----
Note: Credit: 24. Core subjects is compulsory and Extra credits (2+2=4) is also compulsory.								
9	M.Sc. - I	II	COMP4201	Theory	Digital Image Processing (C)	4	I / E	60 + 40
10			COMP4202	Theory	Data Mining and Data Warehousing (C)	4	I / E	60 + 40
11			COMP4203	Theory	Python Programming (C)	4	I / E	60 + 40
12			COMP4204	Theory	**Advanced Operating System (EI)**	4	I / E	60 + 40
13			COMP4205	Pract.	Lab Course on Python Programming and Advance Operating System (C)	4	I / E	60 + 40
14			COMP4206	Pract.	**Project (EII)**	4	I / E	60 + 40
15			COMP4207	Theory	**Artificial Intelligence (EIII)**	4	I / E	60 + 40
16			CC-12	----	Certificate Course – I	2	----	---
17			CYS-102	----	Introduction to Cyber Security – II	2	----	----
Note: : Credit: 28. Core subjects is compulsory and Extra credits (4) is also compulsory.								
18	M.Sc. - II	III	COMP5301	Theory	Mobile Technologies (C)	4	I / E	60 + 40
19			COMP5302	Theory	Soft Computing (C)	4	I / E	60 + 40
20			COMP5303	Theory	Web Services (C)	4	I / E	60 + 40
21			COMP5304	Theory	**Software Architecture& Design Pattern (EI)**	4	I / E	60 + 40
22			COMP5305	Pract.	Lab Course-on Mobile Technologies and Web Services (C)	4	I / E	60 + 40
23			COMP5306	Pract.	**Project (EII)**	4	I / E	60 + 40
24			COMP5307	Theory	**Recent Trends in IT (Internet of Things) (EIII)**	4	I / E	60 + 40
25			CC-23	----	Certificate Course – II	2	----	----

26			SD-23	----	Skill Development – I	2	----	----
Note: Credit: 28. Core subjects is compulsory and Extra credits (2+2) is also compulsory.								
27	M.Sc. - II	IV	COMP5401	Project	Industrial Training/ Institutional Project **(IT) (Core)**	16	I / E	60 + 40
28			SD-23	----	Skill Development – II	2	----	----
Note: Credit:16. Core subject is compulsory, **Total Credits:Academic Credits(24+28+28+16 = 96) + Extra Credits (14) = 110**								

M.Sc. (Computer Science)- II

Semester-III Syllabus

A.Y. – 2020-21 (2019 Pattern)

SYLLABUS (CBCS) FOR M. Sc. (Computer Science)-II (Semester- III)

(w.e.f from Academic Year 2020-2021

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code:**Comp5301

Title of Paper: Mobile Technologies (Core) **Paper:** I

Credit: 4 (4 Lectures/Week) **No. of lectures:** 48

Pre-requisites:

- Concepts of Networking, Wireless communication.
- Familiar with object oriented concepts
- Conversant with OS internals

Course Objectives:

- Students canunderstand basic concepts of mobile technology and mobile platforms
- Students can understand concepts related to wireless communication.
- Create native android applications using basic concepts
- Understand UI design or controls available in android.

Course Outcomes:

CO1: Understand Mobile Computing Concepts
CO2: Mobile Device Architecture
CO3: Wireless Communication
CO4: Location-Based Services
CO5: Understand GSM Technologies
CO6: User Interface Design for Mobile Devices
CO7: Emerging Trends in Mobile Computing

Title and Contents	No. of Lectures
Unit 1 : Wireless Transmission 1.1 Multiplexing and Modulation 1.2 Spread Spectrum 1.3 Wireless transmission media 1.4 Migration from 2G to 4G 1.5 Wireless LAN advantages 1.6 Wireless LAN architecture 1.7 Mobility in Wireless LAN 1.8 Wireless LAN security	7
Unit 2: Introduction to Mobile Computing 2.1 Introduction and need for Mobile computing 2.2 Mobility and portability 2.3 Mobile and Wireless devices 2.4 Mobile Applications 2.5 Mobile Operating system – IOS, BlackBery, Windows ,phone, Plam OS, Symbian OS,PhoneGap 2.6 Cellular systems. 2.7 Introduction to IEEE 802.11	6

Unit 3: GSM Technology 3.1 What is GSM? 3.2 GSM Services. 3.3 GSM Network Architecture a. Radio Subsystem b. Network Subsystem c. Radio Subsystem 3.4 Localization and Calling 3.5 Handover 3.6 GSM security 3.7 GPRS 3.8 CDMA in Mobile Communication	8
Unit 4 : Introduction to Android Operating System & Programming 4.1 Features of Android 4.2 Android Architecture 4.3Fundamental of Android App 4.4 Java for Android 4.5 Activities and Intents 4.6 User Interface 4.7 Services and Broadcast Receivers	8
Unit 5: Android UI Design 5.1 Basic UI Designing (Form widgets ,Text Fields , Layouts ,[dip, dp, sip, sp] versus px) 5.2 Intent(in detail) 5.3 All components (e.g Button , Slider, Image view, Toast) Event Handling 5.4 Adapters and Widgets 5.5 Menu	5
Unit 6:Android Thread and Notification 6.1 Threads running on UI thread (runOnUiThread) 6.2 Worker thread 6.3 Handlers & Runnable 6.4 AsynTask (in detail) 6.5 Broadcast Receivers Services and notifications 6.6 Toast 6.7 Alarms	4
Unit 7: iOS Fundamentals 7.1 **Introduction** - What is IOS ,IOS Architecture, Frameworks, Application Life Cycle, Features 7.2 **Swift -** Introduction to Swift ,General Concepts of Swift 7.3 **Xcode -** Introduction to Xcode , Navigator, Editor Utility, Tools, Console, Document, Simulator, Instruments 7.4 **Startup -** Application Templates, Introduction to Storyboard , Hello World Application, How 'Hello World' Working, Debugging Database, Plist, Preference, Sqlite Web Service, Restful Web Service (JSON & XML)	6
Unit 8: Introduction to Flutter Mobile App Development 8.1 Flutter – Introduction 8.2 Features of Flutter 8.3 Basics of creating flutter application in the Android Studio.	04

8.4 Flutter – Architecture of Flutter Application 8.5 Flutter – Introduction to Dart Programming 8.6 Flutter – Introduction to Gestures. 8.7 Introduction to Beacon Mobile technology	

References:

1. SchillerJochen, (2003). Mobile Communications. **UK.: Pearson Education**
2. Wei-Meng Lee . Beginning Android Application Development. John Wiley & Sons, 2012
3. TalukderAsoke K. Hasan Ahmed,Roopa R Yavagal. Mobile Computing: Technology, Applications and Service Creation
4. Mark Murphy. Beginning Android 3.APress , ISBN 9788132203568
5. Matthijs Hollemans . IOS Apprentic

Websites :

https://www.tutorialspoint.com/
https://developer.android.com/
https://w3resource.com/
https://abhiandroid.com/

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	3	3	3	3
CO2	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	2
CO4	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3
CO6	3	2	2	2	2	2	2
CO7	3	2	2	2	2	2	2

Course Objectives (CO) and Program Outcomes (PO) Mapping:

- **Justification of PO1 to ALL COs :**
  - **PO1:** Apply fundamental principles and methods of Computer Science to a widerange of applications.

CO1: 3 (Strongly Relates)- Introduction of mobile communication functionalities.
CO2: 3 (Strongly Relates)- Knowledge of mobile device architecture involves applying fundamental principles of computer science to understand how different components work together.
CO3: 3 (Strongly Relates)- Understanding wireless communication in mobile computing relies on computer science principles, particularly in the context of networking and data transmission.
CO4: 3 (Strongly Relates)- Location-based services involve the application of computer science principles to provide services based on geographical information.
CO5: 3 (Strongly Relates)- Understanding GSM technologies requires applying computer science principles in the context of mobile communication.
CO6: 3 (Strongly Relates)- User interface design involves applying human-computer interaction principles, a subset of computer science, to create effective and user-friendly mobile interfaces.
CO7: 3 (Strongly Relates)-Staying updated on emerging trends involves applying computer science principles to adapt to and incorporate new technologies.
CO1: Understand Mobile Computing Concepts

- **PO2:** Design, correctly implement and document solutions to significant computational

problems.

CO1: 2 (Moderately Relates)-Understanding mobile computing concepts contributes to the ability to design solutions, though it may not directly involve the implementation or documentation of solutions.
CO2 : 3 (Strongly Relates)-Mobile device architecture is essential for designing and implementing solutions to computational problems related to mobile devices.
CO3 : 3 (Strongly Relates)- Understanding wireless communication is crucial for designing and implementing computational solutions related to mobile communication.
CO4: 3 (Strongly Relates) - Designing and implementing location-based services involve solving significant computational problems related to geographical information.
CO5: 3 (Strongly Relates)- Understanding GSM technologies is crucial for designing and implementing computational solutions related to mobile communication systems.
CO6: 2 (Moderately Relates)-While user interface design is vital for the overall solution, it may not directly involve computational problem-solving, but it contributes to the user experience.
CO7: 2 (Moderately Relates)Staying updated on emerging trends may indirectly influence the design of solutions, but it may not directly involve the implementation of computational solutions.

- **PO3:** Impart an understanding of the basics of our discipline.

CO1: 3 (Strongly Relates)- Understanding mobile computing concepts is fundamental to the discipline of mobile computing and contributes significantly to imparting the basics of the discipline.
CO2: 3 (Strongly Relates)- Knowledge of mobile device architecture is a fundamental aspect of mobile computing, and imparting this understanding aligns with the basics of the discipline.
CO3: 3 (Strongly Relates)- Wireless communication is a core concept in mobile computing, and imparting an understanding of it aligns directly with the basics of the discipline.
CO4: 3 (Strongly Relates)- Imparting an understanding of location-based services is essential for building foundational knowledge in mobile computing.
CO5:: 3 (Strongly Relates)-Understanding GSM technologies is a fundamental aspect of mobile communication and contributes to the basics of the mobile computing discipline.
CO6: 2 (Moderately Relates)- While user interface design is important, its direct association with imparting the basics of the mobile computing discipline is moderate.
CO7: 2 (Moderately Relates)Staying updated on emerging trends contributes to a broader understanding of the discipline, but its direct association with imparting the basics is moderate.

- **PO4:** Prepare for continued professional development.

CO1: 3 (Strongly Relates)-A solid understanding of mobile computing concepts provides a strong foundation for ongoing professional development in the field.
CO2: 3 (Strongly Relates)-Knowledge of mobile device architecture is crucial for professionals in mobile computing, supporting their ongoing development in the field.
CO3: 3 (Strongly Relates)-Proficiency in wireless communication is essential for mobile computing professionals, contributing significantly to their ongoing development.
CO4: 3 (Strongly Relates)-Understanding location-based services is important for professionals in the field, aiding their preparation for continued development.
CO5: 3 (Strongly Relates)- Knowledge of GSM technologies is a valuable skill for mobile computing professionals, contributing to their preparedness for continued development.
CO6: 2 (Moderately Relates)- User interface design skills, while important, may moderately contribute to the overall preparedness for continued professional development.
CO7: 2 (Moderately Relates)-Staying updated on emerging trends can moderately enhance professionals' readiness for ongoing development in the rapidly evolving field of mobile computing.

CO1: Understand Mobile Computing Concepts

- **PO5:** Understand the impact of the IT analyst solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

CO1:3 (Strongly Relates)- Understanding mobile computing concepts is crucial for assessing the societal and environmental impact of IT solutions and promoting sustainable development in the context of mobile computing.
CO2: 3 (Strongly Relates)- Knowledge of mobile device architecture contributes to the ability to assess the impact of IT solutions on society and the environment, supporting sustainable development.
CO3: 3 (Strongly Relates)- Proficiency in wireless communication is essential for evaluating societal and environmental impacts and advocating for sustainable development in mobile computing.
CO4: 3 (Strongly Relates)-Understanding location-based services is crucial for assessing their impact on society and the environment, promoting awareness of sustainable development needs.
CO5: 3 (Strongly Relates)- Knowledge of GSM technologies is important for evaluating their societal and environmental impact, aligning with the principles of sustainable development.
CO6: 2 (Moderately Relates)- While user interface design may moderately contribute, its direct association with societal and environmental impact and sustainable development is not as strong.
CO7: 2 (Moderately Relates)- Awareness of emerging trends can moderately contribute to understanding the societal and environmental impact, but the direct link to sustainable development may be moderate.

- **PO6:** Develop proficiency in the practice of computing.

CO1: 3 (Strongly Relates)- Understanding mobile computing concepts is foundational to developing proficiency in the broader practice of computing.
CO2: 2 (Moderately Relates)- Knowledge of mobile device architecture contributes directly to proficiency in the practice of computing, especially in the mobile computing domain.
CO3: 3 (Strongly Relates)- Proficiency in wireless communication is essential for the practice of computing, particularly in the context of mobile computing.
CO4: 3 (Strongly Relates)- Proficiency in designing and implementing location-based services enhances overall proficiency in the practice of computing.
CO5: 3 (Strongly Relates)- Proficiency in GSM technologies is crucial for mobile computing professionals, contributing significantly to their overall proficiency in computing.
CO6: 2 (Moderately Relates)- Proficiency in user interface design is important, but its direct association with the overall practice of computing may be moderate.
CO7:2 (Moderately Relates)- Awareness of emerging trends can moderately contribute to developing proficiency, as it keeps professionals informed about advancements in the field.

- **PO7:** Develop the capacity to study and research independently that will help to develop skills for transition to employment in hardware/software companies

CO1: 3 (Strongly Relates)- Understanding mobile computing concepts is fundamental for independent study and research, supporting the development of skills for employment in the technology sector.
CO2: 3 (Strongly Relates)- Proficiency in mobile device architecture contributes significantly to independent study and research, aligning with skills needed for employment in hardware/software companies.
CO3: 2 (Moderately Relates)- Independent study and research in wireless communication are crucial for developing skills required in the technology job market.
CO4: 3 (Strongly Relates)- Researching and studying location-based services independently contribute to skills necessary for transitioning to employment in the technology industry.
CO5: 3 (Strongly Relates)- Understanding GSM technologies supports independent study and research, enhancing skills for employment in hardware/software companies.
CO6: 2 (Moderately Relates)-Proficiency in user interface design moderately contributes to independent study, which is valuable for transitioning to employment in the technology sector.
CO7: 2 (Moderately Relates)-Awareness of emerging trends can moderately contribute to independent study and research, preparing individuals for employment in the ever-evolving technology field.

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code:**Comp5302
Title of Paper: Soft Computing (Core) **Paper:** II
Credit: 4 (4 Lectures/Week) **No. of lectures:** 48

Prerequisites : Probability, First Order Mathematical Logic, Classical Logic, Linear algebra and calculus

Objective

- To understand the concepts of how an intelligent system work and its brief development process.
- Be familiar with design of various neural networks & fuzzy logic & Learn genetic programming.

Learning Outcome:

- Describe human intelligence and AI
- Explain how intelligent system works.
- Apply basics of Fuzzy logic and neural networks.
- Understand the ideas of fuzzy sets, fuzzy logic and use of human experience relate with neural networks, generalize appropriate rules for inference systems
- Understand the genetic algorithms and other random search procedures.
- Develop some familiarity with current research problems and research methods in Soft Computing Techniques.

Units &Contents	No. Of Lectures
1. **Introduction to Fuzzy Logic** • The Illusion : Ignoring Uncertainty and accuracy • Uncertainty and information • Fuzzy set and membership • Chance versus Fuzziness • Classical Sets,Fuzzy Sets • Cartesian Product • Crisp Relations • Fuzzy relations • Tolerance and equivalence Relations, Fuzzy Tolerance and equivalence Relations • Value assignments, Other Forms of the Composition Operations • Features of the membership Function • various forms, Fuzzification, Defuzzification to Crisp sets • λ-Cuts for fuzzy Relations, Defuzzification to Scalars	12
2 : Fuzzy logic • Fuzzy Logic • Approximate Reasoning,Others forms of implication operations • Natural Language, Linguistic Hedges • Fuzzy (Ruled-Based) system	04

• Graphical technique of inference • Membership value assignment-Intuition, Inference.	

3 : Fuzzy System and Classification
• Fuzzy System Simulation-
  o Fuzzy Relation
  o Equations
  o Nonlinear Simulation Using Fuzzy Systems
• Fuzzy Associative Memories
• Fuzzy Classification
  o Classification by Equivalence Relations
  o Cluster Analysis
  o Cluster Validity
• c-Means Clustering
• Hard c-Means
• Fuzzy c-Means
• Classification Metric
• Hardening the Fuzzy c-Partition
• Similarity Relations from Clustering
• Fuzzy Arithmetic and Extension Principle
  o Extension Principle
  o Fuzzy Arithmetic
  o Interval Analysis in Arithmetic
  o Approximate Methods of Extension.
	10

4 : Neural Network
• Neural networks:
  o Artificial Neural Network: Definition
  o Advantages of Neural Networks Application
  o Scope of Neural Networks
• Fundamental Concept:
  o Artificial Neural Network
  o Biological Neural Network
• Brain vs. Computer-
  o Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer)
• Artificial Neurons
• Neural Networks and Architectures:
  o Neuron Abstraction
  o Neuron Single Functions
  o Mathematical Preliminaries
  o Neural Networks Defined
• Architectures:
	12

○ Feedforward and Feedback, • Salient Properties of Neural Networks • Geometry of Binary Threshold Neurons and Their Networks: ○ Pattern Recognition and Data Classification ○ Convex Sets ○ Convex Hulls and Linear Separability ○ Space of Boolean Functions ○ Binary Neurons are Pattern Dichotomizers ○ Non-linearly Separable Problems ○ Capacity of a Simple Threshold Logic Neuron ○ Revisiting the XOR Problem ○ Multilayer Networks ○ How Many Hidden Nodes are Enough?	
5 :Introduction to learning • Learning and Memory: ○ An Anecodatal Introduction ○ Long Term Memory • The Behavioural Approach to Learning • The Molecular Problem of Memory • Learning Algorithms • Error Correction and Gradient Descent Rules • Learning Objective for TLNs • Pattern Space and Weight Space • Linear Seperabilty • Hebb Network • Perceptron Network • α- Least Mean Square Learning • MSE Error Surface and Its Geometry • Steepest Descent Search with Exact Gradient Information • μ-LMS: ○ Approximate Gradient Descent ○ Application of LMS to Noise Cancelation.	06
6 :Genetic Algorithms • A Gentle Introduction to Genetic Algorithms: ○ What are Genetic Algorithm? ○ Robustance of Traditional Optimization and Search Methods ○ The Goals of Optimization	04

• How are Genetic Algorithms Different from Traditional Methods? • A simple Genetic Algorithm • Genetic Algorithms at Work—a Simulation by hand • Grist for the Search Mill—Important Similarities • Similarity Templates (Schemata)Learning the Lingo.	

Reference Books

1. Fuzzy Logic With Engineering Applications, 3rd Edition By Timothy Ross , WileyPublication
2. Neural Networks By Satish Kumar, Tata McGraw Hill
3. Introduction to Soft Computing by Deepa &Shivanandan, Wiley Publication
4. Genetic Algorithms in Search, Optimization and Machine Learning By David E. Goldberg, Pearson Education.

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	2	3	2
CO2	3	3	3	2	2	3	2
CO3	3	3	3	2	2	3	2
CO4	3	3	3	2	2	3	2
CO5	3	3	3	2	2	3	2
CO6	3	3	3	2	3	3	2
CO7	3	3	3	2	2	3	2

Justification of PO1 to ALL COs:

PO1: Strongly relates (Weight: 3) -it builds on fuzzy logic and neural networks knowledge, contributing to a deeper understanding.

Justification of PO2 to ALL COs:

PO2:Strongly related (Weight: 3) - understanding the working of intelligent systems is crucial for comprehending software application concepts.

Justification of PO3 to ALL COs:

PO3: Strongly related (Weight: 3) - explaining the working of intelligent systems directly involves theoretical concepts and may be demonstrated using ICT.

Justification of PO4 to ALL COs:

PO4: Moderately relates (Weight: 2) - the ability to select proper algorithms contributes to the effectiveness of in-house applications.

Justification of PO5 to ALL COs:

PO5: Moderately relates (Weight: 2) -as discussions on research problems and methods in soft computing may occur during IT visits.

Justification of PO6 to ALL COs:
PO6: Strongly related (Weight: 3) - knowledge of how intelligent systems work isfundamental for comprehending real-world applications in the IT industry.

Justification of PO7 to ALL COs:
PO7: Moderately relates (Weight: 2)-applying fuzzy logic and neural networks may be in demand in certain industry roles, contributing to employability.

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code :**Comp5303

Title of Paper: Web Services (Core) **Paper:** III

Credit: 4 (4 Lectures/Week) **No. of lectures:** 48

Pre-requisites:

Strong knowledge about Java programming, Good Understanding of Object Oriented Programming concepts.Must be familiar with XML.

Objectives:

- To Understand Web Services and implementation model for SOA.
- To Understand the SOA, its principles and benefits.
- To understand cloud computing as a web service.
- To understand XML concepts. To understand paradigms needed for testing Web Services.

Learning Outcomes: Student will able to :

CO1: Understand the principles of SOA

CO2: Efficiently use market leading environment tools to create and consume web services.

CO3: Identify and select the appropriate framework components in creation of web service solution.

CO4: Students learn to understand the principles of SOAP

CO5: Students identify and select the appropriate framework components in the creation of web service solution.

CO6: Students learn the understanding of the various applications of XML

CO7: Students learn the complete Web Services Development Life Cycle.

Units & Contents	No. of Lecture
1. Web Service and SOA fundamental	**8**
1.Introduction : what are Web Services?, Concept of Saas 2. Web services Vs Web based Implementation 3.Characteristics of Web Services: Types of Web services, Functional and non functional properties , State processing , loose Coupling, Service Granularity, Service Synchronization 4.Service Interface and Implementation 5.The Servicesoriented Architecture (SOA): Roles of Interaction in SOA, Layer of SOA 6.Quality O f Service (QoS) 7.Web Service Interoperability(WS-I) 8.Web Services Vs Components 9.Restful Services 10.Impact and Shortcomings of Web services: Impact of web services	
2. Web Services Architecture	**8**

1. Introduction 2.Web Services Architecture and It's Characteristics: Web service characteristics , Web Service Architecture 3Core building blocks of web services 4Standards and technologies available for implementing web services: SOAP, WSDL,UDDI 5Web Services Communication Models: RPC-based Communication Model, Messaging-based communication Model 6Basic steps of implementing web services 7Developing web services-Enabled applications: Web Services ImplementationUsing J2EE Environment, Developing Web Services Using J2EE:AN Example 8 Packaging and Deploying the Service: Creating web Service Clients	
3. SOAP: Simple Object Access Protocol	**8**
1Introduction 2Inter-application communication and wire protocols: SOAP as a wire representation, SOAP as a messaging protocol 3Structure of a SOAP message: SOAP Envelope, SOAP Header, SOAP Body 4SOAP communication model: RPC-Style, Document –(Message)Style Web Services 5Building SOAP Web Services 6developing SOAP Web Services using Java 7 Error handling in SOAP and Advantages and disadvantages of SOAP.	
4. Describing and Discovering Web Services:	**12**
1 WSDL in the world of Web Services 2 Web Services life cycle: Anatomy of WSDLdefinition document, Patterns Of Operations 3WSDL bindings, WSDL Tools,limitations of WSDL 4 Service discovery: Role of service discovery in a SOA, service discovery mechanisms 5 UDDI –UDDI Registries, uses of UDDI Registry, Searching information in a UDDI Registry, Deletinginformation in a UDDI Registry, limitations of UDDI.	
5. Cloud Computing:	**12**
1 Introduction: What is Cloud Computing?, Essential characteristic of cloud, Cloud Deployment Model, History,Benefits,Risk 2 SOA Meets the Cloud : Comparing SOA with Cloud Computing , SOA Deployment :Cloud Computing Vs The ESB 3 Cloud Computing Technologies: Virtualization, SOA, Grid Computing,Utility Computing 4 Cloud Computing Architecture: Front End,Back End 5 Cloud Model : Public Cloud ,Private Cloud,Hybrid Cloud, Benefits,Disadvantages 6 Security and Privacy: Insecure or incomplete data and deletion, Security Planning, Understanding security of cloud ,Security Boundaries,Understanding Data Security, Isolated Access To data 7 Cloud Computing Application: Bossiness,Social,Entertainment	

Learning Resources

Text Book :

Web Services & SOA Principles and Technology

Reference Book :

1.Restful Web Services Cookbook BySubbuAllamaraju

2. Service Architecture By Thomas Eri

3.XML,Web Services, and the Data Revolution ,F.P.Coyle,Pearson Education

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	3	3	3	3
CO2	2	2	3	3	2	3	3
CO3	2	3	3	2	2	3	3
CO4	1	3	2	2	1	2	2
CO5	1	3	3	2	1	2	2
CO6	1	2	2	1	1	2	2
CO7	1	3	3	1	1	2	2

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly relate

Justification :

1. **Mapping PO1 with All CO's :**

   CO1 is strongly related to PO1 as it involves understanding the principles of Service-Oriented Architecture (SOA), a key aspect in the broader area of Web Services and Cloud Computing.

   CO2 and CO3 are moderately related to PO1 as they involve the practical application of market-leading tools and framework components in the creation and consumption of web services, contributing to knowledge enrichment in Web Services and related technologies.

   CO4, CO5, CO6, and CO7 are partially related to PO1, as they focus on specific aspects of web services development, SOAP principles, XML applications, and the complete Web Services Development Life Cycle, respectively, contributing to a broader understanding of the subject but not as directly aligned with the specified areas in PO1.

2. **Mapping PO2 with All CO's :**

   CO1 is strongly related to PO2 - Understanding the principles of Service-Oriented Architecture (SOA) directly aligns with the broader concept of software applications and projects.

   CO2 is moderately related toPO2 -While the use of tools is part of software applications and projects, it's not exclusively tied to the understanding of SOA principles.

   CO3 is strongly related to PO2 - This directly contributes to understanding the dimensions of software application and projects, especially in the context of web services.

   CO4 is strongly related to PO2- Understanding SOAP principles contributes to the broader understanding of software applications and projects.

CO5is strongly related to PO2 - This is directly aligned with the dimensions of software applications and projects, specifically in the context of web service solutions.

CO6 is moderately related to PO2 - While XML is a significant technology in software applications, it is not directly tied to the principles of SOA.

CO7 is strongly related to PO2- Understanding the complete life cycle of web services is integral to grasping the dimensions of software applications and projects.

3. **Mapping PO3 with All CO's:**

CO1 is moderately related to PO3-This is related as understanding SOA requires grasping theoretical concepts, but it may not directly involve programming and ICT demonstrations.

CO2 is strongly related to PO3- This is directly related as it involves practical skills in using tools and technologies, which aligns with the use of ICT in programming and demonstration.

CO3 is strongly related to PO3 - This is strongly related as it involves both theoretical understanding and practical application, aligning with the use of ICT in programming.

CO4 is moderately related to PO3- This is related as understanding SOAP involves theoretical knowledge, but it may not directly involve programming and ICT demonstrations.

CO5 is strongly related to PO3 - This is strongly related as it involves practical skills in selecting framework components, aligning with the use of ICT in programming.

CO6 is moderately related to PO3 - This is related as understanding the applications of XML involves theoretical knowledge, but it may not directly involve programming and ICT demonstrations.

CO7 is strongly related to PO3 -This is strongly related as it involves understanding the entire development life cycle, which includes both theoretical knowledge and practical skills with the use of ICT.

4. **Mapping PO4 with All CO's:**

CO1 is strongly related to PO4 as understanding the principles of SOA is crucial for developing in-house applications.

CO2 is strongly related to PO4 as efficiently using market-leading environment tools for web services aligns with developing in-house applications.

CO3 is moderately related to PO4 as selecting appropriate framework components for web service solutions is a part of developing in-house applications.

CO4 is moderately related to PO4 as understanding SOAP principles contributes to the development of in-house applications.

CO5 is moderately related to PO4 as selecting framework components for web service solutions is a part of developing in-house applications.

CO6 is partially related to PO4 as understanding various applications of XML may have some relevance to in-house application development.

CO7 is partially related to PO4 as learning the complete Web Services Development Life Cycle has
partial relevance to developing in-house applications.

5. **Mapping PO5 with All CO's:**

CO1 is strongly related to PO5 as understanding the principles of SOA is essential for meaningful interactions with IT experts during visits.

CO2 is moderately related to PO5 as efficiently using market-leading tools for web services contributes to better engagement with IT experts during visits.

CO3 is moderately related to PO5 as identifying and selecting framework components in web service solutions has some relevance to interactions with IT experts.

CO4 is partially related to PO5 as understanding SOAP principles may have limited relevance to interactions with IT experts during visits.

CO5 is partially related to PO5 as selecting framework components for web service solutions is partially relevant to interactions with IT experts.

CO6 is partially related to PO5 as learning the various applications of XML has partial relevance to interactions with IT experts.

CO7 is partially related to PO5 as learning the complete Web Services Development Life Cycle has partial relevance to interactions with IT experts during visits.

6. **Mapping PO6 with All CO's:**

CO1 is strongly related to PO6 as understanding the principles of SOA is fundamental for gaining valuable industrial exposure during the 6-month industrial internship in the IT industry.

CO2 is strongly related to PO6 as efficiently using market-leading tools for web services is crucial for practical application and experience during the industrial internship.

CO3 is strongly related to PO6 as identifying and selecting framework components in web service solutions is directly applicable in the context of the 6-month industrial internship.

CO4 is moderately related to PO6 as understanding SOAP principles may have some relevance to tasks encountered during the industrial internship.

CO5 is moderately related to PO6 as selecting framework components for web service solutions is moderately relevant to tasks undertaken in the industrial internship.

CO6 is moderately related to PO6 as learning the various applications of XML may have some relevance in the context of the industrial internship.

CO7 is moderately related to PO6 as learning the complete Web Services Development Life Cycle is moderately relevant to tasks and projects encountered during the 6-month industrial internship.

7. **Mapping PO7 with All CO's:**

CO1 is strongly related to PO7 and PS08 as understanding the principles of SOA is crucial for making students employable in the current IT industry and for enabling them to publish their work in reputed journals.

CO2 is strongly related to PO7 as efficiently using market-leading tools for web services is essential for students to meet the current demands of the IT industry and become employable.

CO3 is strongly related to PO7 as identifying and selecting framework components in web service solutions is directly aligned with making students employable in the IT industry.

CO4 is moderately related to PO7 and PS08 as understanding SOAP principles may have some relevance to employability in the IT industry and the potential to publish work in reputed journals.

CO5 is moderately related to PO7 as selecting framework components for web service solutions is moderately relevant to making students employable.

CO6 is moderately related to PS08 as learning the various applications of XML may have some relevance to publishing work in reputed journals.

CO7 is moderately related to PO7 as learning the complete Web Services Development Life Cycle is moderately relevant to making students employable in the IT industry.

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code:**Comp5304
Title of Paper: Software Architecture & Design Pattern **Paper:** IV
Credit: 4 (4 Lectures/Week) **No. of lectures:** 48

Objectives:

To Understand and learn the software architecture, its styles, views and pattern for design software
with minimum complexity and maintain flexibility

Prerequisites: System Analysis and Design, Software Engineering, OOSE, Software project Management, UML

Outcomes: Course Outcomes:

CO1-Able to assist learner to utilize styles and views to state.
CO2-Architecture, define documentation, analyse the architectural structures and it's Influence on business and development process.
CO3-Evaluate and select appropriate design pattern for a situation
CO4-Compare the performance of the software on inclusion of various design patterns.
CO5-Analyse and suggest architecture design for an application
CO6-Apply design patterns to software design
CO7-Evaluate and select appropriate design pattern for a situation

Units &Title and Contains	No of Lect.	Assignments /test
1. Introduction to Software Architecture 1.1 Introduction to concept of Software Architecture 1.2 Definition , Architectural structures 1.3 Need and Influence of software architecture in organization as business and technical aspects 1.4 Architecture Business Cycle 1.5 Introduction – Functional requirements, Technical constraints, Quality Attributes	**4**	**Assignment-1**
2. Quality Attribute 2.1 Introduction Quality Attribute 2.2 Documenting Quality Attributes 2.3 Six part scenarios 2.4 Case studies	**4**	**Assignment-2**
3. Architectural Views 3.1 Introduction ,Definitions for views 3.2 Structures and views, Representing views, available notations, 3.3 Standard views,4+1 view of RUP, Siemens 4 views SEI's perspectives and views 3.4 Case studies	**6**	**Assignment-3** **Test-I**
4. **ARCHITECTURAL STYLES** 4.1 Introduction 4.2 Data flow styles with Case study 4.3 Call-return styles with Case study	**6**	**Assignment-4**

4.4 Shared Information styles with Case study 4.5 Event styles with Case study		
5. Common Software Architectural Patterns 5.1 Layered pattern 5.2 Client-server pattern 5.3 Master-slave pattern 5.4 Pipe-filter pattern, 5.5 Broker pattern 5.6 Peer-to-peer pattern 5.7 Event-bus pattern 5.8 Model-view-controller pattern 5.9 Blackboard pattern 5.10 Interpreter pattern	**12**	**Assignment-5** **Test-II**
6. Design Pattern 6.1 Important Design Patterns 6.2 Design Pattern Catalogue, Creational, Structural and behavioral patterns 6.3 Structural Decomposition 6.4 Organization of Work, Access Control.	**10**	**Assignment-6**
7. DOCUMENTING THE ARCHITECTURE 7.1 Good practices,Documenting the Views using UML, 7.2 Merits and Demerits of using visual languages 7.3 Need for formal languages 7.4 Architectural Description LanguagesACME 7.5 Case studies. Special topics: SOA and Web services,Cloud Computing, Adaptive structures	**6**	**Assignment-7**

Reference Books:

- Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
- Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
- Software Design, David Budgen, second edition, Pearson education, 2003
- Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
- Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education, 2006
- J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education, 2003.
- Design Patterns in C#, Steven John metsker, Pearson education, 2004.
- Pattern Oriented Software Architecture, F. Buschmann& others, John Wiley & Sons
- Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis, William J Brown et al., John Wiley, 1998
- Object-oriented analysis, design and implementation, brahma dathan, sarnathrammath, universities press,2013
- Design patterns, erich gamma, Richard helan, Ralph johman , john vlissides ,PEARSON Publication,2013.

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	1	2	1	1	1
CO2	3	3	2	3	3	3	3
CO3	3	3	1	2	1	2	2
CO4	2	2	1	2	1	2	2
CO5	3	3	2	3	2	3	3
CO6	3	3	1	2	1	2	2
CO7	3	3	1	2	1	2	2

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1 Justification of PO1 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to enriching knowledge in various IT areas, as it focuses on communication styles rather than the core technical aspects of the listed subjects.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence aligns strongly with enriching knowledge in IT areas, as it directly pertains to architecture, a key aspect mentioned in PO1.

CO3 - (Weightage: 3 - Strongly Related)Justification: Evaluating and selecting design patterns is strongly related to the objective of enriching knowledge, particularly in the context of design and analysis of algorithms and software design, which are explicitly mentioned in PO1.

CO4 - (Weightage: 2 - Moderately Related)Justification: Comparing software performance with the inclusion of design patterns is moderately related to enriching knowledge, as it provides insights into the practical implications of design choices, contributing to the understanding of software design.

CO5 - (Weightage: 3 - Strongly Related)Justification: Analysing and suggesting architectural design strongly aligns with the goal of enriching knowledge, especially in the context of architecture, which is emphasized in PO1.

CO6 - (Weightage: 3 - Strongly Related)Justification: Applying design patterns to software design is strongly related to enriching knowledge, as it directly involves practical application in software design, contributing to the understanding of design and programming languages mentioned in PO1.

CO7 - (Weightage: 3 - Strongly Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is strongly related to enriching knowledge, especially in the context of design and programming languages, as mentioned in PO1.

2 Justification of PO2 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to students understanding software applications and projects, as it focuses more on communication styles than the comprehensive understanding of software concepts.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence on business and development processes strongly aligns with students understanding all

dimensions of software applications and projects, as it directly involves key aspects of software architecture and development.
CO3 - (Weightage: 3 - Strongly Related)Justification: Evaluating and selecting design patterns is strongly related to students' understanding of software applications and projects, particularly in the context of making informed decisions in software design.
CO4 - (Weightage: 2 - Moderately Related)Justification: Comparing software performance with the inclusion of design patterns is moderately related to students' understanding of software applications and projects, as it provides insights into the practical implications of design choices.
CO5 - (Weightage: 3 - Strongly Related)Justification: Analysing and suggesting architectural design strongly aligns with the goal of students understanding all dimensions of software applications and projects, as it involves key aspects of software architecture.
CO6 - (Weightage: 3 - Strongly Related)Justification: Applying design patterns to software design is strongly related to students' understanding of software applications and projects, as it directly involves the practical application of design principles.
CO7 - (Weightage: 3 - Strongly Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is strongly related to students' understanding of software applications and projects, especially in the context of making informed design decisions.

3 Justification of PO3 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to students' understanding of computer subjects, as it focuses more on communication styles than the comprehensive understanding of programming and theoretical concepts.
CO2 - (Weightage: 2 - Moderately Related)Justification: Analysing architectural structures and their influence on business and development processes is moderately related to students' understanding of computer subjects, as it provides insights into broader architectural considerations but may not cover the entire spectrum of computer subjects.
CO3 (Weightage: 1 - Partially Related)Justification: Evaluating and selecting design patterns is partially related to students' understanding of computer subjects, particularly in the context of design and programming, but it does not comprehensively cover all programming and theoretical concepts.
CO4 - (Weightage: 1 - Partially Related)Justification: Comparing software performance with the inclusion of design patterns is partially related to students' understanding of computer subjects, as it focuses on a specific aspect (performance) and may not cover all programming and theoretical concepts.
CO5 - (Weightage: 2 - Moderately Related)Justification: Analysing and suggesting architectural design is moderately related to students' understanding of computer subjects, as it provides insights into architectural considerations but may not cover all aspects of programming and theoretical concepts.
CO6 - (Weightage: 1 - Partially Related)Justification: Applying design patterns to software design is partially related to students' understanding of computer subjects, as it focuses on a specific aspect of software design and may not comprehensively cover all programming and theoretical concepts.
CO7 - (Weightage: 1 - Partially Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is partially related to students' understanding of computer subjects, as it focuses on a specific aspect of design and programming.

4 Justification of PO4 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to developing in-house applications, as it may contribute to effective communication in the project but doesn't directly address the development of applications.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence on business and development processes strongly aligns with developing in-house applications, as it directly involves key aspects of software architecture in projects.

CO3 - (Weightage: 2 - Moderately Related)Justification: Evaluating and selecting design patterns is moderately related to developing in-house applications, as it contributes to making informed decisions in software design within the context of project development.

CO4 - (Weightage: 2 - Moderately Related)Justification: Comparing software performance with the inclusion of design patterns is moderately related to developing in-house applications, as it provides insights into the practical implications of design choices in a project setting.

CO5 - (Weightage: 3 - Strongly Related)Justification: Analysing and suggesting architectural design strongly aligns with developing in-house applications, as it directly involves key aspects of software architecture in the context of application development.

CO6 - (Weightage: 2 - Moderately Related)Justification: Applying design patterns to software design is moderately related to developing in-house applications, as it involves the practical application of design principles within the context of a project.

CO7 - (Weightage: 2 - Moderately Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is moderately related to developing in-house applications, as it contributes to effective software design decision-making in a project setting.

5 Justification of PO5 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to interacting with IT experts during visits, as effective communication styles may enhance the interaction but do not cover the entire scope of engaging with experts or gaining knowledge during visits.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence on business and development processes strongly aligns with interacting with IT experts and gaining knowledge during IT visits, as it directly involves key aspects of IT architecture and industry practices.

CO3 - (Weightage: 1 - Partially Related)Justification: Evaluating and selecting design patterns is partially related to interacting with IT experts during visits, as it may provide insights into design practices but does not comprehensively cover the spectrum of interactions with experts.

CO4 - (Weightage: 1 - Partially Related)Justification: Comparing software performance with the inclusion of design patterns is partially related to interacting with IT experts during visits, as it may touch on performance aspects but does not cover the full scope of expert interactions.

CO5 - (Weightage: 2 - Moderately Related)Justification: Analysing and suggesting architectural design is moderately related to interacting with IT experts during visits, as it involves discussions on architectural considerations, contributing to knowledge gained during visits.

CO6 - (Weightage: 1 - Partially Related)Justification: Applying design patterns to software design is partially related to interacting with IT experts during visits, as it may provide insights into practical applications but does not fully encompass the range of interactions with experts.

CO7 - (Weightage: 1 - Partially Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is partially related to interacting with IT experts during visits, as it touches on design decision-making but does not cover the complete scope of expert interactions.

6 Justification of PO6 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to getting industrial exposure through an internship, as effective communication styles may enhance the internship experience but do not directly address the core aspects of industrial exposure.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence on business and development processes strongly aligns with getting industrial exposure through an internship, as it directly involves key aspects of IT architecture and industry practices.

CO3 - (Weightage: 2 - Moderately Related)Justification: Evaluating and selecting design patterns is moderately related to getting industrial exposure through an internship, as it contributes to making informed decisions in software design within the context of an industrial setting.

CO4 - (Weightage: 2 - Moderately Related)Justification: Comparing software performance with the inclusion of design patterns is moderately related to getting industrial exposure through an internship, as it provides insights into the practical implications of design choices in an industrial context.

CO5 - (Weightage: 3 - Strongly Related)Justification: Analysing and suggesting architectural design strongly aligns with getting industrial exposure through an internship, as it directly involves key aspects of software architecture in an industrial setting.

CO6 - (Weightage: 2 - Moderately Related)Justification: Applying design patterns to software design is moderately related to getting industrial exposure through an internship, as it involves the practical application of design principles within the context of an industrial project.

CO7 - (Weightage: 2 - Moderately Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is moderately related to getting industrial exposure through an internship, as it contributes to effective software design decision-making in an industrial setting.

7 Justification of PO7 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Assisting learners in utilizing styles and views is partially related to making students employable and responsible citizens, as effective communication styles contribute to professionalism but do not cover the full spectrum of employability skills or responsible citizenship.

CO2 - (Weightage: 3 - Strongly Related)Justification: Analysing architectural structures and their influence on business and development processes strongly aligns with making students employable according to the current demand of the IT industry, as it directly involves key aspects of IT architecture and industry practices.

CO3 - (Weightage: 2 - Moderately Related)Justification: Evaluating and selecting design patterns is moderately related to making students employable, as it contributes to making informed decisions in software design within the context of industry demands.

CO4 - (Weightage: 2 - Moderately Related)Justification: Comparing software performance with the inclusion of design patterns is moderately related to making students employable, as it provides insights into the practical implications of design choices in the context of industry requirements.

CO5 - (Weightage: 3 - Strongly Related)Justification: Analysing and suggesting architectural design strongly aligns with making students employable according to the current demand of the IT industry, as it directly involves key aspects of software architecture in an industry setting.

CO6 - (Weightage: 2 - Moderately Related)Justification: Applying design patterns to software design is moderately related to making students employable, as it involves the practical application of design principles within the context of industry demands.
CO7 - (Weightage: 2 - Moderately Related)Justification: Repeated for emphasis, evaluating and selecting design patterns is moderately related to making students employable, as it contributes to effective software design decision-making in the context of industry requirements.

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code:** Comp5305
Title of Paper: Lab Course based on Comp5301 & Comp5303
Paper: V (Lab Course)
Credit: 4 (4 Hours Practical/Week/batch) **No. of Practical's:** 13

Course Outcome.

CO 1 - To understand why Android is a useful language for developers.
CO 2 - To learn how to write basic UI design programs.
CO 3 - To learn how to write thread and notification programs.
CO 4 - To learn how to write Intent and Toast in Android.
CO 5 - To learn how to Startup.
CO 6 - To learn how to use flutter.
CO 7 - To learn how to write web services

Sr.No	Practical Assignments
Mobile Technologies Practical Assignments Topics	
1	Assignment based on basic UI Design
2	Assignment based on Basic UI Design
3	Assignment based on Thread and Notification
4	Assignment based on handler on UI thread
5	Assignment based on using Intent, Toast
6	Assignment based on swift in ios
7	Assignment based on startup
8	Assignment based on flutter
Web services Practical Assignments Topics	
1	Introduction of Basic web services
2	Assignment on SOAP
3	Assignment on WSDL
4	Assignment on UDDI
5	Assignment on XML

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code:**Comp5306
Title of Paper: Projects- Lab Course **Paper:** VI **(E-II Lab Course)**
Credit: 4 (4 Hours Practical/Week/batch) **No. of Practical's:** 12

- The Project can be platform, language and technology independent.
- Project will be evaluated by the project guide.
- Assessment will be done weekly in the respective batch.
- Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.
- You should fill your status of project work on the progress report and get the signature of project guide regularly.
- Progress report should sharply focus how much time you have spent on specific task?
- You should keep all sign progress report.
- Project will not be accepted, if progress report is not submitted and all the responsibilities remain with student.

Roll No. & Name of Student:	
Title of the Project:	
Project Guide Name:	

Sr.No.	Date	Details of Project Work	Project Guide Sign (With Date)

Project Guide

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	3	3	2	3	3
CO2	3	3	3	3	2	3	3
CO3	2	3	3	3	2	3	3
CO4	3	3	3	3	2	3	3
CO5	2	3	3	3	2	3	3
CO6	2	3	3	3	2	3	3
CO7	3	3	3	3	2	3	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:

1. Justification of PO1 to ALL COs :

CO 1: Partially Related (Weightage: 1) - Understanding Android's scripting utility provides foundational knowledge, but its direct impact on specified areas may vary.

CO 2: Strongly Related (Weightage: 3) - Proficiency with lists, tuples, and dictionaries is fundamental for AI, web services, and other core computing subjects.

CO 3: Moderately Related (Weightage: 2) - Indexing and slicing skills are important for efficient data access, moderately contributing to various areas.

CO 4: Strongly Related (Weightage: 3) - Writing functions and passing arguments is crucial across algorithms, AI, and software project management.

CO 5: Moderately Related (Weightage: 2) - Building reusable modules is beneficial, with a moderate impact on several areas.

CO 6: Moderately Related (Weightage: 2) - File handling skills contribute moderately to data management in different computing domains.

CO 7: Strongly Related (Weightage: 3) - Designing object-oriented programs aligns well with software project management and mobile technologies.

2. **Justification of PO2 to ALL COs :**

PO2: Strongly Related (Weightage: 3) - Proficiency in Android (CO1-CO7) provides a comprehensive foundation for understanding software applications and projects across various dimensions.

3. Justification of PO3 to ALL COs :

PO3: Strongly Related (Weightage: 3) - Proficiency in Android (CO1-CO7) ensures a holistic understanding of computer subjects, combining theoretical concepts and practical programming, facilitated by the use of ICT.

4. Justification of PO4 to ALL COs :

PO4: Strongly Related (Weightage: 3) - Proficiency in Android (CO1-CO7) directly contributes to the development of in-house applications by providing essential scripting, data manipulation, modularization, and object-oriented programming skills.

5.Justification of PO5 to ALL COs :

PO5: Moderately Related (Weightage: 2) - Proficiency in Android (CO1-CO7) provides a foundational skill set for engaging with IT experts during visits, offering insights into scripting, data handling, modularization, and object-oriented programming aspects.

6.Justification of PO6 to ALL COs :

PO6: Strongly Related (Weightage: 3) - Proficiency in Android (CO1-CO7) enhances the effectiveness of the 6 months Industrial Internship by providing essential scripting, data manipulation, modularization, and object-oriented programming skills crucial in the IT industry.

7.Justification of PO7 to ALL COs :

PO7: Strongly Related (Weightage: 3) - Proficiency in Android (CO1-CO7) enhances employability by providing essential scripting, data manipulation, modularization, and object-oriented programming skills aligned with current IT industry demands, fostering responsible citizenship.

Class: M. Sc. (Computer Science) (Sem-III) **Paper Code :**Comp5307
Title of Paper: Internet of Things (IOT) **Paper:** VII **(E-III)**
Credit: 4 (4 Lectures/Week) **No. of lectures:** 48

Pre-Requisite: Basic understanding of electronics and microprocessors.

Course Objectives:

- The Internet of Things (IoT) is aimed at enabling the interconnection and integration of the physical world and the cyber space.
- To learn about SoC architectures, programming Raspberry Pi and implementation of internet of things and protocols.

Course Objectives:

- CO1-Enable learners to understand System on Chip Architectures.
- CO2-Introduction and preparing Raspberry Pi with hardware and installation.
- CO3-Learn physical interfaces and electronics of Raspberry Pi and program them using practical's
- CO4-Learn how to design IoT based prototypes.
- CO5-Able to understand the application areas of IOT ·
- CO6-Able to realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks
- CO7-Able to understand building blocks of Internet of Things and characteristics.

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Unit and Contents	No. Of Lectures
Unit 1: System on Chip (SoC) and Internet of Things (IoT) Overview - **System on Chip:** What is System on chip? Structure of System on Chip. - **SoC products:** Field Programmable Gate Array **(**FPGA**),** General Purpose Graphics Processing Units **(**GPU), Accelerated Processing Unit (APU), Compute Units. -**The IoT paradigm** giving overview of IoT supported Hardware platforms such as: Raspberry pi, SoC on ARM 8 Processors, Arduino and Intel Galileo boards. -**Network Fundamentals**: Wired Networking(Router, Switches), Wireless Networking (Access Points) **-Introduction to Raspberry Pi:** Introduction to Raspberry Pi, Raspberry Pi Hardware, Preparing your raspberry Pi. **-Raspberry Pi Boot:** Learn how this small SoC boots without BIOS. Configuring boot sequences and hardware. **-Introduction to IoT:** What is IoT? IoT examples, Simple IoT LED Program. **-IoT and Protocols** **-IoT Security:** HTTP, UPnp, CoAP, MQTT, XMPP**.** **-IoT Service as a Platform:** Clayster, Thinger.io, SenseIoT, carriots and Node RED. **-IoT Security and Interoperability:** Risks, Modes of Attacks, Tools for Security and Interoperability.	20
Unit 2: Programming Raspberry Pi **Raspberry Pi and Linux:** About Raspbian, Linux Commands, Configuring Raspberry Pi with Linux Commands **Programing interfaces:** Introduction to Node.js, Python. **Raspberry Pi Interfaces:** UART, GPIO, I2C, SPI **Useful Implementations:** Cross Compilation, Pulse Width Modulation, SPI for Camera.	10
Unit 3: Case Study & advanced IoT Applications:	10

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)	
Unit 4: Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	8

References:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning

2. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , ArshdeepBahga

3. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally

4. “Mobile Computing,” Tata McGraw Hill, Asoke K Talukder and Roopa R Yavagal, 2010.

5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition

6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition

7. “Fundamentals of Mobile and Pervasive Computing,” F. Adelstein and S.K.S. Gupta, McGraw Hill, 2009.

8. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010

Mapping of this course with Programme Outcomes

Course Outcomes	Programme Outcomes (POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	1	1	1	3	3
CO2	2	2	2	1	1	2	2
CO3	2	2	2	1	1	2	2
CO4	3	3	1	3	2	3	3
CO5	3	3	1	2	3	3	3
CO6	3	3	3	2	3	3	3
CO7	3	3	2	2	3	3	3

Weight: 1 - Partially related 2 - Moderately Related 3 - Strongly related

Course Objectives (CO) and Program Outcomes (PO) Mapping:
Justification of PO1 to ALL COs:
CO1 - (Weightage: 1 - Partially Related) Justification: Understanding System on Chip Architectures is partially related to enriching knowledge in the listed areas, as it provides insight into hardware architectures but doesn't cover the full spectrum of software and computing subjects.

CO2 - (Weightage: 2 - Moderately Related) Justification: Preparing Raspberry Pi involves practical knowledge

related to hardware and installation, moderately related to the goal of enriching knowledge in various IT areas. It aligns with the practical aspects of certain subjects.

CO3 - (Weightage: 2 - Moderately Related)Justification: Learning physical interfaces and electronics of Raspberry Pi is moderately related to enriching knowledge in IT areas, as it involves practical application but is more focused on specific hardware-related skills.

CO4 - (Weightage: 3 - Strongly Related)Justification: Designing IoT-based prototypes is strongly related to enriching knowledge in IT areas, particularly in the context of recent trends like IoT, involving a combination of software and hardware aspects.

CO5 - (Weightage: 3 - Strongly Related)Justification: Understanding the application areas of IoT strongly aligns with the goal of enriching knowledge in IT areas, as it directly pertains to a current trend and its applications.

CO6 - (Weightage: 3 - Strongly Related)Justification: Realizing the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks is strongly related to enriching knowledge in IT areas, focusing on current trends and their impact on computing.

CO7 - (Weightage: 3 - Strongly Related)Justification: Understanding the building blocks of IoT and its characteristics is strongly related to enriching knowledge in IT areas, specifically in the context of recent trends and technologies.

Justification of PO2 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Understanding System on Chip Architectures is partially related to students understanding all dimensions of software application and projects. While hardware understanding is beneficial, it doesn't comprehensively cover software application concepts.

CO2 - (Weightage: 2 - Moderately Related)Justification: Preparing Raspberry Pi involves practical knowledge related to hardware and installation, moderately related to the goal of understanding software application and projects. It introduces practical aspects but is hardware-centric.

CO3 - (Weightage: 2 - Moderately Related)Justification: Learning physical interfaces and electronics of Raspberry Pi is moderately related to understanding software application and projects, as it involves practical application but is more focused on specific hardware-related skills.

CO4 - (Weightage: 3 - Strongly Related)Justification: Designing IoT-based prototypes is strongly related to understanding software application and projects, especially in the context of IoT. It combines software and hardware aspects, contributing to a comprehensive understanding.

CO5 - (Weightage: 3 - Strongly Related)Justification: Understanding the application areas of IoT strongly aligns with the goal of understanding software application and projects, as it directly pertains to a current trend and its applications.

CO6 - (Weightage: 3 - Strongly Related)Justification: Realizing the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks is strongly related to understanding software application and projects, focusing on current trends and their impact on computing.

CO7 - (Weightage: 3 - Strongly Related)Justification: Understanding the building blocks of IoT and its characteristics is strongly related to understanding software application and projects, specifically in the context of recent trends and technologies. It contributes to a holistic understanding.

Justification of PO3 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Understanding System on Chip Architectures is partially related to students understanding computer subjects, as it provides insights into hardware but doesn't cover the full spectrum of programming and theoretical concepts.

CO2 - (Weightage: 2 - Moderately Related)Justification: Preparing Raspberry Pi involves practical knowledge related to hardware and installation, moderately related to understanding computer subjects. It introduces practical aspects but is hardware-centric.

CO3 - (Weightage: 2 - Moderately Related)Justification: Learning physical interfaces and electronics of Raspberry Pi is moderately related to understanding computer subjects, as it involves practical application but is more focused on specific hardware-related skills.

CO4 - (Weightage: 1 - Partially Related)Justification: Designing IoT-based prototypes is partially related to understanding computer subjects. While it involves practical application, the focus on hardware and IoT may not cover the full spectrum of computer subjects.

CO5 - (Weightage: 1 - Partially Related)Justification: Understanding the application areas of IoT is partially related to understanding computer subjects. While it involves application scenarios, it doesn't directly address programming or theoretical concepts.

CO6 - (Weightage: 3 - Strongly Related)Justification: Realizing the revolution of the Internet in various domains strongly relates to understanding computer subjects, especially in the context of recent trends and their impact on computing.

CO7 - (Weightage: 2 - Moderately Related)Justification: Understanding the building blocks of IoT is moderately related to understanding computer subjects, providing insights into specific technologies but not covering the full spectrum of programming and theoretical concepts.

Justification of PO4 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Understanding System on Chip Architectures is partially related to the development of in-house applications. While it provides insights into hardware, it doesn't directly cover the software development aspect of in-house applications.

CO2 - (Weightage: 1 - Partially Related)Justification: Preparing Raspberry Pi with hardware and installation is partially related to developing in-house applications. It involves practical knowledge but focuses more on hardware preparation than the software development aspect.

CO3 - (Weightage: 2 - Moderately Related)Justification: Learning physical interfaces and electronics of Raspberry Pi is moderately related to developing in-house applications. While it involves practical application, it is more focused on hardware-related skills.

CO4 - (Weightage: 3 - Strongly Related)Justification: Designing IoT-based prototypes is strongly related to developing in-house applications. It involves both hardware and software aspects, contributing to a comprehensive understanding of project development.

CO5 - (Weightage: 2 - Moderately Related)Justification: Understanding the application areas of IoT is moderately related to developing in-house applications. While it provides context for potential applications, it doesn't directly address the development process.

CO6 - (Weightage: 2 - Moderately Related)Justification: Realizing the revolution of the Internet in various domains is moderately related to developing in-house applications. It provides context but may not directly contribute to the practical aspects of application development.

CO7 - (Weightage: 2 - Moderately Related)Justification: Understanding the building blocks of IoT is moderately related to developing in-house applications. It provides insights into specific technologies but may not cover the full spectrum of software development.

Justification of PO5 to ALL COs:

CO1 - (Weightage: 1 - Partially Related)Justification: Interacting with IT experts and knowledge by IT visits is partially related to understanding System on Chip Architectures. While it may provide exposure to expert insights, it doesn't specifically focus on the mentioned architectural understanding.

CO2 - (Weightage: 1 - Partially Related)Justification: Interacting with IT experts and knowledge by IT visits is partially related to preparing Raspberry Pi with hardware and installation. While it may provide practical exposure, it is not directly aligned with the process of hardware preparation.

CO3 - (Weightage: 1 - Partially Related)Justification: Interacting with IT experts and knowledge by IT visits is partially related to learning physical interfaces and electronics of Raspberry Pi. While it may offer practical exposure, it doesn't specifically target these hardware-oriented skills.

CO4 - (Weightage: 2 - Moderately Related)Justification: Interacting with IT experts and knowledge by IT visits is moderately related to learning how to design IoT-based prototypes. It may provide insights into IoT applications but doesn't directly involve the design process.

CO5 - (Weightage: 3 - Strongly Related)Justification: Interacting with IT experts and knowledge by IT visits is strongly related to understanding the application areas of IoT. It provides direct exposure to real-world applications and expert insights.

CO6 - (Weightage: 3 - Strongly Related)Justification: Interacting with IT experts and knowledge by IT visits is strongly related to realizing the revolution of the Internet in various domains. It offers exposure to current trends and expert perspectives.

CO7 - (Weightage: 3 - Strongly Related)Justification: Interacting with IT experts and knowledge by IT visits is strongly related to understanding the building blocks of IoT and its characteristics. It provides exposure to foundational knowledge and expert insights.

Justification of PO6 to ALL COs:

CO1 - (Weightage: 3 - Strongly Related)Justification: The industrial internship is strongly related to understanding System on Chip Architectures. Practical exposure in the industry can provide insights into real-world applications and implementations.

CO2 - (Weightage: 2 - Moderately Related)Justification: The industrial internship is moderately related to the introduction and preparation of Raspberry Pi with hardware and installation. While it may involve practical aspects, the specific focus on Raspberry Pi may vary in an industrial setting.

CO3 - (Weightage: 2 - Moderately Related)Justification: The industrial internship is moderately related to learning physical interfaces and electronics of Raspberry Pi. The application of these skills in an industry context may differ from classroom-based learning.

CO4 - (Weightage: 3 - Strongly Related)Justification: The industrial internship is strongly related to learning how to design IoT-based prototypes. It provides a real-world environment for applying IoT design principles and skills.

CO5 - (Weightage: 3 - Strongly Related)Justification: The industrial internship is strongly related to understanding the application areas of IoT. Exposure to real-world projects can enhance understanding and application knowledge.

CO6 - (Weightage: 3 - Strongly Related)Justification: The industrial internship is strongly related to realizing the revolution of the Internet in various domains. Practical experience in the industry can provide insights into current trends and advancements.

CO7 - (Weightage: 3 - Strongly Related)Justification: The industrial internship is strongly related to understanding the building blocks of IoT and its characteristics. Practical exposure in an industrial setting can deepen the understanding of IoT components and their functionalities.

Justification of PO7 to ALL COs:

CO1 - (Weightage: 3 - Strongly Related)Justification: Understanding System on Chip Architectures is strongly related to making learners employable in the IT industry. This knowledge is valuable for various roles, especially in hardware and embedded systems.

CO2 - (Weightage: 2 - Moderately Related)Justification: Introduction and preparing Raspberry Pi are moderately related to making learners employable. While practical skills are valuable, the direct applicability may vary based on industry demands.

CO3 - (Weightage: 2 - Moderately Related)Justification: Learning physical interfaces and electronics of Raspberry Pi is moderately related to employability. Practical programming skills enhance employability, but the specific focus on Raspberry Pi may be context-dependent.

CO4 - (Weightage: 3 - Strongly Related)Justification: Learning how to design IoT-based prototypes is strongly related to making learners employable in the IT industry. IoT skills are in demand, and hands-on experience in designing prototypes is valuable.CO5 - (Weightage: 3 - Strongly Related)Justification: Understanding the application areas of IoT is strongly related to employability. Knowledge of IoT applications aligns with current

industry demands.CO6 - (Weightage: 3 - Strongly Related)Justification: Realizing the revolution of the Internet in various domains is strongly related to employability. Awareness of technological advancements is crucial in meeting industry demands.CO7 - (Weightage: 3 - Strongly Related)Justification: Understanding the building blocks of IoT and its characteristics is strongly related to making learners employable. This foundational knowledge is essential for roles related to IoT development and implementation.