DEPARTMENT OF COMPUTER SCIENCE

PREAMBLE

UG   : Programme Profile and Syllabi of courses offered in V& VI semesters along with evaluation components III &IV (With effect from 2018-2021 batch onwards).

PROGRAMME PROFILE B.Sc Computer Science

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon Completion of the Programme, the Students will able to

- Understand, analyze, design, develop and optimize solutions related to Computer programming languages.

- Apply the concepts in core areas related to computer programming for efficient design of computer-based systems of varying complexity.

- Test the technical issues in Software Engineering and deliver a quality product for business success.

- Innovate and develop new technologies.

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/ Week	Credit Min/Max
I	I	Language	UTAL105/ UTAL106/ UHIL101/ UFRL101	Basic Tamil-I/ Advanced Tamil-I/ Hindi-I/ French-I	-	4	2/3
	II	English	UENL107/ UENL108	General English-I/ Advanced English-I	-	5	¾
	III	Core I	UCSM106/ UCAM107	Programming in C	UCSM104	6	5
	III	Core II	UCSM107/ UCAM108	Fundamental of Computer Science	UCSM105	5	4
			UCSM108/ UCAM109	Advanced Computer Science	UCSM106		
	III	Core III	UCSR109/ UCAR105	Programming in C - Practical	UCSR107	3	2
	III	Allied I	UMAA113	Statistical Methods	-	5	4
	IV	Value Education				2	1
					Total	**30**	**21/23**
II	I	Language	UTAL205/ UTAL206/ UHIL201/ UFRL201	Basic Tamil-II/ Advanced Tamil-II/ Hindi-II/ French-II	-	4	2/3
	II	English	UENL207/ UENL208	General English-II/ Advanced English-II	UENL205/ UENL206	5	3/4
	III	Core IV	UCSM206/ UCAM205	Data Structures	UCSM205	6	6
	III	Core V	UCSR206/ UCAR204	Data Structures - Practical	UCSR204	4	3

	III	Allied II	UMAA210	Mathematics for Computer Science	-	5	4
	IV	Non Major Elective				4	2
	IV	Soft Skill				2	1
	V	Extension Programme / Physical Education/ NCC				-	1/2
					Total	**30**	**22/25**
III	I	Language	UTAL305/ UTAL306	Basic Tamil-III / Advanced Tamil–III	-	4	2/3
			UHIL301/ UFRL301	Hindi-III / French-III	-		
	II	English	UENL307/ UENL308	General English-III/ Advanced English-III	UENL305/ UENL306	5	¾
	III	Core VI	UCSM305/ UCAM310	Java Programming	UCSM304	5	5
	III	Core VII	UCSM306	Microprocessor and its Applications	UCSM608	4	4
	III	Core VIII	UCSR308/ UCAR304	Java Programming – Practical	UCSR305	4	3
	III	Allied III	UPHA304	Digital Electronics	UPHA303	3	3
	III	Allied IV	UPHR304	Digital Electronics – Practical	-	3	2
	IV	Value Education				2	1
					Total	**30**	**23/25**
IV	I	Language	UTAL405/ UTAL406/	Basic Tamil-IV / Advanced Tamil–IV	-	4	2/3
			UHIL401/ UFRL401	Hindi-IV / French-IV	-		
	II	English	UENL407/ UENL408	General English-IV / Advanced English-IV	UENL405/ UENL406	5	¾
	III	Core IX	UCSM408	Graphics & Multimedia	UCSM608/ UCSM610	6	6
	III	Core X	UCSM409/ UCSM609	Operating System	UCSM506	5	5
	III	Core XI	UCSR411	Operating System & Graphics Lab	UCSR606	5	3
	IV	Online courses		NPTEL/SPOKEN TUTORIAL/SWAYAM		3	½
		Soft skill				2	1
	V	Extension Programme / Physical Education				-	0/2
					Total	**30**	**21/26**
V	III	Core XII	UCSM506	Middleware Technologies	-	5	5
	III	Core XIII	UCSM509	Database Systems	UCSM407	5	4
	III	Core XIV	UCSM510	Computer Networks	UCSM506	5	5
	III	Core XV	UCSM511	Software Engineering	UCSM504	5	4

	III	Core XVI	UCSR509	Middleware Technologies – Practical	-	4	3
	III	Core XVII	UCSR511	Database Systems-Practical	UCSR404	4	3
	IV	Value Education				2	1
					Total	**30**	**25**
VI	III	Core XVIII	UCSM612	Cloud Computing	-	5	5
	III	Core XIX	UCSM613	Open Source Technology	UCSM508	5	5
	III	Core XX	UCSM610	Big Data Tools	-	4	4
	III	Core XXI	UCSR607	Open Source Technology-Practical	UCSR508	4	3
	III	Core XXII	UCSP601	Project		5	5
	III	Major-Elective	(UCSO606/ UCAO606)/ UCSO607/ UCSO608	Network Security / Mobile Computing /Internet of Things	-	5	4
	III	Viva – Voce	UCSM611	Comprehensive Viva Voce	-	-	1
	IV	Soft skill				2	1
	V	Extension Programme / Physical Education/ NCC				-	0/2
					TOTAL	**30**	**28/30**
					GRAND TOTAL	**180**	**140/154**

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

Class & Major	Semester	Category	Course Code	New Course Title	Previous Course Code	Contact Hrs/ Week	Credit Min/Max
B.Com with Computer Applications	I	Allied	UCSA104	C Programming	-	3	3
	I	Allied Practical	UCSR110	C Programming Lab	-	3	2
	II	Allied	UCSA204	Object Oriented Programming	-	3	3
	II	Allied Practical	UCSR207	Object Oriented Programming – Lab	-	3	2
	III	Allied	UCSA305	Fundamentals of Blockchain Technology	-	3	3
	III	Allied Practical	UCSR309	Blockchain Technology Using Solidity – Lab	-	3	2
	IV	Allied	UCSA406	Digital Marketing Analytics	-	3	3
	IV	Allied Practical	UCSR412	Web Design - Lab	-	3	2
	V	Allied	UCSA509	Business Analytics and Intelligence.	UCSA508	3	3
	V	Allied Practical	UCSR512	Business Analytics and Intelligence using SAS - Lab	UCSR511	3	2

BBA, B.Com and Economics	IV	Allied	UCSA407	Cyber Security in Finance	-	3	3
	IV	Allied Practical	UCSR413	Cyber Security Lab	-	3	2
Tamil	V	Allied	UCSA505	Tamil Kanini	-	3T+2P	5
Maths	III	Allied	UCSA304	Mathematical Programming using C	-	3	3
	III	Allied Practical	UCSR307	Mathematical Programming using C – Lab	-	3	2
	V	Allied	UCSA507	Object Oriented Programming using Java	-	3	3
	V	Allied Practical	UCSR508	Object Oriented Programming using Java - Lab	-	3	2
Physics	III	Allied	UCSA306	Computational Physics with Python	-	3	3
	III	Allied Practical	UCSR310	Computational Physics with Python – Lab	-	3	3

NON-MAJOR ELECTIVE

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/week	Credit Min/Max
II	IV	Non Major Elective	UCSE206	Tableau Programming	UCSE202	2T+2P	2
			UCSE207	Python Programming	UCSE203	4P	2
			UCSE208	R Programming	UCSE204	4P	2
			UCSE209	Arduino Programming	UCSE205	4P	2

EXTRA CREDIT EARNING PROVISION

Semester	Part	Category	Course Code	Course Title	Contact Hrs/week	Credit Min	Credit Max
II	III	Core	UCSI201	Summer Internship / Working Model	-	-	1
IV	III	Core	UCSI401	Summer Internship	-	-	1
V	III	Self Study Paper	UCSS501	Python Programming	2	1	1
V	III	Self Study Paper	UCSS502/ UCAS502	Android Applications	2	1	1
VI	III	Self Study Paper	UCSS601/ UCAS601	Angular JS	2	1	1
VI	III	Self Study Paper	UCSS602/ UCAS602	Green Computing	2	1	1

Inclusion of Experiential Learning

A. Experiential Learning (Mandatory)

Course Mapping				Collaborating Agency - MSME		
Sem	Course Code	Course Title	Assessment	Course Title	Hours/Days /Month	Mode of Evaluation
VI	UCSM610	Big Data Tools	Component IV	Data Analytics certification	4 Days	Reflection

B. Skill Orientation Programme (Only for Interested students) – Extra Credit Earning Provision

Sem	Category	Course Code	Course Title	Collaborating Agency	Hours/ Days/Month	Mode of Evaluation	Credits (Min/Max)
V	Core	UCST501	Robotics Process Automation	**MSME**	4 Days	Reflection	1

MIDDLEWARE TECHNOLOGIES
UCSM506

Semester	**: V**	**Credit**	**: 5**
Category	**: Core IX**	**Hours / Week : 5**	
Class & Major : III B.Sc CS		**Total Hours : 65**	

Objectives:
To enable the students

- Understand Principles of programming using a .NET Framework.
- Analyze the importance of server side programming and web development.
- Develop applications for distributed environments.

Learning Outcomes:
On Completion of the course, the students will be able to

- Ability to study the set of services that a middleware system constitutes of.

- Understand how middleware facilitates the development of distributed applications in heterogeneous environments.

- Design the basics of Web services that are the most oft-used middleware technique.

UNIT - I .NET FRAMEWORK   **12 Hrs**

Introduction to .NET – Benefits of .NET Framework – The ASP.NET Technologies – The ASP.NET Life Cycle – Understanding ASP.NET 4.0 Page Directives –Working with Server Controls – Implementing Code Sharing- Compilation in ASP.NET 4.0.

UNIT - II APPLICATION STRUCTURE AND STATE   **12 Hrs**

Structure of an Application - The Application Domain - The Application Lifetime - The Application Directory Structure - The Global. asax Application File - Using States - HTTP Handlers - Postback and Cross-Page Posting.

UNIT - III WEB STANDARD CONTROLS   **15 Hrs**

The Control Class - The Web Control Class - Label - Button – Text Box - Literal – Place Holder - Hidden Field - File Upload - Image - Image Button - Image Map - ListBox – Drop Down List – Bulleted List – Hyper Link – Link Button – Check Box – Check Box List – Radio Button – Radio Button List – Table – Panel – Wizard - Xml – View – Multi View – Substitution – Localize – Calendar – Ad Rotator.

UNIT - IV OTHER WEB CONTROLS   **13 Hrs**

Navigation Controls: Tree View – Menu – Site MapPath. Validation Controls: Base Validator – Required Field Validator- Range Validator – Regular Expression Validator – Compare Validator – Custom Validator – Validation Summary.

UNIT - V DATABASE CONTROLS   **13 Hrs**

Working with Database Controls: Grid View - Data List - Details View - Form View – List View- Repeater – Data Pager – Chart – Query Extender –Sql Data Source – Access Data Source- Link Data Source – Object Data Source – Xml Data Source – Entity Data Source – Site Map Data Source.

Text Book
- Kogent. *(2012), ASP.NET 4.0 Black Book.* Dreamtech Press publications.

Reference Book
- Kogent.*(2011), .NET 4.0 programming (6-in-1) Black book.* Dreamtech Press publications.

E- Resource
- https://www.tutorialspoint.com/asp.net/asp.net_tutorial.pdf

DATABASE SYSTEMS
UCSM509

Semester	**: V**	**Credits**	**: 4**
Category	**: Core XIII**	**Hours/Week**	**: 5**
Class& Major	**: III B.Sc Computer Science**	**Total Hours**	**: 65**

Objectives:

To enable the students
- Understand the concepts of DBMS
- Design the ER diagram for database
- Create database using SQL queries and normal forms

Learning Outcomes:

On Completion of the course, the students will be able to
- Understand DB concepts and structures and also query language
- Apply various normalization techniques
- Design and build a simple database

UNIT - I INTRODUCTION   8 Hrs

Purpose of database system – Data models – database languages – Transaction management – Storage management – DBA – Database users – System structure.

UNIT - II RELATIONAL DATABASE   9 Hrs

Structure – Fundamental and Additional Relational Algebra operations – Tuple Relational Calculus – Domain Relational Calculus.

UNIT - III DATABASE DESIGN AND ER MODEL   10 Hrs

Overview of design process – Entity relationship model – Mapping Cardinalities – ER Diagrams – Extended ER Features.

UNIT - IV RELATIONAL DATABASE DESIGN   12 Hrs

Features of good relational designs – Decomposition using functional dependencies –Functional Dependencies – Normal forms based on primary keys – second & third Normal forms – Boyce-codd Normal Form – Properties of Relational Decompositions – Multi-valued Dependencies & Fourth Normal Form – Join Dependencies & Fifth Normal Form.

UNIT -V SQLAND ORACLE   13 Hrs

Basic Structure of SQL Queries – Set operations – Aggregate functions – Null values –nested sub queries – Complex Queries – Views – Modification of Databases – Joined Relations. **Advanced SQL:** Embedded SQL – Dynamic SQL – Oracle - Introduction – SQL (DDL, DML, DCL Commands) – Integrity Constraints – PL/SQL – PL/SQL Block – Procedure, Function – Cursor management – Triggers – Exception Handling.

Text Book
- Abraham Silberchatz, Henry F. Korth, S. Sudharshan. (2005). *Database System Concepts.* (5[th]ed.,). McGraw Hill. New Delhi.

Reference Book
- Elmasri, Navathe, Somayajulu, Gupta.(2008**).** *Fundamentals of Database Systems*.(4[th]ed.,). Pearson Education. New Delhi.

E-Resources
- http://www.w3schools.com/html/
- http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/
- http://engineerportal.blogspot.in/2013/09/database-system-concepts-6th-edition.html

COMPUTER NETWORKS
UCSM510

Semester	**: V**	**Credits**	**: 5**
Category	**: Core XIV**	**Hours/Week**	**: 5**
Class &Major : III B.Sc (CS)		**Total Hours**	**: 65**

Objectives:

To enable the students

- Understand the concepts of computer networks and layered approach
- Apply signals for transfer data between nodes
- Implement routing entries given a simple example of network topology

Learning Outcomes:

On Completion of the course, the students will be able to

- Learn the concepts of computer network hardware and software operate
- Investigate the fundamental issues driving network design
- Apply the network technologies in various development

UNIT- I INTRODUCTION TO NETWORK   14 Hrs

Introduction to network: Uses - Network Hardware: LAN – WAN – MAN – Wireless – Home Networks. Network Software: Protocol Hierarchies – Design Issues for the Layers – Connection-oriented and connectionless services – Service Primitives – The Relationship of services to Protocols. Reference Models: OSI Reference Model – TCP/IP reference Model – Comparison of OSI and TCP/IP – Critique of OSI and protocols – Critique of the TCP/IP Reference model

UNIT- II PHYSICAL LAYER   12 Hrs

Physical layer: Guided Transmission Media: Magnetic Media – Twisted Pair Coaxial Cable – Fiber Optics. Communication Satellites: Geostationary, Medium – Earth Orbit, Low Earth Orbit – Public Switched Telephone Network: Structure of telephone network – local loops – Modems – Switching techniques.

UNIT- III DATA LINK LAYER   12 Hrs

Data link layer: Data link layer design issues – Error Detection and correction – Medium Access Control Sub Layer: Multiple Access Protocols – ALOHA – Wireless LAN Protocols. Bluetooth: Bluetooth Architecture – Bluetooth application.

UNIT- IVNETWORK LAYER   15 Hrs

Network Layer: Routing algorithms: The optimality Principle – Shortest path routing – Routing for mobile hosts – Congestion Control Algorithms. Transport Layer: The Transport 57 Service –Services Provided to the Upper Layers. TCP: Introduction to TCP – The TCP Service Model – The TCP Protocol – TCP Connection Establishment and Connection Release.

Application Layer: DNS – The Domain Name System

UNIT- V ROUTING   12 Hrs

ROUTING: Routing (RIP, OSPF, metrics)–Switch basics–Global Internet (Areas, BGP,IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)

Text Books
- James F. Kurose, Keith W. Ross. (2009). *Computer Networking – A Top-Down Approach Featuring the Interne*. (5thed.,). Pearson Education.

Reference Books
- Behrouz A. Forouzan. (2011). *Data communication and Networking*. (4thed.,).Tata McGraw – Hill.

E-Resources
- http://www.w3schools.com/html/
- https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

SOFTWARE ENGINEERING
UCSM511

Semester : V	**Credits**	:4
Category : Core XV	**Hours/Week**	: 5
Class & Major: III B.Sc CS	**Total Hours**	: 65

Objectives:
To enable the students
- Define the requirements of software
- Analyse the role of project management including planning, scheduling, risk management, etc
- Evaluate the software measurement and software risks

Learning Outcomes:
On Completion of the course, the students will be able to
- Identify the phases in a software project
- Apply the requirements engineering and Analysis Modeling.
- Implement the software engineering to adopt to readily changing environments using the appropriate theory principles and processes

UNIT - I SOFTWARE PROCESS AND AGILE DEVELOPMENT   10Hrs

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT- II REQUIREMENTS ANALYSIS AND PECIFICATION 15Hrs

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT- III SOFTWARE DESIGN   10 Hrs

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow-User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT -IV TESTING AND MAINTENANCE   15 Hrs

Software testing fundamentals-Internal and external views of Testing-white box testing – basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT- V PROJECT MANAGEMENT   15 Hrs

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection – Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

Text Book

- Roger S. Pressman. (2010). S*oftware Engineering – A Practitioner's Approach.* (7th ed.,). McGraw-Hill International Edition.

Reference Books

- Rajib Mall. (2009). *Fundamentals of Software Engineering.* (3rd ed.,). PHI Learning Private Limited.

E-Resources

- https://sovannarith.files.wordpress.com/2012/07/software-engineering-9th-ed-intro-txt-i-sommerville-pearson_-2011-bbs.pdf
- http://dinus.ac.id/repository/docs/ajar/Sommerville-Software-Engineering-10ed.pdf
- http://dinus.ac.id/repository/docs/ajar/RPL7th_ed_software_engineering_a_practitioners_approach_by_roger_s._pressman_.pdf

MIDDLEWARE TECHNOLOGIES – PRACTICAL
UCSR509

Semester : V   **Credits** : 3
Category : Core Practical VII   **Hours/Week** : 4
Class & Major : III B.Sc CS   **Total/Hours** : 52

Objectives:
To enable the students
- Improve the programming skills in NET.
- Design a database with enhanced models and techniques.
- Create web based applications for distributed environments.

Learning Outcomes:

On Completion of the course, the students will be able to
- Implement the set of services that a middleware system constitutes of.
- Understand how middleware facilitates the development of distributed applications in heterogeneous environments.
- Design the basics of Web services that is the most oft-used middleware technique.

LAB EXERCISES:

1. Create a feedback application using web controls.
2. Create a web page using Image map and calendar control.
3. Create a web page using File Upload, Hyperlink and Link button.
4. Creating and Using a Simple User Control.
5. ADO.NET application to insert, delete, update records in database.
6. Create a simple web page using all validation controls.
7. Create a web page using ad rotator & menus.
8. Create a web page using grid view, form view, detail view and list view.
9. Data List and Repeater control.
10. Create a web page to manage the session.

DATABASE SYSTEMS – PRACTICAL
UCSR511

Semester : V   **Credit** : 3
Category : Core Practical XVII   **Hours/Week** : 3
Class & Major : III B.Sc Computer Science   **Total Hours** : 39

Course Objectives:

To enable the students
- Develop practical skills on various queries, views ,indexes, triggers in SQL
- Design the database for different application.
- Implement the techniques to access the database

Learning Outcomes:

On Completion of the course, the students will be able to

- Understand, appreciate and effectively the concepts of database technologies
- Design and implement a database schema for a given problem domain
- Implement PL/SQL including procedures, functions, cursors and packages

Lab Exercises

1. Create a Student Information and Mark Details database using DDL, DML, TCL and DCL.

2. Create a Library database and perform the Aggregate Function & SET Operations.

3. Create a Hospital database and perform the Inner and Outer Joins Operations.

4. Create Bank database and query it using Group by having and Order by.

5. Create Employee database and query it using sub queries.

6. Create Views and indexes for the Phone Directory database.

7. Create PL/SQL Block for Mark Sheet processing.

8. Create the Procedures for Stock Management database.

9. Create the Functions for Real Estate database.

10. Create different types of Triggers for Event Management database.

Note: All the tables should be created with Constraints.

CLOUD COMPUTING
UCSM612

Semester : VI	**Credit** : 5
Category : Core XVIII	**Hours/Week : 5**
Class & Major : III B.Sc CS	**Total Hours : 65**

Objectives:

To enable the students

- Understand the concepts of cloud computing
- Appreciate the evolution of cloud from the existing technologies
- Analyze the services on the various issues in cloud computing

Learning Outcomes:

On Completion of the course, the students will be able to

- Understand the services of cloud computing
- Apply the architecture of compute and storage cloud, service and delivery models
- Evaluate the various ideas of cloud computing, paradigm, benefits, current and future challenges

UNIT- I INTRODUCTION   12 Hrs

Cloud Computing Foundation: Introduction to Cloud Computing. Evolution of Cloud Computing: Hardware Evolution - Internet Software Evolution - Server Virtualization

UNIT- II WEB SERVICES DELIVERED FROM THE CLOUD   13 Hrs

Communication-as-a-Service (CaaS)- Infrastructure-as-a-Service (IaaS)- Monitoring-as-a-Service (MaaS)- Platform-as-a-Service (PaaS)- Software-as-a-Service (SaaS).Building Cloud Networks: Cloud Data Center- Collaboration- Service-Oriented Architectures- Data Center-Based SOA- Open Source Software Is Used

UNIT- III FEDERATION, PRESENCE AND PRIVACY IN THE CLOUD   13 Hrs

Federation in the Cloud: Four Levels of Federation- Federated Services and Applications-Protecting and Controlling- Future of Federation. Presence in the Cloud: Presence Protocols-Leveraging Presence- Presence Enabled Future of Presence- Identity-as-a-Service (IaaS)-Compliance-as-a-Service (CaaS)- Future of Identity. Privacy to Cloud-Based: Privacy Risks and the Cloud- Protecting Privacy information- Future of Privacy

UNIT -IV SECURITY IN THE CLOUD   14 Hrs

Cloud Security Challenges- Software-as-a-Service Security: Security Management (People)-Security Governance -Risk Management -Risk Assessment -Security Awareness - Education and Training -Secure Software Development Life Cycle (Sec SDLC)- Security Architecture Design- Security Images -Data Privacy - Data Security - Application Security-Virtual Machine Security.

UNIT- V FOG AND EDGE COMPUTING   13 Hrs

Internet of Things and new Computing Paradigm – Addressing the Challenges in Federating Edge Resources – Integrating IOT, Cloud Infrastructures – Management and Orchestration of Network Slices in 5G,Fog,Edge and Clouds- Optimization problems in Fog and Edge Computing.

Text Books

- Rittinghouse, John W, & James F. Ransome. (2017).*Cloud Computing:implementation. Management and Security*. CRC Press.
- Rajkumar Buyya,Satish Narayana Sriama. (2019). *Fog and Edge Computing. Principles and Paradigms*.wiley Publication.

Reference Book

- Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi.(2013). *Mastering Cloud Computing*. Tata Mcgraw Hill.

E-Resources
- http://www.w3schools.com/html/
- https://www.tutorialspoint.com/cloud_computing/index.htm

OPEN SOURCE TECHNOLOGY
UCSM613

Semester : VI		**Credit** : 5
Category : Core XIX		**Hours/Week** : 5
Class & Major : III B.Sc CS		**Total Hours** : 65

Objectives:
To enable the students

- Understand the context and operation of open source software communities and associated software projects.
- Analyze the familiar queries with participating in a J Query
- Apply the scripting language like J Son or Perl

Learning Outcomes:
On Completion of the course, the students will be able to

- Define a basic idea of open source technology and their software development process
- Understand the role and future of open source software
- Develop web page with dynamic changes

UNIT – I INTRODUCTION   13 Hrs

Introduction- open source-PHP – history – features – variables – statements – operators conditional statements – if – switch – nesting conditions – merging forms with conditional statements – loops – while do – for loop iteration with break and continue.

UNIT – II ARRAYS AND FUNCTIONS   13 Hrs

Arrays: Creating an array – modifying array – processing array – grouping form with arrays – using array functions – creating user defined functions – using files – sessions – cookies – executing external programs – Creating sample applications using PHP.

UNIT – III MYSQL   13 Hrs

Effectiveness of MySQL – MySQL Tools – Prerequisites for MySQL connection – Databases and tables – MySQL data types – Creating and manipulating tables – Insertion, updation and deletion of rows in tables – Retrieving data – Sorting and filtering retrieved data – Advanced data filtering – Data manipulation functions – Aggregate functions – Grouping data – Sub queries – Joining Tables – Set operators – Full text searching.

UNIT – IV PHP WITH MYSQL   13 Hrs

Working MySQL with PHP – database connectivity – usage of MYSQL commands in PHP, processing result sets of queries –handling errors – debugging and diagnostic functions – validating user input through Database layer and Application layer – formatting query output with Character, Numeric, Date and time – sample database applications.

UNIT – V J QUERY USER INTERFACE   **13 Hrs**

Intro to jQuery UI – Need of jQuery UI in real web sites – Downloading and Importing j Query UI – Draggable – Droppable – Resizable – Selectable – Sortable – Accordion – Auto Complete – Date Picker – Dialog – Menu – Progress Bar – Slider – Spinner – Tabs – Tooltip – Color Animation – Easing Effects – addClass – removeClass – Effects – jQuery UI themes – Customizing jQuery UI widgets / plug-ins – jQuery UI with CDN – Consuming jQuery Plug-– Regular expressions.

Text Books
- VikramVaswani,. (2015). *PHP and MySQL*. Tata McGraw-Hill.
- Ben Forta.(2016). *MySQL Crash course* SAMS.
- Dan Wellman. (2016). *jQuery UI 1.8: The User Interface Library for jQuery*. Packt Publishing. Brimingham–Mumbai.
- Rebecca Murphey. (2017). *jQuery Fundamentals.(1st ed.,).* Superhero Labs Publisher.

Reference Books
- Tim Converse, Joyce Park and Clark Morgan. (2008). *PHP 5 and MySQL*. Wiley India reprint. Robert Sheldon. Geoff Moes.

E-Resources
- http://www.w3schools.com/html/
- https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_open_source_software.htm

BIGDATA TOOLS
UCSM610

Semester	**: VI**	**Credit**	**:4**
Category	**: Core XIV**	**Hours/week**	**:4**
Class & Major	**: III B.Sc CS**	**Total Hours**	**:52**

Objectives:
To enable the students
- Understand the basics concepts of Big data use cases and solutions.
- Build and maintain reliable, scalable, distributed systems with Apache Hadoop and also write Map-Reduce based Applications.
- Learn difference between conventional SQL and No SQL (MongoDB) query language.
- Design Mongo DB based Big data Applications.

Learning Outcomes:
On Completion of the course, the students will be able to
- Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
- Ability to understand and apply scaling up Hadoop techniques and associated computing techniques and technologies.

- Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

UNIT - I INTRODUCTION   10 Hrs

Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, and Big data applications. Algorithms using Map Reduce

UNIT - II HADOOP   11 Hrs

Big Data – Apache Hadoop & Hadoop EcoSystem– Moving Data in and out of Hadoop – Understanding inputs and outputs of Map Reduce - Data Serialization.

UNIT - III HDFS, HIVE AND HIVEQL, HBASE   10 Hrs

HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data- Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase concepts- Advanced Usage, Schema Design, Advance Indexing- PIG, Zookeeper- how it helps in monitoring a cluster, H Base uses Zookeeper and how to Build Applications with Zookeeper.

UNIT - IV SPARK & NoSQL   10 Hrs

Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.   NoSQL – Uses - Types of NoSQL databases - Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, New SQL

UNIT - V DATA BASE FOR THE MODERN WEB   11 Hrs

Introduction to Mongo DB - key features, Core Server tools - Creating and Querying through Indexes, Constructing queries on Databases - Collections and Documents - MongoDB Query Language.

Text Books

- Chris Eaton, Dirk derooset al.(2012).*Understanding Big data.* McGraw Hill.
- Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, *Professional Hadoop Solutions*. Wiley.
- Sima Acharya, Subhashini Chhellappan. Willey Mongo DB in Action. Kyle Banker. Piter Bakkum , *BIG Data and Analytics*. Shaun Verch. Dream tech Press.

Reference Books

- VigneshPrajapati.(2013). *Big Data Analyticswith R and Haoop*. Packet Publishing.
- Tom White.(2012). *HADOOP: The definitive Guide*. O Reilly.

E– Resources

- http://www.bigdatauniversity.com/
- http://www.coreservlets.com/hadoop-tutorial/#Pig-1
- http://in.reuters.com/tools/rss
- http://www.altova.com/xmlspy.html
- https://www.w3.org/RDF/

OPEN SOURCE TECHNOLOGY – PRACTICAL
UCSR607

Semester	**: VI**	**Credit**	**: 3**
Category	**:** Core XX	**Hours/Week**	**: 3**
Class &Major : III BSc CS		**Total Hours**	**: 39**

Objectives:
To enable the students
- Develop an interactive and secured web application
- Reduce the code to build user interface application
- Design web applications for develop software

Learning Outcomes:
On Completion of the course, the students will be able to
- Develop an interactive and secured web application
- Evaluate the code to build user interface application
- Develop the web applications by various user interfaces

Lab Exercise

PHP
1. Creating simple webpage using PHP
2. Use of conditional statements and looping statements in PHP
3. Creating different types of arrays
4. Creating user defined functions
5. File manipulation using PHP
6. Creation of sessions
7. Creation of cookies

MySQL
1. Creating simple table with constraints
2. Insertion, Updation and Deletion of rows in MYSQL tables
3. Demonstration of joining tables
4. Usage of sub queries
5. Usage of aggregate functions
6. Working with string, numeric and date functions

PROJECT
UCSP601

Semester : V		**Credits** : 5
Category : Core X		**Hours/Week** : 5
Class & Major: III B.Sc Computer Science		**Total Hours** : 65

Objectives:
To enable the students
- Acquire knowledge in Computer Science research.
- Develop Software Development and Programming skills.

Learning Outcomes:
On Completion of the course, the students will be able to
- Identify practical problem solving using the laboratory techniques and Computer science behind the set experiment.
- Provide students a hands-on experience of Designing, Performing, and Analyzing results from a Real time applications based project.
- Acquire effective knowledge in experiential learning for the students which plays a key role in bridging the gap between industry and Academia.

Guidelines
- Project is offered for final year B.Sc Computer Science students in Semester VI.
- Project can be done according to area of interest.
- Project should do as group with maximum of three students.
- Project can be Field study, Survey, Mining data, Computer Graphics and Multimedia, Extraction of data components from Computer Science area.
- Evaluation scheme for the project will be Internal 60 and External 40.

Assessment

S. No	Internal		External	
	Component	**Marks**	**Component**	**Marks**
1	Review of the Literature	10	Dissertation	10
2	Area of Research	10	Presentation	20
3	Implementation	10	Viva - voce	10
4	Execution of Results	10		-
5	Result and Discussion	10		-
6	Report preparation	10		-
	Total	**60**		**40**
	Maximum marks		100	

NETWORK SECURITY
UCSO606

Semester	: VI	**Credit**	:4
Category	: Major Elective	**Hours/Week**	:5
Class	: III B.Sc CS	**Total Hours**	:65

Objectives:
To enable the Students
- Understand the Cryptography and Network Security concepts and application.
- Acquire knowledge in various types of Encryption and Decryption mechanism.
- Classify and evaluate computer and security threats and models.

Learning Outcomes:
On Completion of the course, the students will be able to
- Identify some of the factors driving the need for network security
- Identify and classify particular examples of attacks
- Define the terms vulnerability, threat and attack
- Identify physical points of vulnerability in simple networks

UNIT - I INTRODUCTION   **13 Hrs**
The concepts of Security- the Need for Security - Security Approaches- Principles of Security- Types of Attacks. Convention Encryption: Conventional Encryption Mode-Steganography- Classical Encryption Techniques - Simplified DES- Block Cipher Principles - The Data Encryption Standard - The Strength of DES - Differential and Linear Cryptanalysis - Block Cipher Design Principles - Block Cipher Modes of operation - Conventional Encryption algorithms.

UNIT - II PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS   **12 Hrs**
Public Key Cryptography - Principles of Public Key Cryptosystems - The RSA
Algorithm - Key Management - Diffie Hellman Key Exchange - Elliptic Curve Cryptography Message Authentication and Hash Functions Authentication Requirements - Authentication Functions - Message Authentication Codes - Hash Functions - Security of Hash Functions.

UNIT - III HASH AND MAC ALGORITHMS   **12 Hrs**
Introduction Nifty things to do with a Hash - MD5 Message Digest Algorithm - Secure Hash Algorithm (SHA-I) - RIPEMD - HMAC - CMAC - Digital Signatures - Authentication Protocols -Digital Signature Standard.

UNIT - IV NETWORK SECURITY APPLICATIONS   **15 Hrs**
Authentication Applications - Kerberos - X.509 authentication service - public key Infrastructure (PKI) - Electronic Mail Security - Pretty Good Privacy - S/MIME - IP Security - IP Security Overview - IP Security Architecture - Authentication Header - Encapsulating payload - combining security association - Key Management - Web Security - Web Security Considerations - Secure Socket Layer & Transport Layer Security - Secure Electronic Transaction - Introduction to Wireless security.

UNIT - V INTRUDERS, VIRUSES, WORMS AND CYBER SECURITY   13 Hrs

Intruders - Intrusion detection - password management - Viruses and Related Threats - Distributed Denial of service attacks - Firewall Design Principles - Trusted Systems - virtual private network (VPN). Introduction to Cyber Security – Goals of Cyber Security – Computer Forensics – Steganography – Cyber Crime – Vulnerability Assessment.

Text Books
- William Stallings.(2013).*Cryptography and Network Security*. (6th ed.,). Prentice Hall.
- AtulKahate. (2006).*Cryptography and Network Security*.Tata McGraw-Hills.

Reference Books
- Neal Krawetz.(2007). *Introduction to Network Security*. Thomson Business Press.
- EricMaiwald. (2004). *Information Security Series*. Fundamental of Network security. Dreamtech press.

E– Resource
- http://www.nptel.ac.in/courses/106105031

MOBILE TECHNOLOGIES
UCSO607

Semester	**: VI**	**Credit**	**: 4**
Category	**: Major Elective**	**Hours/Week : 5**	
Class	**: II1 B.Sc CS**	**Total Hours : 65**	

Objectives:
To enable the Students
- Understand the Wireless communication and its devices.
- Examine Wireless Communication Protocols, and Principles.
- Determine the network infrastructure requirements to support mobile devices.

Learning Outcomes:
On Completion of the course, the students will be able to
- Explain the basic physical and technical settings functioning of mobile technologies.
- Describe the basic principles of mobile technologies.
- Describe the development and implementation of mobile technologies.

UNIT - I INTRODUCTION   12 Hrs

Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmission – Multiplexing – Spread Spectrum and cellular systems – Medium Access Control – Comparisons.

UNIT - II TELECOMMUNICATIONS SYSTEM   12 Hrs

Telecommunication System – GSM – Architecture – Sessions – Protocols – Hand over and Security – UMTS and IMT 2000 – Satellite System.

UNIT - III WIRELESS LAN   16 Hrs

Introduction-Wireless LAN advantages-IEEE 802.11 Standards-Wireless LAN Architecture - Mobility in Wireless LAN-Deploying Wireless LAN-Mobile Ad hoc Networks and Sensor Networks-Wireless LAN Security-Wireless Access in Vehicular Environment-Wireless Local Loop-HiperLAN- Bluetooth – MAC Layer – Security and Link Management.

UNIT - IV MOBILE IP   13Hrs
Mobile IP: Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies.

UNIT-V WIRELESS APPLICATION PROTOCOL   12 Hrs
Wireless Application Protocol (WAP) – Architecture – XML – WML Script – Applications.

Text Book

- Jochen Schiller. (2003). *Mobile Communication*. 2nd Edition. Pearson Education. Delhi.

Reference Books

- UweHansmann, Lothar Merk, Martin S Nicklons and Thomas Stober.(2003) .*Principles of Mobile Computing*. Springer.
- William Stallings, (2002). *Wireless Communications and Networks*. Pearson Education.
- Kaveh Pahlavan, Prasanth Krishnamoorthy.(2003). *Principles of Wireless Networks*. (1sted). Pearson Education.
- Sandeep Singhal. *the Wireless Application Protocol: Writing Applications for the Mobile Internet*.

E - Resources

- https://sgar91.files.wordpress.com/2011/10/mobile_communications_schiller_2e.pdf
- http://www.geethanjaliinstitutions.com/engineering/coursefiles/downloads/ece/wcn.pdf

INTERNET OF THINGS
UCSO608

Semester : VI	**Credits** : 4
Category : Major Elective	**Hours/Week** : 5
Class &Major : III B.Sc CS	**Total Hours** : 65

Objectives:

To enable the students
- Analyze the concepts of an interactive and secured web application
- Reduce the code to build user interface application
- Design web applications for develop software

Learning Outcomes:
On Completion of the course, the students will be able to
- Understand the concepts of market perspective of IoT.
- Compare and Contrast the use of Devices, Gateways and Data Management in IoT.
- Implement state of the art architecture in IoT.

UNIT - I INTRODUCTION   **13 Hrs**

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks – Mobile Internet – Wired Communication.

UNIT - II PROGRAMMING THE MICROCONTROLLER FOR IOT   **13 Hrs**

Basics of Sensors and actuators – examples and working principles of sensors and actuators – Cloud computing and IOT – Arduino/Equivalent Microcontroller platform – Setting up the board - Programming for IOT – Reading from Sensors.

UNIT – III RFID AND INFORMATION TECHNOLOGY INTEGRATION   **13Hrs**

What Is RFID? - The Three Core Components of an RFID System - RFID Tags - RFID Interrogators - RFID Controllers - What Is RFID Middleware? - The Recent Focus on Middleware - Core Functions of RFID Middleware - Middleware as Part of an RFID System—The EPC Architecture - The Present State of Middleware Development - Middleware Vendors.

UNIT – IV MACHINE-TO-MACHINE INTERACTIONS   **13Hrs**

Introduction - Types of IoT interaction - Basic local M2M interactions - Cloud M2M with IFTTT - M2M alarm system - Automated light controller - Automated sprinkler controller - Troubleshooting basic M2M issues

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS   **13Hrs**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs – Cloud for IoT - Amazon Web Services for IoT.

Text Books
- Charalampos Doukas. (2002). *Building Internet of Things with the Arduino*- Create space-
- V. Daniel Hunt, Albert Puglia, Mike Puglia. (2007). *Rfid-A Guide To Radio Frequency Identification* –Wiley,
- Marco Schwartz. (2016)**.** *Internet of Things with Arduino Cookbook*. Packt Publishing Olivier Hersent, David Boswarthick, Omar Elloumi. (2012).*The Internet of Things–Key applications and Protocols*. Wiley.

References Book
- Luigi Atzor et.al.(2010). *The Internet of Things: A survey-* Journal on Networks-Elsevier Publications.

E-Resources

- http://postscapes.com/
- http://www.theinternetofthings.eu/what-is-the-internet-of-things

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS
BUSINESS ANALYTICS AND INTELLIGENCE
UCSA509

Semester : V	**Credit** : 3
Category : Allied	**Hours/Week** : 3
Class &Major : B.COM(CA)	**Total Hours** : 39

Objectives:
To enable the students

- Understand the concepts of business problems and its solutions.
- Evaluate the processes needed to develop, report, and analyze business data.
- Apply Excel and Excel add-instructions to solve business problems

Learning Outcomes:
On Completion of the course, the students will be able to

- Understand and critically apply the concepts and methods of business analytics
- Identify, model and solve decision problems is different areas
- Implement powering consumer applications and new opportunity for entrepreneurship for analytics

UNIT-I INTRODUCTION   7 Hrs
Business Intelligence: overview-need for Business Intelligence-information and knowledge-
Role of Mathematical models- characteristics of business intelligence -structure and components of business intelligence.

UNIT- II ANALYTICS STRATEGY   8 Hrs
        Business Analytics at the strategic level: Strategy and BA-Link between strategy and Business Analytics-BA supporting strategy at functional level-Functions-information as strategic resource.

UNIT -III DATA VISUALIZATION   8Hrs
        Data visualization-Online Analytical Processing (OLAP)-Reports and Queries -Multidimensionality Advanced Business Analytics.

UNIT -IV DATA MINING   8 Hrs
        Data Mining definition, objetives and benefits Methods-Applications of DM -Data Mining Software Tools-Data Mining Process-Text   and Web DM. Business Analytics at

Analytical level : Statistical data mining-descriptive Statistical methods-data mining with target variables.

UNIT-V   BUSINESS INTELLIGENCE   8 Hrs
Business Intelligence Architectures: Cycle of Business Intelligence Analysis-Development of Business Intelligence System- spread sheets. BI Tools: Concept of dashboard. BI Applications in different domains- CRM, HR.

Text Book

- Turban, Sharda. (2014). *Decision Support and Business Intelligence Systems.* (4[th]ed). Delen, Pearson.

Reference Books

- Olivia Parr Rud. (2009). *Business Intelligence Success Factors Tools for aligning your business in the global economy*. John Wiley and Sons.

- Steve Williams and Nancy Williams. (2007). *The Profit impact of Business Intelligence*. Morgan Kauffman Publishers Elsevier.

- Gert H.N. Laursen & Jesper Thorlund. (2010). *Business Analytics for Managers: Taking Business Intelligence beyond reporting*. Wiley and SAS Business Series.

E-Resources

- http://www.w3schools.com/html/
- https://www.tutorialspoint.com/management_information_system/business_intelligence_system.h tm

BUSINESS ANALYTICS AND INTELLIGENCE USING SAS LAB
UCSR512

Semester   : V   **Credit   : 2**
Category   : Allied   **Hours/Week : 3**
Class &Major: B.Com (CA)   **Total Hours : 39**

 Objectives:
To enable the students
- Understand the concepts of SAS platform for alter, manage and retrieve data
- Analyze the SAS provides of graphical point-and-click user interface.
- Implement the statistical data for non-technical users

Learning Outcomes:
On Completion of the course, the students will be able to
- Understand the concept of a SAS Enterprise Guide.
- Create the numerical and pictorial summaries of data for Distribution Analysis.
- Develop the various applications for statistical analysis of data.

Lab Exercise

1. Logging on to the SAS platform via SAS Enterprise Guide

2. Creating and saving a project SAS Enterprise Guide

3. Importing an Excel File into SAS.

4. Output Formats.

5. Expression builder to create variable using query.

6. Exploring Output Formats and Setting Default

7. Exploring the Data and Creating a Basic Report

8. Summary statistics.

9. Filtering

10. Graphical Exploration

OBJECT ORIENTED PROGRAMMING USING JAVA
UCSA507

Semester : V **Credit : 3**
Category : Allied **Hours/Week : 3**
Class & Major: III B.Sc Maths **Total Hours : 39**

Objectives:
To enable the students
- Understand the concepts of oops.
- Design and build Java applications
- Overview all the features of the language and its associated Package

Learning Outcomes:
On Completion of the course, the students will be able to
- Understand the use of OOPs concepts.
- Understand the use of Packages and Interface in java.
- Able to develop and understand exception handling, multithreaded applications with synchronization.
- Able to design GUI based applications and develop applets for web applications.

UNIT – I FUNDAMENTALS OF OOPS **7 Hrs**
Fundamentals of OOPS: Basic Concepts – Benefits of OOP – Application of OOP – Java Evolution – Overview of Java – Data types, Variables and Constants - Operators – Control Statements.

UNIT – II CLASSES AND CONSTRUCTORS 8 Hrs

Introducing Classes, Objects and Methods: Defining class – Creating Objects – Accessing Class Members – Constructors – Method overloading – Static Members – Inheritance

UNIT – III INTERFACES AND PACKAGES 9 Hrs

Interfaces: Defining Interfaces – Extending Interfaces –Implementing Interfaces - Package: Java API Package - Naming Conventions – Creating & Accessing a Package – using a Package - Adding a class to a Package – Hiding Classes – Multithreaded Programming: Life cycle of a Thread – Managing Errors and Exceptions.

UNIT – IV APPLET 8 Hrs

Applet: Introduction – How Applets Differ from Applications – Building Applet Code – Applet Life Cycle – Applet Tag – Adding Applet to HTML File – Running the Applet – Graphics Programming.

UNIT – V FILES IN JAVA 7 Hrs

Managing Input and output files in Java: stream classes - Byte Stream classes –Character stream classes - I/O Exceptions – Creation of Files - Random Access Files – Other Stream Classes.

Text Book

- Balagurusamy, E.(2010). *Java Programming*. (2nded). Tata McGraw Hill. New Delhi.

Reference Book

- Cay. S. Horst Mann & Gary Cornell. (2006). *Core java*, *Volume I.* (7th ed.,).
  Sun Microsystem Press Java Series. New Delhi.

OBJECT ORIENTED PROGRAMMING USING JAVA –LAB
UCSR508

Semester : V	**Credit** : 2
Category : Allied Practical	**Hours/Week** : 3
Class & Major: III B.Sc Maths	**Total Hour** : 39

Objectives:
To enable the students
- Write Java code in the form of both applications and applets.
- Implement Exception and threads
- Creating files using I/O Packages

Learning Outcomes:
On Completion of the course, the students will be able to
- Able to solve real world problems using OOP techniques.
- Able to understand the use of abstraction.

- Able to understand the use of Packages and Interface in java.
- Develop applets for web applications.

LAB EXERCISES

1. Random Number Generation using predefined Random class.
2. Implement Mathematical function using predefined math package.
3. Implementing string manipulation using string and string buffer classes
4. Simple programs using Classes and Objects
5. Implementing Inheritance concepts with simple programs.
6. Implementing Thread Based Applications
7. Implementing Exception Handling.
8. Implementing Interfaces and Packages Concepts.
9. Implementing Graphics using Applet.
10. Sequential File Manipulations.

III and IV Evaluation Components of CIA

Semester	Part	Category	Course Code	Course Title	Component III	Component IV
V	III	Core IX	UCSM506	Middleware Technologies	Assignment	Seminar
	III	Core XIII	UCSM509	Database Systems	Query writing	ER Diagram
	III	Core XIV	UCSM510	Computer Networks	Assignment	Seminar
	III	Core XV	UCSM511	Software Engineering	Project Designing	Seminar
	III	Core Practical VII	UCSR509	Middleware Technologies – Practical	DPA	Viva Voce
	III	Core XVII	UCSR511	Database Systems-Practical	DPA	Viva-voce
VI	III	Core XVIII	UCSM612	Cloud Computing	Assignment	Seminar
	III	Core XIX	UCSM613	Open Source Technology	App Development	Seminar
	III	Core XIV	UCSM610	Big Data Tools	Assignment	Seminar
	III	Core XXI	UCSR607	Open Source Technology-Practical	DPA	Viva-voce

ALLIED COURSES OFFERED TO OTHER DEPARTMENTS

Semester	Part	Category	Course Code	Course Title	Component III	Component IV
V	III	Allied	UCSA509	Business Analytics and Intelligence.	Assignment	Seminar
	III	Allied Practical	UCSR512	Business Analytics and Intelligence using SAS - Lab	DPA	Viva-voce
	V	Allied	UCSA507	Object Oriented Programming using Java	Program Writing	Assignment
	V	Allied Practical	UCSR508	Object Oriented Programming using Java - Lab	DPA	Viva-voce

COURSE PROFILE M.Phil (Computer Science)

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon Completion of the Programme, the Students will able to

- Ability to analyze and apply the latest technologies in the concepts of key areas in computer science.
- Critical analysisof problems and thorough evaluation of potential benefits of alternative solution in designing software and/or hardware systems.
- Ability to analyze and synthesize computing systems through quantitative and qualitative techniques.
- Ability to use knowledge in various domains to identify research gaps and provide solution to new ideas and innovations.

Semester	Category	Course Code	Course Title	Contact Hrs/Week	Credit Min/Max
I	Core Paper I	MCSM108	Research Methodology	6	5
	Core Paper II	MCSM109	Advanced Topics in Computer Science	6	5
	Core Paper III	MCSM107	Special Area Study	6	5
	Elective	MRPE101	Research publication and ethics	2	2
II	Core Paper IV	MCSD201	Dissertation &Viva-voce	30	13