B.Sc. COMPUTER SCIENCE

CURRICULUM FRAMEWORK AND SYLLABI
(Under Choice Based Credit System - Outcome Based Education)
**(For the students joining in the
Academic year 2021 – 2022 and afterwards)**

**DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
THE GANDHIGRAM RURAL INSTITUTE
(Deemed to be University)
Gandhigram - 624 302
Dindigul District
Tamil Nadu**

THE GANDHIGRAM RURAL INSTITUTE (Deemed to be University)
DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

B. Sc. COMPUTER SCIENCE
(Under Choice Based Credit System - Outcome Based Education)

Vision

To provide quality-assured academic, research and extension services in the domain of Computer Science and Applications, to promote dissemination of knowledge in Information and Communication Technologies for Rural Development.

Mission

Empower the rural youth by transforming them into proficient and socially responsible computer professionals and cater them to the envisaged demand in the operational and functional domains of the industries and service sectors.

Graduate Attribute

The graduates of our institute are expected to possess the following attributes.

1. *Informed*
    The graduates of GRI are well-informed and are able to retrieve, analyse and assimilate complex information. They understand the local and global issues and are able to apply their knowledge. They are able to work in tandem with the rural community.
2. *Problem solver*
    The graduates of GRI have the ability to work on development issues. They are capable of being creative, logical and critical thinking which in turn help them to respond to challenges and opportunities effectively. They are also capable of making and implementing decisions.
3. *Active learners and critical thinkers*
    Graduates of this university are active learners and are capable of critically analyzing issues. They are capable of undertaking critical enquiry and reflection, find and evaluate information using a variety of sources and technologies. They do possess the attitude of acknowledging the works and ideas of others.
4. *Effective communication*
    The graduates have good communication skills and are capable of articulating their ideas effectively. They can negotiate and engage with people in varied settings.
5. *Rural minded*
    The graduates of GRI are well-informed and are able to retrieve, analyse and assimilate complex information. They understand the local and global issues and are able to apply their knowledge. They are able to work in tandem with the rural community.

The Gandhigram Rural Institute (Deemed to be University)
Gandhigram – 624 302

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PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To prepare the graduates with expected domain knowledge to be employed in public and Information Technology (IT) enabled services.

PEO 2: To demonstrate needed skill in Computer Science and other inter-disciplinary areas.

PEO 3: To train the students to apply current tools and technologies to develop software solutions for social needs.

PEO 4: To prepare the students to continue the process of lifelong learning through professional activities that contribute to personal and social development.

PEO 5: To motivate the students to become entrepreneurs in IT enabled ventures

PROGRAMME OUTCOME (PO)

PO 1: To become knowledgeable in the subject of Computer Science and Allied Subjects that are relevant and appropriate to the domain.

PO 2: To design and develop software solutions to cater to the industrial requirements.

PO 3: To develop communication skill to present ideas effectively and efficiently.

PO 4: To equip the students to the changing needs and motivate them to take-up masters and research programmes.

PO 5: To inculcate human, professional and ethical values to become a socially responsible citizen.

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO 1: Demonstrate the working principles of various hardware and software of a computer system.

PSO 2: Acquire knowledge in programming and understand the basic concepts and techniques in computer domain.

PSO 3: Analyse and identify the customer requirements to develop software solutions.

PSO 4: Develop software solutions for real life problems by applying latest technologies.

PSO 5: Empower the students with technical and other soft skills for successful career, entrepreneur and higher studies.

Mapping of PEOs with PSOs & POs:

PEO Vs. PO&PSO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
PEO1	3	3	3	2	2	3	3	3	3	3
PEO2	3	3	2	2	3	3	3	3	3	3
PEO3	3	3	2	2	2	3	3	3	3	3
PEO4	3	3	3	3	3	3	3	3	3	3
PEO5	3	3	2	2	2	3	3	3	3	3

Strongly Correlating (S)   -   3 marks

Moderately Correlating (M)   -   2 marks

Weakly Correlating (W)   -   1 mark

No Correlation (N)   -   0 mark

CO & PO ATTAINMENT RUBRICS

Direct Assessment:

i)   CFA & ESE   - 30 %

ii) Assignment/Reports/Case Study   - 40%

Indirect Assessment:

i)   Exit Survey   - 30 %

DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
B.Sc. (Computer Science)
(Under Choice Based Credit System)

SUBJECTS OF STUDY AND SCHEME OF EXAMINATION (Under Revision)
(For the students joining in 2021 - 2022 and afterwards)

Course code	Title of the Course	Credits	Hours Theory	Practical	CFA	ESE	Total
SEMESTER I							
21TAMU0101/ 21HIDU0101/ 21MALU0101/ 21FREU0101	**Language I** Tamil/Hindi/Malayalam /French	3	3	-	40	60	100
21ENGU01F1/ 21ENGI01F1	**Language II** English	3	3	-	40	60	100
21CSCU0101	Programming in C	4	4	-	40	60	100
21CSCU0102	Lab–I:C Programming	1	-	3	60	40	100
21MATU01B1	Allied Maths – I for Computer Science	4	4	-	40	60	100
21NSSU0001/ 21FATU0001/ 21SPOU0001	NSS/Fine Arts/Sports	1	-	1	50	-	50
21YOGU0001	Yoga	1	-	1	50	-	50
21EVSU0101	Environmental Studies	3+1	3	2	40	60	100
Total Credits		**21**					
SEMESTER II							
21TAMU0202/ 21HIDU0202/ 21MALU0202/ 21FREU0202	**Language I** Tamil/Hindi/Malayalam /French	3	3	-	40	60	100
21ENGU02F2/ 21ENGI02F2	**Language II** English	3	3	-	40	60	100
21CTSU0001/ 21CHIU0001/ 21MLU0001	Core Tamil / Core Hindi /Core Malayalam	2	2	-	20	30	50
21CSCU0203	Object Oriented programming with C++	4	4	-	40	60	100
21CSCU0204	Lab II: C++ Programming	1	-	3	60	40	100
21MATU02B2	Allied Maths – II for Computer Science	4	4	-	40	60	100
21GTPU0001	Gandh's Life, Thought And Work	2	2	-	20	30	50
21EXNU0001	Extension Education	2	2	-	20	30	50
21ENGU00C1/ 21ENGI00C1	Communication and Soft Skills	2	2	-	20	30	50
Total Credits		**23**					

SEMESTER III							
21TAMU0303/ 21HIDU0303/ 21MALU0303/ 21FREU0303	**Language I** Tamil/Hindi/Malayalam /French	3	3	-	40	60	100
21ENGU03A3/ 21ENGI03A3	**Language II** English	3	3	-	40	60	100
21CTSU0002/ 21CHIU0002/ 21MLU0002	Core Tamil/Core Hindi/Core Malayalam	2	2		20	30	50
21CSCU0305	Relational Database Management Systems	4	4	-	40	60	100
21CSCU0306	Lab–III:RDBMS	1	-	3	60	40	100
21PHYU03B1	Allied Physics – I forComputer Science: Digital Principles	4	4	-	40	60	100
21SHSU0001	Shanthi Sena	1	2	-	50	-	50
21CSAU03A1	Multimedia Technologies	2+1	2	2	20+30	30+20	100
21EXNU03V1	VPP	2	-	-	50	-	50
21CSCU03F1	Extension/Field Visit	-	-	2	-	-	-
Total Credits		**23**					
SEMESTER IV							
21CSCU0407	Advanced Operating Systems Concepts	4	4	-	40	60	100
21CSCU0408	Data Structures	4	4	-	40	60	100
21CSCU0409	Lab – IV: Data Structures	1	-	3	60	40	100
21PHYU04B2	Allied Physics – II for Computer Science: Microprocessor and Assembly Language Programming	2+1	3	2	40	60	100
21CSCU04DX	Discipline Centric Elective – 1	4	4	-	40	60	100
-------	Elective: Generic-I	3	3	-	40	60	100
21CSCU04F2	Human Values and Professional Ethics	1	-	2	50	-	50
Total Credits		**20**					

	SEMESTER V						
21CSCU0510	Introduction to Java Programming	4	4	-	40	60	100
21CSCU0511	Computer Graphics	4	4	-	40	60	100
21CSCU0512	Software Engineering	4	4	-	40	60	100
21CSCU0513	Lab V: Java Programming	1	-	3	60	40	100
21CSCU05DX	Discipline Generic Elective – II	4	4	-	40	60	100
21CSCU05SX	Skill based Elective	2	2	-	20	30	50
	Elective: Generic -II	3	3	-	40	60	100
Total Credits		**22**					
	SEMESTER VI						
21CSCU0614	Web Technologies	4	4	-	40	60	100
21CSCU0615	Computer Networks	4	4	-	40	60	100
21CSCU0616	Computer Organization	4	4	-	40	60	100
21CSCU0617	Lab VI: Web Technologies	1	-	3	60	40	100
21CSCU06MX	Modular Course I	2	2	-	50	-	50
21CSCU06MY	Modular Course II	2	2	-	50	-	50
21CSCU0618	Project	4	-	8	40	40+20*	100
Total Credits		**21**					
Total Credits for B.Sc. (CS) Programme		**130**					

CFA – Continuous Formative Assessment (Internal Evaluation) ESE – End Semester Examination (External Evaluation)

*40 for external evaluation and
 20 for concurrent Viva – voce evaluation.

List of Modular Course

Modular Course: I (21CSCU06MX)

| 21CSCU06M1 | Introduction to R Programming |
| 21CSCU06M2 | Fundamentals of Statistics and SPSS |

Modular Course: II (21CSCU06MY)

| 21CSCU06M1 | Information Technology for Rural Development (ITRD) |
| 21CSCU06M2 | Financial Accounting Software |

List of Discipline Centric Electives

Discipline Centric Elective –I (21CSCU04DX)

21CSCU04D1	Data Mining
21CSCU04D2	Big Data Analytics
21CSCU04D3	Management Information Systems

Discipline Centric Elective –II (21CSCU05DX)

21CSCU05D1	Mobile Computing
21CSCU05D2	Cloud Computing
21CSCU05D3	Enterprise Resource Planning

<p align="center">**<u>List of Skill based Elective Courses</u>**</p>

Skill based Elective Course (21CSCU05SX)

| 21CSCU05S1 | Mobile Application Development |
| 21CSCU05S3 | Skill Development for Employability |

Value Added Courses (2 Credits)	
Course Code	**Title**
21CSCU0VA1	Open Source Software
21CSCU0VA2	Document Preparation using LateX
21CSCU0VA3	Client/Server Technologies
21CSCU0VA4	Linux and Shell Programming
21CSCU0VA5	Software Testing
21CSCU0VA6	Introduction to Artificial Intelligence
21CSCU0VA7	Ethical Hacking
21CSCU0VA8	Introduction to Internet of Things

Course Code & Title	21CSCU0101 PROGRAMMING IN C Credits: 4		
Class	**B.Sc. (Computer Science)**	**Semester**	**I**
Course Objectives	**The Course aims to** • Impart the Principles of C Language • Lay the foundation to learn other advanced programming languages • Motivate the students to develop projects using C		

UNIT	CONTENTS	Lecture Schedule
I	**Program Structure and Fundamentals** Program Structure: Identifiers – Data Types – Integer – Float – Character – Constants – Variables. Operators and Expressions, Managing Input and Output Operations.	12
II	**Control Structures** Decision Making and Branching: *if* Statement – *if ... else* Statement – Nested *if ... else* Statements – *?:* operator – *switch* Statement – *go to* Statement Loop Statement: *for* Statement – *do... while* Statement – *while ... do* Statement	13
III	**Arrays and String** Arrays: Definition – Declaration – Entering Values in Arrays – Manipulating Arrays String: Declaring, Initializing, Printing and Reading strings, String manipulation functions	12
IV	**Functions, Structures & Union** Functions: Defining User defined function -Accessing a function- Passing arguments to a function - Recursion Structure& Union: Defining – Declaring – Initialization – Structures and Functions – Array of structures – Union	13
V	**Pointers and File** Pointers: Understanding Pointers – Pointers and Functions File: Defining – Opening and Closing – Input and output operations – File Random Access	14
	Total Conduct Hours	**64**

Text Book:
      E. Balagurusamy, Programming in ANSI C, 8/e Tata McGraw Hill, 2019.
References:
1. Stephen G. Kochan, Programming in C, 4th Ed., Pearson Education, 2015.
2. Byron Gottfried, Programming with C, 2ndEd., TMH publications, 2006.
3. Kalavathi.P, C – A Text for Beginners, Bonfring Publications, Tamil Nadu, 2014
Web resources
1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3schools.in/c-tutorial/
3. http://www.learn-c.org/en/Welcome

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Develop logic for problem solving through programming
	CO2: Decide on the appropriate C data types for problem solving
	CO3: Exhibit ability to contextually and optimally use the C programming constructs - *decision making, iteration, looping*
	CO4: Develop C programs with the concept of modularity using functions
	CO5: Design, code, debug, test and document C programs
	CO6: Provide computational solutions for real-time problems using C Programming

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	3
CO2	2	2	3	2	3
CO3	3	2	1	3	3
CO4	3	3	3	3	3
CO5	1	3	3	3	3

Course Code & Title	21CSCU0102 LAB – I: C PROGRAMMING		
Class	B.Sc. (Computer Science)	Semester	I
Course Objective	**The Course aims to** • Give a strong foundation on the structured programming using C language. • Provide hands–on training in C Programming • Train the students to implement various programming concepts and write C Program for the given problem		

Sl. No.	CONTENTS	No. of Hours
1. 2. 3. 4. 5. 6.	C Programming with Control structures if, nested if, for, while and do … while Array handling – one and two dimensional array Pointers Functions and Recursive function Structure and Union File handlings – read and write operations	48
Total Conduct Hours		**48**
Course Outcomes	**On successful completion of the course, the students will be able to** **CO1:** Analyse and understand the various programming constructs through simple C programs **CO2:** Write the C programs using control structures **CO3:** Trace the execution of programs and debug the programs **CO4:** Implement programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor statements **CO5:** Exhibit ability to handle files	

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Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	3
CO2	2	2	3	2	3
CO3	3	2	2	3	3
CO4	3	3	3	3	3
CO5	1	3	3	3	3

Course Code& Title	21MATU01B1 ALLIED MATHS – I FOR COMPUTER SCIENCE		
Class	B.Sc. (Computer Science)	Semester	I
Course Objectives	The Course aims to • The learner will acquire knowledge of set theory, Logic and matrices • The learners will become proficient in basic ideas of graph theory andcomplex numbers		

UNIT	CONTENTS	Lecture Schedule
I	**Set Theory** Relations - Equivalence relations - Partial order – Function - Binary operations - Groups : definitions and examples - Elementary properties	12
II	**Logic** Introduction – Connectives - Truth tables - Tautology implicationand equivalence of formulae	13
III	**Matrices** Elementary Transformation - Inverse of a matrix - Rank of a matrix -Simultaneous linear equations - Cayley Hamiltom theorem	13
IV	**Graph Theory** Introduction - Definition and examples - Degrees and sub graphs - Matrices - Connectedness: walks, trials and paths - Connectednessand components	13
V	**Introduction to Different Types of Expansion and ComplexNumber** **Introduction to Different Types of Expansion** Factorial Notation - Meaning of C(n,r), P(n,r) - Binomial theorem for positive index, any index - Exponential expansion – Logarithm expansion **Complex Number:** Definition of Complex Number - Operations on Complex Number (Addition, Subtract, Multiplication, Division), Conjugate complex number - Modulus and Amplitude of a Complex Number - Polar form of a complex number	13
Total Contact Hours		**64**

Text Books:

1. S.Arumugam & A. Thangapandi Issac, Modern Algebra, SCI Tech Publications, 2002(Unit I&III)
2. Dr.M.K.Venkkatraman, Dr.N.Sridharan, Dr.N.Chandrasekaran, Discrete Mathematics,National Publishing Company, 2000 (Unit II)
3. S.Arumugam and S.Ramachandran, Invitation to Graph Theory, SCI Tech Publications,2005, Chennai (Unit IV)
4. H. K. Dass, Polytechnic Mathematics (Unit V)

Course Outcomes	On successful completion of the course, the students will be able to **CO1:** Explain the basic concepts of set theory **CO2:** Analyze logical identities **CO3:** Solve problems in matrices **CO4:** Analyze the structure of Graph Theory **CO5:** Explain various types of expansion and complex number system

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	2	3	2
CO2	3	1	3	1	3
CO3	2	2	3	3	2
CO4	3	1	3	2	2
CO5	3	3	3	1	3

Course Code & Title	**21CSCU0203** **OBJECT ORIENTED PROGRAMMING WITH C++** **Credits: 4**		
Class	**B.Sc. (Computer Science)**	**Semester**	**II**
Course Objectives	**The Course aims to** • Demonstrate the difference between traditional imperative design and object-oriented design • Discuss the usage of function in C++ and usage of user defined data type class to create objects • Explain the efficient usage of memory through operators and providing new meaning to existing operators • Identify the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code • Explain the storage of data into file forms • Understand the handling of errors and strings		

UNIT	CONTENTS	Lecture Schedule
I	Principles of Object-Oriented Programming - Beginning with C++ - Tokens, Expressions and Control Structures - Functions in C++	
II	Classes and Objects - Operator Overloading and Type Conversions	
III	Inheritance - Pointers, Virtual Functions and Polymorphism	
IV	Managing Console I/O Operations - Working with File 8	
V	Exception Handling - Manipulating Strings	
Total Conduct Hours		

Text Book:

Object Oriented Programming with C++, 8/e, E. Balagurusamy, Tata McGraw Hill publishing Company Limited, September 2020.

References:

1. The C++ Programming Language, Bjarne Stroustrup, Addision – Wesly Publishing Company, New York,1994.
2. C++ How to Program, 7/e, HM Deitel and PJ Deitel, Prentice Hall,2010.
3. Let Us C++, Yashavant P. Kanetkar, BPB Publications,1999.

Web resources

1. https://beginnersbook.com/2017/08/c-plus-plus-tutorial-for-beginners.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Apply class structures as fundamentals" and modular building blocks for real time applications
	CO2: Develop solutions for the problem using basic oops concepts
	CO3: Interpret the difference between static and dynamic binding. Apply both techniques to solve problems.
	CO4: Analyze generic data type for the data type independent programming which relate it to reusability.
	CO5: Apply file forms to handle large data set.

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	3	2	-
CO2	3	3	3	2	2
CO3	3	3	3	-	2
CO4	3	3	3	2	2
CO5	3	3	3	2	2

Course Code & Title	21CSCU0204 LAB – II: C++ PROGRAMMING			
				Credits: 1
Class	B.Sc. (Computer Science)		Semester	I
Course Objective	**COURSEOBJECTIVES** • This course aims to train the students for developing C++ programs for general applications			

Sl. No.	CONTENTS	No. of Hours
	• Simple programs • Programs with Functions • Classes and objects creation • Constructor and destructor usage • Operator Overloading • Type conversion • Inheritance – Single and Multiple • Pointers • Virtual Functions • Console I/O operations • Files and Streams • Exception Handling • String Operations	
Total Conduct Hours		
Course Outcomes	**On successful completion of the course, the students will be able to** CO1: Understand the salient features of C++ programming CO2: Develop programs using object oriented programming concepts CO3: Realize the usage of pointers with OOP_1s concept CO4: Design real-time applications using files and exception handling CO5: Demonstrate the usage of exception handling and strings	

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	-
CO2	3	3	3	2	2
CO3	3	3	3	-	2
CO4	3	3	3	2	2
CO5	3	3	3	2	2

Course Code & Title	21CSCU0305 RELATIONAL DATABASE MANAGEMENT SYSTEMS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	**The Course aims to** • Explain the concepts of database management systems • Demonstrate the various data models and database systems • Create and manipulate to implement database concepts • Design database schema considering the normalization rule		

UNIT	CONTENTS	Lecture Schedule
I	**Databases and Database Users & Database System Concepts and Architecture** Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene – Workers behind the Scene - Advantages of Using the DBMS Approach - A Brief History of Database Applications – When Not to Use a DBMS Data Models, Schemas, and Instances – Three - Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs - Classification of Database Management Systems	12
II	**Data Modeling Using the Entity – Relationship (ER) Model** Using High-Level Conceptual Data Models for Database Design - A Sample Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types -Refining the ER Design for the Company Database - ER Diagrams, Naming Conventions, and Design Issues [1]	13
III	**The Relational Data Model and Relational Database Constraints & SQL** The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations Basic SQL: SQL Data Definition and Data Types - Specifying Constraints in SQL - Basic Retrieval Queries in SQL - INSERT, DELETE, and UPDATE Statements in SQL	13
IV	**Complex Queries, Triggers, Views and Schema Modification** Complex Queries, Triggers, Views and Schema Modification: More Complex SQL Retrieval Queries - Specifying Constraints	13

		as Assertions and Actions as Triggers - Views (Virtual Tables) in SQL - Schema Change Statements in SQL	
V	**Functional Dependencies and Normalization**		13
		Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal - Boyce-Codd Normal Form - Multivalued Dependency and Fourth Normal Form - Join Dependencies and Fifth Normal Form	
	Total Contact Hours		64

Text Book:

Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, New Delhi, 2016.

References:

1. Ramez Elmasri and Shamkant B. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson, New Delhi, 2014.
2. Avi Silberchartz, Henry F. Korth and S.Sudarshan, Database System Concepts, 6/e, McGraw – Hill Higher Education, International Edition, 2010.
3. Peter Rob, Carlos Coronol, Steven A. Morris, Keeley Crokett, Database Principles, 2/e, Cengage Learning, 2013

On completion of the course, students will be able to

CO1: Discuss the components, functions and various database design
techniques used for modelling the databases management system.
CO2: Analyse the various data models and database architecture
CO3: Examine the clauses and functions of SQL and write optimal queries in
the above language.
CO4: Design entity-relationship diagrams to represent simple database
application scenarios
CO5: Apply the database schema normalization rules and techniques to
criticize and improve the database design.

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Code & Title	21CSCU0306 LAB III: RDBMS			
			Credits: 1	
Class	B.Sc. (Computer Science)		Semester	III
Course Objectives	**The Student should be able to** • Prepare the students to create and manipulate relations using SQL • Write basic queries, views and triggers using SQL • Use and understand stored procedure operations and triggers			
Sl.No.	CONTENTS		No. of Hours	
	• Basic SQL – DDL & DML, Views, Group operations, aggregate operations, System operations in Oracle • Intermediate SQL –Joins, Subqueries • Advanced SQL – Nested tables • ER Modeling • Database Design and Normalization • Stored procedure implementation • Triggers		48	
Total Conduct Hours				
Course Outcomes	**On completion of the course, students will be able to** **CO1:** Model the databases using SQL **CO2:** Write SQL queries, sub queries and aggregate functions using single and multiple tables **CO3:** Implement views and triggers using SQL **CO4:** Model a simple database and generating reports. **CO5:** Develop a simple database with all basic functionalities.			

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Code & Title	21CSAU03T1 MULTIMEDIA TECHNOLOGIES Credits: 4		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	**The Course aims to** • Understand the basic concepts of multimedia elements • Develop webpage using multimedia elements. • Practice shoot and edit videos		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction and Tools** Introduction: Definition of Multimedia - Basic Multimedia Software Tools - Multimedia Authoring Tools	12
II	**Text and Images** Text: Fonts and Faces - Using Text in Multimedia - Font Editing and Design Tools Hypermedia and Hypertext. Images: Making Still Images, Coloring Images - Image File Formats	13
III	**Sound** Digital Audio - MIDI Audio, Multimedia System Sounds - Audio File Formats, Sound recording and editing tools Adding Sound to Multimedia Project.	13
IV	**Animation** Animation: Principles of Animation - Animation Techniques - Animation File Formats - Making Animations Video: How Video Works and is Displayed - Digital Video Containers - Shooting and Editing Video.	13
V	**The Internet and Multimedia** Internet History – Internetworking - Multimedia on the Web - Developing for the Web - Text for the Web - Images for the Web Sound for the Web - Animation for the Web - Video for the Web	13
Total Contact Hours		**64**

Text Book:

Tay Vaughan, Multimedia: Making It Work, Eighth Edition, McGrawHill, 2014.

Reference:

A.C. Luther, Authoring Interactive Multimedia, A.P. Professional, 1994.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Explore the basic understanding of various Multimedia Concepts. **CO2:** Utilize the Multimedia tools **CO3:** Familiarize the concepts of text and image editing. **CO4:** Practice sound and video editors. **CO5:** Develop multimedia projects for Web

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Code & Title	21CSCU0407 ADVANCED OPERATING SYSTEMS CONCEPTS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	**The Course aims to** • To provide a thorough knowledge on the objectives, services & design of an operating system. • To acquaint with the concepts of Process, synchronization, CPU, Memory Management, and Virtual machines. • To learn the elements of distributed OS. • To outline the association between the design of OS and System performance.		

UNIT	CONTENTS	Lecture Schedule
I	**Operating Systems Overview and Structures**	12
	Operating Systems Overview: Computer System Organization - Computer System Architecture - Operating System Operations - Resource Management - Security and Protection - Virtualization - Distributed Systems - Kernel Data Structures - Computing Environments - Free and Open Source Operating Systems. **Operating System Structures:** Services - User Operating System Interface - System Calls - System Services - Linkers and Loaders - Operating System Structure - Building and Booting - Operating-System Debugging.	
II	**Process Management and CPU Scheduling**	12
	Process: Concept - Process Scheduling - Operations on Processes – Inter-Process Communication - Shared-Memory Systems - Message-Passing Systems. **CPU Scheduling**: Basic Concepts - Scheduling Criteria - Scheduling Algorithms – Thread Scheduling - Multiple-Processor Scheduling - Real-Time CPU Scheduling - Algorithm Evaluation.	
III	**Process Synchronization and Deadlocks**	13
	Process Synchronization: Background - The Critical-Section Problem - Peterson"s Solution - Hardware Support for Synchronization - Mutex Locks - Semaphores **Deadlocks**: System Model - Multithreaded Applications - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.	

	Main Memory and Virtual Memory		
IV	**Main Memory**: Background - Swapping - Contiguous Memory Allocation - Segmentation - Paging - Structure of the Page Table. **Virtual Memory:** Background - Demand Paging - Page Replacement - Allocation of Frames - Thrashing - Memory Compression.		14
	Virtual Machines and Network Distributed Systems		
V	**Virtual Machines:** Overview – History - Benefits and Features - Building Blocks - Types of VMs and their Implementations - Virtualization and Operating-System Components Distributed Systems: Advantages of Distributed Systems -Network Structure- Communication Structure - Network and Distributed Operating Systems - Design Issues - Distributed File Systems - DFS Naming and Transparency.		13
	Total Contact Hours		**64**

Text Book: J.Archer Harris, John Cordani, Operating System, Mc-Graw Hills Publication, 2020 **References:** 1.Silberschatz P.B.Galvin, Gange, "Operating System Concepts", 6th Ed, John Wiley & Sons., 2002 2.H.M. Deitel, An Introduction to Operating System, Second Edition, Addison Wesley, 1990.	
Course Outcomes	**On successful completion of the course, the students will be able to** **CO1:** •Appreciate the conceptual framework of Operating System and its Structures, Operations and Services **CO2:** Delineate the principles of Process Scheduling & Synchronization. **CO3:** Analyze the performance of CPU scheduling algorithms. **CO4:** Describe the mechanics of Deadlock handling, Main memory and Virtual Memory Management. **CO5:** Compare the functional features of traditional, modern and distributed OS.

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	3	2
CO2	3	3	3	3	3
CO3	3	2	3	2	3
CO4	3	1	2	3	2
CO5	3	3	3	2	3

Course Code & Title		21CSCU0408 DATA STRUCTURES		Credits: 4
Class	B.Sc. (Computer Science)		Semester	IV
Course Objectives	**The Course aims to** • Explain the design and implementation of various basic and advanced data structures. • Describe various techniques for representation of the data in the real world. • Prepare the students to choose the appropriate representation of data structures and their applications			

UNIT	CONTENTS	Lecture Schedule
I	**Introduction and Overview** Introduction - Basic Technology; Elementary Data Organization – Data Structures - Data Structure Operations String Processing: Introduction – Basic Terminology – Storing String– Character Data Type – String Operations – Word Processing – Pattern Matching algorithms	12
II	**Array, Records and Pointers** Introduction – Linear Arrays – Representation of Linear Arrays in Memory – Traversing Linear Arrays – Inserting and Deleting – Sorting; Bubble Sort – Searching; Linear Search – Binary Search – Multidimensional Arrays – Pointers; Pointer Arrays – Records; Record Structures – Representation of Records in Memory; Parallel Arrays – Matrices – Sparse Matrices	13
III	**Linked List** Introduction – Linked List – Representation of linked List in Memory – Traversing a Linked List – Searching a Linked List – Memory Allocation; Garbage Collection – Insertion into a Linked List–Deletion from a Linked List–Header Linked List–Two-way Lists	13
IV	**Stack, Queue and Recursion** Introduction – Stacks - Array Representat$_1$ion of Stacks – Linked Representation of Stacks – Arithmetic Expressions; Polish Notation – Quicksort, an Application of Stacks – Recursion – Tower of Hanoi –Implementation of Recursive Procedures by Stacks – Queues – Linked Representation of Queues – Deques – Priority Queues	13
V	**Trees** Introduction – Binary Trees – Representing Binary Trees in Memory Traversing Binary Trees – Traversal Algorithm using Stacks – Header Nodes; Threads – Binary Search Trees – Searching and Inserting in Binary Search Trees–Deleting in a Binary Search Tree- AVL Search Trees – Insertion in an AVL Search Tree – Deletion in an AVL Search Tree	13
	Total Conduct Hours	**64**

Text Book:

Seymour Lipschutz, Data Structures, Revised First Edition, Schaum"s Outlines, Mc-Graw Hill Education, 2017. Chapters 3, 4, 5, 6, 7.1 to 7.12

References:

1. Debasis Samanta, Classic Data Structures , PHI Learning Pvt. Ltd., Second Edition, 2009.

Horowitz, Shani, Dinesh Mehta, Fundamentals of Data Structures in C++, Galgotia

Course Outcomes	On completion of the course, students will be able to
	CO1: Describe the representation of single dimensional and multi-dimensional arrays and their applications
	CO2: Analyze the string processing and various string operations
	CO3: Formulate the data representation using linked list and its variants
	CO4: Demonstrate primitive operations of Stacks and Queues
	CO5: Relate the various types of binary trees and illustrate binary tree traversals with algorithms and examples

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	1	3	3
CO2	3	3	1	2	3
CO3	3	3	1	1	3
CO4	3	3	1	1	3
CO5	3	3	1	2	3

Course Code & Title	21CSCU0409 Lab IV: DATA STRUCTURES		
			Credits: 1
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to • Explain the design and implementation of various basic and advanced data structures. • Describe various techniques for representation of the data in the real world. • Prepare the students to choose the appropriaterepresentationof data structures and theirapplications		

Sl.No.	CONTENTS	Hours of Work
1.	Array	
2.	String operations	
3.	Sorting and Searching	
4.	Stack – Creation, Push and Pop, Conversion and evaluation of Prefix and Postfix expression	
5.	Queues – Creation, Insertion, Deletion	
6.	Linked list – Creation, Insertion and Deletion using Singly Linked List, Circular List and Doubly - Linked list.	48
7.	Binary Trees – Creation, Tree traversal	
8.	Binary Search Tree – Creation, Searching and Deleting an element	
Total Conduct Hours		**48**
Course Outcomes	On completion of the course, students will be able to **CO1:** Implementation of array functions **CO2:** Write string operations and sorting & searching algorithm **CO3:** Implement by using stack and queues **CO4:** Learn to understand linked list **CO5:** Develop a simple tree traversal	

2

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

Course Code & Title	Human Values and Professional Ethics		Credits: 1
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	**The Course aims to** 1. Facilitate students to distinguish between values and skills; understand the need, and understand the basics of value education. 2. Sensitize and familiarize students on the process of intra-personal negotiating skills 3. Help them to understand the meaning of happiness and prosperity of a human being. 4. Promote harmony at all the levels of human living, and live accordingly. 5. Ensure harmony in their profession and lead an ethical life.		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction - Need, Basic Guidelines, Content and Process for Value Education** Understanding the need, basic guidelines, content and process for Value Education, Self- Exploration–what is it? - its content and process; „Natural Acceptance‟ and Experiential Validation - as the mechanism for self exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	13
II	**Understanding Harmony in the Human Being - Harmony in Sel** Understanding human being as a co-existence of the sentient „I‟ and the material „Body‟, Understanding the needs of Self („I‟) and „Body‟ - Sukh and Suvidha, Understanding the Body as an instrument of „I‟ (I being the doer, seer and enjoyer), Understanding the characteristics and activities of „I‟ and harmony in „I‟, Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.	13
	Harmony in Human-Human Relationship, Family and Society	

III	Understanding harmony in the Family - the basic unit of human interaction, Understanding values in human-human relationship; meaning of (Justice) and program for its fulfillment to ensure mutual happiness; Trust and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of trust & respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as Comprehensive Human Goals, Visualizing a universal harmonious order in society - Undivided Society, Universal Order - from family to world family!.	12
IV	**Understanding Harmony in the Nature and Existence - Whole existence as Co- existence** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature, Understanding Existence as Co- existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.	13
V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.	13
Total Contact Hours		**64**

Text Book:

1. Human Values, Kshitiz Jain, Neelkanth Publishers Pvt. Ltd.., 2018.
2. Human Values and Professional Ethics,TanuShukla , AnupamYadav, Gajendra Singh Chauhan, Cengage 2017.
3. Human Values and Professional Ethics, R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

References:

1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. The Story of Stuff, Annie Leonard, Free Press,2011.
3. Small is Beautiful, E. F Schumacher, Blond & Briggs, 1973
4. Slow is Beautiful, Cecile Andrews, New Society Publishers, 2006.

Course Outcomes	On successful completion of the course, the students will be able to
	1. Apply the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, 2. Appraise the means of happiness and prosperity 3. Appreciate the distinction between the Self and Body; meaning of Harmony in the Self the Co-existence of Self and Body. 4. Understand the value of harmonious relationship based ontrust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society 5. Analyse the nature and existence of elements of harmony 6. Distinguish between ethical and unethical practices, 7. Design the strategies to actualize a harmonious climate in workplace.

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

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SEMESTER V

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Course Code & Title	21CSCU0510 INTRODUCTION TO JAVA PROGRAMMING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	**The Course aims to** • Provide the foundation to the object oriented programmingconcepts • Discuss the implementation of OOP"s concepts in Javalanguage • Make learners as a good Javaprogrammers • Import skills and knowledge to create and run Java programs for solving real timeproblems		

UNIT	CONTENTS	Lecture Schedule
	Basics	
I	Introduction: Object Oriented Programming Concepts - Encapsulation, Inheritance, Polymorphism, Features of Java Language, Types of Java Programs, Java Architecture. Literals, Data Types and Variables: Literals - Integer, Floating Point, Character, String and Boolean Literals, Data Types - Integer, Floating Point, Character and Boolean. Variables The Structure of A Java Program – Comments, Expressions and Statements, Type Conversion, Block Statements and Scope Operators –Arithmetic, Bitwise, Relational, Boolean Logical and Ternary. OperatorPrecedence Control Statements – If...Else, Switch, While, Do...While, For..., Break, Continue and Comma Statement, Arrays - One-Dimensional and Multi-Dimensional Arrays.	13
	Classes and Packages	
II	Classes: Defining A Class, The New Operator and Objects, The Dot Operator, Method Declaration and Calling, Constructors, Instance Variable Hiding, This in A Constructor, Method Overloading, Passing Objects as Parameters to Methods Inheritance: Creating Subclasses, Method Overriding, Final Class, Final Method, Final Variables, Object Destruction and Garbage Collection, Recursion, Static Method, Static Variables and Static Block, Abstract Classes, Mathematical Methods Packages and Interfaces: Package, The Import Statement, Access Modifier, Interfaces - Defining Interfaces, Implementing an Interface Wrapper Classes – The Number Class, The Character Class, The Boolean Class	13
	Exceptions, Input and Output Classes	

III	Exceptions: Types of Exceptions, Catching Exceptions - Nested Try Blocks, Hierarchy of Multiple Catch Blocks, Throw Statement, Creating your Own Exceptions, Throws Statement, The Finally Block, Checked and Unchecked Exceptions Input and Output Classes - I/O Streams, The File Class, ByteStream – Input Stream, Output Stream, Disk File Handling - File Input Stream, File Output Stream, Filtered Byte Stream – Data Output Stream, Data Input Stream	12
	Strings and Threads	
IV	Strings: String Class - Equality Operator(==) and Equals Method, String Concatenation with +, String buffer Class, Threads - Multitasking, Creating a Thread, States of a Thread, Multithreaded Programming, Thread Priorities, Join Method, Controlling the Threads	13
	Applets and Graphics	
V	Applets: Applet Basics, Methods of Building an Applet, Some General Methods of Applet, Displaying Text in Status Bar, Embedding Applet Information, The HTML Applet Tag, Reading Parameters intoApplets Graphics - Drawing Lines, Rectangles, Ovals and Circles, Arcs, Polygons and Polyline.	13
Total Contact Hours		64

Text Book:

1. K. Somasundaram, Introduction to JAVA Programming, JaicoPublishing House, New Delhi, 2013.

References:
1. K.Somasundaram, Programming in Java2, Jaico Publishing House, NewDelhi, 2009.
2. H.Schildt,Java2:TheCompleteReference,4/e,TMHPublishingCompany,NewDelhi,2001.
3. K.Somasundaram,Do„n‟LearnJAVA–APracticalApproach,AnuradhaPublications, Chennai,2013.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Outline the concepts of OOP and basics of Java language features, types, control statements and array. **CO2:** Grasped the idea of inheritance, package and identify classes, objects, member of a class and the relationship among them. **CO3:** Discuss the implementation of exception handling and Input Output stream classes. **CO4:** Describe the methods in String. Identify the use of threads to perform subtask and inter-thread communication. **CO5:** Develop client side programming with AWT.

Mapping of COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

Course Code & Title	21CSCU0511 COMPUTER GRAPHICS				Credits: 4
Class	B.Sc. (Computer Science)			Semester	V
Course Objectives	The Course aims to • Explain about the creation of ouput primitives. • Describe the techniques of two dimensional and three dimensional transformations • Demonstrate the use of graphics functions in developing solutions to graphics applications				

UNIT	CONTENTS	Lecture Schedule
I	**Overview of Graphics Systems** Overview Of Graphics Systems - Video Display Devices - Raster Scan And Random Scan Systems - Input Devices - GUI and Interactive Input Methods: Logical Classification of Input Devices Input Functions - Interactive Picture Constructive Techniques.	13
II	**Output Primitives** Output Primitives: Points and Lines – Line Drawing Algorithms – DDA and Bresenham - Loading the Frame Buffer – Line Function – Circle Generating Algorithms - Filled Area Primitives – Fill Area Functions – Cell Array - Character Generation.	13
III	**Attributes of Output Primitives** Attributes Of Output Primitives : Line Attributes - Curve Attributes- Colour and Gray Scale - Area Fill Attributes – Character Attributes - Bundled Attributes – InquiryFunctions Antialiasing	12
IV	**Two Dimensional Geometric Transformations** Two Dimensional Geometric Transformations: Basic Transformations – Matrix Representation - Composite Transformations – General Fixed Point – Scaling – Other Transformations - Two Dimensional Viewing ^{2}: The Viewing Pipeline – Window– To– Viewport Coordinate Transformation - Clipping Operations – Point Clipping – Line Clipping – Cohen – Sutherland Line Clipping - Sutherland – Hodgeman Polygon Clipping – Curve Clipping – Text Clipping	13
V	**Three Dimensional Concepts** Three Dimensional Concepts: Three Dimensional Methods – Three Dimensional Geometric and Modeling Transformations - Translation – Rotation – Scaling – Other Transformations – Visible– Surface Detection Methods – Classification – Depth Buffer Method - Scan Line Method – Depth Sorting Method - BSP Tree Method – Area Subdivision Method.	13
Total Contact Hours		**64**

Text Book:

1. Donald Hearn & M. Pauline Baker, Computer Graphics C Version, 2nd Edition, Pearson India Education Services Private Limited, 2016.

(Chapters: 2, 3.1-3.5,3.11-3.14,4.1-4.8,5.1-5.4,6.1-6.7,6.8-6.10,9.1,11,13.1-13.8)

References:

1. Edward Angel and Dave Shreiner, *Interactive Computer Graphics: A top-down approach with OpenGL*, 6th Edition, Addison Wesley,2012.
2. Foley, Van Dam, Feiner, Hughes, *Computer Graphics Principles and Practice*, 3rd Edition, C. Addison Wesley,2014.
3. W.M.Newman and R.F.Sproull, Principles of Interactive Computer Graphics, 2/e, Tata McGraw– Hill Publishing Co. Ltd,1997.
4. D.F.Rogers, Procedural Elements for Computer Graphics, 2/e, Tata McGraw– Hill Publishing Co. Ltd.,2001.
5. V. Xiang and R.A. Plastock, Computer Graphics, Schaum"s Outline Series, Tata McGraw– Hill Publishing Co.,2002.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Identify the types of graphics monitors, workstations, input devices and input techniques available to work with graphics. **CO2:** Understand the mathematical and heuristic algorithms behind the graphics object generation **CO3**: Familiarize the attributes to control the object shape and antializing techniques for accurate display. **CO4**: Understand the forms of 2D transformations, mapping process from worldviewtodisplayviewandclippingprocesstoselectthevisible portion. **CO5:** Construct the algorithms for 3D object modelling and processing

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3^2	PSO 4	PSO 5
CO1	3	3	2	3	3
CO2	2	2	3	3	2
CO3	2	3	2	3	2
CO4	3	2	2	3	2
CO5	3	3	3	3	3

Course Code & Title	21CSCU0512 SOFTWARE ENGINEERING		Credits: 4
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	**The Course aims to** • Understand the various processes requirementsand concepts • Discuses the quality concepts and software quality assurance • Demonstrate the software testing strategies • Analyze the project scheduling and risk management		

UNIT	CONTENTS	Lecture Schedule
I	**PROCESS MODELS** A Generic Process Model – Process Assessment and Improvement - Prescriptive Process Models – Specialized Process Models – The Unified Process - Personal and Team Process Models - Process Technology – Product and Process.	12
II	**DESIGN CONCEPTS** The Design Process – Software Quality Guidelines and Attributes - The Evolution of Software Design - Design Concepts – The Design Model- Data Design Elements- Architectural Design Elements- Interface Design Elements- Component-Level Design Elements- Deployment-Level Design Elements.	13
III	**QUALITY ASSURANCE** Elements of Software Quality Assurance – SQA Tasks, Goals and Metrics – Formal Approaches to SQA – Statistical Software Quality Assurance – Software Reliability	13
IV	**SOFTWARE TESTING STRATEGIES** A Strategic approach to software testing – Strategic Issues - test strategies for conventional software – Validation Testing – System Testing – The art of Debugging	13
V	**RISK MANAGEMENT** Software Risks - Risk Identification – Assessing Overall Project Risk - Risk Components and Drivers - Risk Projection – Developing a Risk Table - Assessing Risk Impact - Risk Refinement – Risk Mitigation, Monitoring and Management – The RMMM Plan	13
	Total Contact Hours	**64**

Text Book:

1. Roger S. Pressman, Software Engineering – A Practitioner''s Approach, 7/e, McGraw Hill Inc., 2014.

References:

1. Alistair Cockburn, Agile Software Development, 2/e ,Pearson Education, 2007
2. Richard E.Fairley, Software Engineering concepts, Mc-Graw Hill, 1984.
3. Ian Sommervillie, Software Engineering, 9/e, Addison Wesley, 2011.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Differentiate the various processes and understanding requirements and concepts CO2: Understand the quality concepts CO3: Gain knowledge in software quality assurance CO4: Formulate the software testing strategies CO5: Analyze the project scheduling and risk management

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

Course Code & Title	21CSCU0513 LAB – VI: JAVA PROGRAMMING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to • Develop the programs using all the fundamental concepts of Java programming • Utilize the existing packages for efficient programming • Help them create their own packages and databases • Demonstrate the advanced programming using threads and applets • Explain them the data storage with different file formats		

Sl.No.	Conduct	No. of Hours
	Java Programming with Control statements, arrays Classes, Inheritance Packages, Interfaces Mathematical Methods Exception handling Input / Output classes Strings Threads Applets and Graphics Applications using the above concepts	48
Total Conduct Hours		**48**
Course Outcomes	**On completion of the course, students will be able to** **CO1:** Develop programs using the fundamental concepts in Java **CO2:** Demonstrate classes, objects, principles of inheritance and polymorphism, encapsulation, method overloading and to show thread priority, exception handling. **CO3:** Develop application using packages and store the data in the database. **CO4:** Design GUI using applets. **CO5:** Apply object oriented design for all real world problems.	

Mapping of COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

Course Code & Title	21CSCU0614 WEB TECHNOLOGIES		Credits: 4
Class	B.Sc. (Computer Science)	Semester	VI
Course Objectives	The Course aims to • Provide insight into the basics of Web Technoloies • Design and implement a dynamic web applications using HTML, JavaScript and PHP		

UNIT	CONTENTS	Lecture Schedule
I	**Web Essentials** Clients, Servers, and Communication: The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - HTTP Response Message - Web Clients - Web Servers	12
II	**Markup Language** Introduction to HTML: Headings - Linking- Internal linking - Images- Special Characters and horizontal Rules - Lists- Tables-Forms-Frames- Meta elements	13
III	**Style Sheets** CSS : Introduction to Cascading Style Sheets - Cascading Style Sheet Features - CSS Core Syntax - Style Sheets and HTML - Style Rule Cascading and Inheritance - Text Properties - CSS Box Model - Normal Flow Box Layout - Beyond the Normal Flow	13
IV	**Client-Side Programming** Java Script: Introduction to Scripting -Control Statements – Functions Objects: Math object –Array Object-String Object Document object - Boolean and Number objects -.Window object. Dynamic HTML: Events-Using cookies	14

	Server-Side Programming	
V	PHP : Introduction – Syntax – Comments – Variables – Operators – Expression – Conditional and Branching Statement – Looping statements - Functions – Arrays - Form Elements – File Handling –	14
	Total Contact Hours	**64**

Text Books:

1. Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, New Delhi, India, Last Impression 2010.
2. Steven Holzner, PHP: The Complete Reference, Tata McGraw-Hill, 2017
3. Deitel, Internet and World Wide Web – How to Program, Fourth Edition, Pearson Prentice Hall, 2011

References:

1. UttamK. Roy, "Web Technologies", Oxford University Press, 2011.
2. Julie C. Meloni, Sams Tech Yourself: HTML, CSS and JavaScript all in One, SAMS, 2014.
3. Achyut S Godole & Atul Kahate, Web Technologies, TCP/IP Architecture and JavaProgramming, Second Edition, Tata Mc-Graw Hill, 2010
4. Deitel H.M and Nieto T.R, Internet and World Wide Web How to Program, Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2012
5. JavaScript: Programming Basics for Absolute Beginners (Step-By-Step JavaScript Book 1), Nthan Clark, Kindle Edition, 2018

E-Resource:

- www. w3schools.com
- https://www.seu1.org/files/level6/IT230/Book/(web.tech%201st%20book)%20Web%20Technologies%20-%20A%20Computer%20Science%20Perspective.pdf
- https://www.pearson.ch/HigherEducation/Pearson/EAN/9780273764021/Internet-and-World-Wide-Web-How-to-Program

Course Outcomes	**On completion of the course, students will be able to** **CO1:** Outline the basics of client server communication **CO2:** Design webpages using HTML & CSS **CO3:** Have practical experience in creating dynamic HTML. **CO4:** Generate dynamic content to webpages using JavaScript and PHP **CO5:** Develop web applications for any realtime problems.

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

Course Code & Title		21CSCU0615 COMPUTER NETWORKS		
				Credits: 4
Class	B.Sc. (Computer Science)		Semester	VI
Course Objectives	**The Course aims to** • Understand the basics of computer networks, with all types and models. • Understand the protocol stacks. • Learn the working of the transmission media and link layer • Understand the functionalities of Network, Transport and application layers.			

UNIT	CONTENTS	Lecture Schedule
I	Uses of computer networks - Network hardware - Network – software - Reference models - Example networks - Network standardization	12
II	Communication Media: Guided transmission media - Wireless transmission - Communication satellites - The public switched telephone network- The mobile telephone system	13
III	Data link layer: Data link layer design issues - Error detection and correction - Elementary data link protocols - Sliding window protocols - Multiple access protocols – Wireless LANs - Bluetooth 3	13
IV	Network Layer: Network layer design issues - Routing algorithms - Congestion - control algorithms - Quality of service - Internetworking	13
V	Transport Layer: Transport service - Elements of transport protocols – DNS- Electronic mail – The World Wide Web.	13
Total Contact Hours		**64**

Text Books:

1. Andrew S.Tannenbaum and David J. Wetherall, "Computer Networks" 5/e, Pearson Education 2011

References:

1. Douglas E. Comer, "Computer Networks and Internet", Sixth Edition, Pearson, 2018

2. William Stallings "Network Security Essentials: Applications and Standards", Sixth Edition, Pearson 2018.

Course Outcomes	On completion of the course, students will be able to
	• Remember the basic terminologies and concepts in computer networks. • Understand the various types of communication media • Recognize the different functionalities of data-link layer • Identify and analyze the functionalities of network layer. • Appraise the working of the transport layer and application layer.

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

Course Code & Title	21CSCU0616 **COMPUTER ORGANIZATION**		Credits: 4
Class	**B.Sc. (Computer Science)**	**Semester**	**VI**
Course Objectives	**The Course aims to** • Understand the basic building blocks and the architecture of computers • Learn the techniques in Computer Organization • Explain the advance processor architectures		

UNIT	CONTENTS	Lecture Schedule
I	**Functional Units** Basic operational concepts, Bus structures, Machine instructions, memory locations, addressing modes, assembly language	12
II	**Arithmetic** Number representations, addition and subtraction of signed numbers, Design of fast adders, Multiplication of signed numbers, Fast multiplication and Integer division	13
III	**Processing Unit** Concepts, Execution of complete instruction, Multi bus organization, ALU; Control Unit:Hardwired Control, Micro programmed Control; Micro Instructions, Micro program sequencing, Micro instructions with next address field and pre-fetching ₃	13
IV	**Memory &** memory **Input and output organization** RAM, ROM, Cache Memories, and Virtual memory **Input and output organization:** Accessing I/O devices, Interrupts, DMA, and Interface circuits	13
V	**Advanced Processor Architecture** RISC, Pipelining, Super Scalar Processors, VLIW, Parallel and Vector Processors.	13
Total Contact Hours		**64**

References:

1. Carl Hamacher, Zvonko Vranesic, safwat Zaky, "Computer Organization and EmbeddedSystems", Sixth Edition, Tata McGraw Hill, 2011.
2. William Stallings, "Computer Organization and Architecture", Tenth Edition, Pearson Education, 2015.
3. David A. Patterson, John L.Hennessy, "Computer Organization and Design", Fourth Edition, Morgan Kauffmann Publishers, 2011.

Course Outcomes	**On completion of the course, students will be able to**
	CO1: Explain the computer architecture
	CO2: Perform simple arithmetic operations for fixed-point and floating-point addition, subtraction, multiplication & division
	CO3: Design combinational and sequential digital circuits.
	CO4: Construct an instruction set for simple tasks

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	3	2
CO2	3	3	3	2	2
CO3	3	3	3	2	2
CO4	3	3	3	1	2
CO5	3	3	3	3	2

Course Code & Title	21CSCU0617 Lab VI: WEB TECHNOLOGIES		Credits: 1
Class	B.Sc. (Computer Science)	Semester	VI
Course Objectives	The Course aims to • Explore the designing of web applications • Design and implement a dynamic web applications using HTML, JavaScript and PHP		

Sl.No.	CONTENTS	No. of Hours
1. 2. 3. 4. 5. 6. 7.	Webpage design using HTML Tags Creating – Ordered List, Unordered List, Tables, Frames, Links, Image Anchor, Image Maps Using Form Controls with Input Tag, Cascading Style Sheets Creating XML Document Working with client-side scripting using JavaScript Working with server-side scripting using PHP	48
Total Conduct Hours		**48**
Course Outcomes	**On completion of the course, students will be able to** **CO1:** Design webpages using HTML and CSS **CO2:** Write scripts webpages using JavaScript to develop dynamic **CO3:** Develop online web applications using JavaScript and PHP **CO4:** Develop web application project using web designing tools And Techniques **CO5:** Hosts the web application in the internet	

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Discipline Centric Elective: I

Course Code & Title	21CSCU04D1 DATA MINING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	**The Course aims to** • Explore how this interdisciplinary field brings together techniques from databases, statistics, machine learning, and information retrieval. • Teach the basic concepts of Data Warehousing and its Architecture • Discuss the basic algorithms and techniques used in data mining		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction** Data Mining – Need for Data Mining – Kinds of Data can be Mined Kinds of Patters can be Mined – Technologies used Applications Targeted – Major Issues in Data Mining Data Objects and Attribute Types – Basic Statistical Descriptions of Data Data Visualization – Measuring Data Similarity and Dissimilarity	12
II	**Data Pre-processing** Data Preprocessing: An Overview-Data Cleaning Data Integration Data Reduction Data Transformation and Data Discretization	12
III	**Data Warehousing** Data Warehousing: Introduction- Difference between Database Systems and Data Warehouses Data Warehousing: A Multitiered Architecture Data Warehouse Models- Extraction, Transformation and Loading-Metadata Repository Data Cube: A Multidimensional Data Model Data Warehouse Design and Usage-Efficient Data Cube Computation-An Overview	15
IV	**Classification** Classification – Basic Concepts Decision Tree Induction Bayes Classification Methods	12
V	**Cluster Analysis** Cluster Analysis - Partitioning methods Hierarchical methods- BIRCH, ROCK Density based methods – DBSCAN Grid based methods : STING	13

Total Contact Hours	64

Text Book:
1. Jiawei Han, MichelineKamber and Jian Pei, *Data Mining: Concepts and Techniques*,Morgan Kauffmann Publishers , 2012.
   (Chapters: 1,2,3,4.1,4.2.1,4.3,4.4.1,8.1-8.3,10.1-10.4)

References:

1. Hongbo DLL, Data Mining Techniques and Applications: An Introduction,
2. Cengage Lmg Business Press, 2010.
3. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, 3[rd]Edition Morgan Kauffmann Publishers, 2011.
4. Udit Agarwal, *Data Mining & Data Warehousing*, 1st Edition, S.K.Kataria&sons Publication, 2016.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Comprehend the fundamental principles of data mining **CO2:** Explain the data extraction and transformation techniques. **CO3:** Describe Data Warehouse architecture and multidimensional data model **CO4:** Illustrate the use of decision tree induction for mining classification rules and other classification methods **CO5:** Explain the different types of clustering methods used in Cluster analysis.

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	2	2	3	3	2
CO3	2	3	2	3	2
CO4	3	2	2	3	2
CO5	3	3	3	3	3

Course Code & Title	21CSCU04D2 BIG DATA ANALYTICS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	**The Course aims to** • Provide overview of approach facilitating data analytics on Big Data • Demonstrate the application of big data analytics technologies • Discuss about Big Data Tools and R Packages.		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction and Tools** Understanding Big Data: Concepts and TerminologyBig Data Characteristics - Different types of data. Business Motivations and Drivers for Big data Adoption Big Data Analytics Lifecycle - Case Study Example	12
II	**Enterprise Technologies and Big Data Business Intelligence** Online Transaction Processing(OLTP) - Online Analytical Processing(OLAP) Extract Transform Load (ETL) - Data Warehouses - Data Marts- Traditional BI- Big Data BI- Case Study Example. Big Data Storage Concepts: Clusters - File Systems and Distributed File Systems - NoSQL – Sharding – Replication - Sharding and Replication - CAP Theorem – Case Study Example.	13
III	**Big Data Processing Concepts** Parallel Data Processing - Distributed Data Processing Processing Workloads - Cluster - Processing in Batch ModeProcessing in Real-time Mode - Case Study Example	13
IV	**Big Data Tools** R, R - Hadoop – Architecture – R Packages – Classification	13
V	**R Database** R Database – RHbase, RHive – R Storm – Mongodb – Dataset basics	13
	Total Contact Hours	64

Text Book:

Thomas Erl,WajidKhattak and Paul Buhler, Big Data Fundamentals Concepts, Driver & Techniques, 3rd Edition, Pearson publication, 2018. Chapters : 1-8

References:

1. Pam Baker , *Big Data Strategies* , 1st edition , Cengage Learning India Private Limited, 2016.

2. Dr. Anil Maheshwari, *Big Data,*1st edition , Published by McGraw Hill Education (India) Private Limited, 2017. 3. Seema Acharya and Subhashini Chellappan, *Big Data and Analytics*, 2nd edition, Wiley India Private Limited, 2017. 4. Seema Acharya, Data Analytics using R, McGraw Hill Education publication (India) Private Limited, 2018.	

Course Outcomes	**On successful completion of the course, the students will be able to** **CO1:** Explain the fundamental concepts of Big data **CO2:** Explain the Big Data storage concepts **CO3:** Utilize Big Data processing concept **CO4:** Illustrate the Big Data Tools using R Programming packages **CO5:** Demonstrate Big Data storage using R-Database

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	1
CO2	3	3	3	3	2
CO3	1	2	3	3	2
CO4	2	2	3	2	2
CO5	3	3	3	1	3

Course Code & Title	21CSCU04D3 MANAGEMENT INFORMATION SYSTEMS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to • Provide a foundation to information system • Knowledge on Impart e-business systems • Provide enterprise business support systems		

UNIT	CONTENTS	Lecture Schedule
I	**Foundation of Information Systems in Business**	12
	Foundation Concepts – Information Systems in Business – The Components of Information Systems	
II	**Competing with Information Technology**	13
	Fundamentals of Strategic Advantage – Using Information Technology for Strategic Advantage	
III	**e-Business Systems**	13
	e-Business Systems – Functional Business Systems	
IV	**Enterprise Business Systems**	13
	Getting All the geese Lined up: Managing at the Enterprise Level – Enterprise Resource Planning: The Business Backbone – Supply Chain Management: The Business Network	
V	**Electronic Commerce Systems**	13
	Electronic Commerce Fundamentals – e-Commerce Applications and issues.	
	Total Contact Hours	64

Text Book:

1. James A O Brien, George M Marakas and Ramesh Behl, "Management Information Systems", Tata McGraw Hill Education Private Limited, 2010.

References:
1. Kenneth C. Laudon , Jane P. Laudon, Management Information Systems: Managing the Digital Firm 15th Edition, Kindle Edition, Pearson, 2017

Course Objectives	CO1: Know the fundamentals of information systems CO2: Learn the strategic advantages of IT CO3: Know the functional business systems CO4: Plan the enterprise business CO5: Learn e-commerce applications

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Discipline Centric Elective: II

Course Code & Title	21CSCU05E1 MOBILE COMPUTING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	**The Course aims to** • Learn the importance of mobile devices and use • Understand the merits and communication strategies in present scenario. • Analyze and use various tools and techniques used in mobile computing		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction** Need for Mobile Computing- Mobile and Wireless Devices - Applications – A short history – Market for Mobile Communications	12
II	**Wireless Transmission** Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation - Spread Spectrum and Cellular Systems	13
III	**Medium Access Controls** SDMA, FDMA, TDMA, CDMA, comparisons and GSM	13
IV	**Satellites and Wireless LAN** Satellite Basics - Wireless LAN : IEEE 802.11 – Architecture, Physical Layer, MAC Layer, HIPERLAN 1, Bluetooth – Architecture, Link Management and Security.	13
V	**Mobile Network Layer** [4] Mobile Network Layer: Mobile IP – Goals, Packet Delivery Strategies, Registration, Tunneling and Reverse Tunneling, Mobile Ad–hoc Networks – Routing Strategies	13
	Total Contact Hours	64

Text Book:
1. Jochen Schiller, Mobile Communication, 2/e, Pearson Education, Delhi 2008.
2. Singhal Sandeep and Bridgm Thomas, The Wireless Application Protocol, Pearson Education, India, 2001.

References:
Wireless Application Protocol: "Writing Applications for the Mobile Internet", Sandeep Signal et al.

Course Outcomes	**On successful completion of the course, the students will be able to** **CO1:** Learn the types of mobile and wireless devices available and

	their features. **CO2:** Understand different types of telecommunication systems **CO3:** Identify the types of wireless LAN architecture and protocols. **CO4:** Learn the structure, features and transmission techniques of mobile IP. **CO5:** Learn and understand simple mobile applications

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Code & Title	21CSCU05D2 CLOUD COMPUTING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to • Classify the various Cloud computing applications • Understand the architecture of Cloud computing • Know the Cloud computing standards		
UNIT	CONTENTS		Lecture Schedule
I	**UNDERSTANDING CLOUD COMPUTING** History of Cloud computing - Cloud Computing Architectural Framework - Types of Clouds - pros and cons of cloud computing - difference between web 2.0 and cloud - key challenges in cloud computing - Major Cloud players - Cloud Deployment Models - Virtualization in Cloud Computing - types of virtualization - Parallelization in Cloud Computing - cloud resource management - dynamic resource allocation - Optimal allocation of cloud models		12
II	**CLOUD SERVICE MODELS** Software as a Service (SaaS) - Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Service Oriented Architecture (SoA) - Elastic Computing - On Demand Computing		13
III	**APPLICATIONS** Deployment of applications on the cloud - Hypervisor - Case studies - Xen, VMware, Eucalyptus - Amazon EC2, KVM, Virtual Box, Hyper-V		13
IV	**CLOUD COMPUTING FOR EVERYONE** Cloud data centres - Energy efficiency in data centre - Mobile cloud computing service models - Collaboration with services and applications: CRM management - Project management - Email - on line database - calendar - schedules - Word Processing - Presentation - Spreadsheet - Databases - Desktop - Social Networks and Groupware		13
V	**CLOUD SECURITY** Cloud security - Security threats and solutions in clouds - Auditing protocols - dynamic auditing - storage security - Privacy preserving - Fully Homo-morphic Encryption - big data security - Cloud availability - DoS attacks - Fault tolerance management in cloud computing - Cloud computing in India		13

Total Contact Hours	64

Text Book:

 Anthony T.Velte, Toby J. Velte Robert Elsenpeter, Cloud Computing a Practical Approach, TATA Mc-Graw - Hill, New Delhi, 2010

References:

1. Judith Hurwitz, Bloor.R, Kanfman.M, Halper.F, (2010), "Cloud Computing for Dummies", Wiley India Edition.
2. Gautam Shroff, (2010), "Enterprise Cloud Computing" ,Cambridge University press.
3. Ronald Krutz and Russell Dean Vines, (2010), "Cloud Security", Wiley-India pvt. Ltd.
4. Michael Miller – Que, Cloud Computing: Web-Based Applications, That Change the Way You Work and Collaborate Online - 2008
5. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Gain knowledge in Basics of Cloud computing. **CO2:** Understand Cloud Computing architecture **CO3:** Learn frameworks in cloud computing. **CO4:** Discuss practical applications of cloud computing **CO5:** Know CRM management

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

Course Code & Title	**21CSCU05D3** **ENTERPRISE RESOURCE PLANNING**		Credits: 4
Class	**B.Sc. (Computer Science)**	**Semester**	
Course **Objectives**	**The Course aims to** • Classify the different types of business processes • Provide existing business models in ERP • Impart the future trends in ERP systems		

UNIT	CONTENTS	Lecture Schedule
I	**Enterprise Resource Planning** Introduction - basic concepts-benefits of ERP and limitations - Evolution of ERP - Materials Requirements Planning (MRP) - Manufacturing Resource Planning (MRP II) - Business modelling	12
II	**ERP and its related Technologies** Data Mining - Data Warehousing - Business Process Reengineering - Decision Support System (DSS) - Management Information System (MIS) - Executive Information System (EIS) – OLAP	13
III	**ERP for Manufacturing Processes** Distribution requirements planning (DRP) - Master production schedule - ERP for manufacturing processes - Distribution requirements planning (DRP)	13
IV	**Master Production Schedule** ERP software selection - Risks Factors-Role of consultants - Modules in an ERP software package - Fi4nance-sales and distribution-plant	13
V	**Future Directions of ERP** Mobile ERP system Case Studies of ERP implementation - Problems - challenges and software solution for the enterprises - performance indicators of an ERP package	13
Total Contact Hours		

Text Books:

Alexis Leon, "Enterprise Resource Planning", Tata Mc-Graw-Hill, 3rd Edition, 2014.

References:

1. Bret Wagner, Ellen Monk, "Enterprise Resource Planning", Cengage Learning, 3rd

Edition, 4th Edition, 2013.
2. Sandeep Desai, Abhishek Srivastava, "ERP to E2RP A Case Study Approach", Prentice Hall of India, Delhi, 2013.

Course Outcomes	On completion of the course, students will be able to
	CO1: Differentiate the software lifecycle for traditional and ERP software **CO2:** Demonstrate different approaches for ERP software selection and deployment. **CO3:** Examine the integration of ERP modules and its sub-modules **CO4:** Compare Re-engineered business processes of chosen enterprise system. **CO5:** Know the future trends in ERP systems

Mapping of COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

LIST OF SKILL BASED ELECTIVE COURSES

Course Code & Title	21CSCU05S1 MOBILE APPLICATION DEVELOPMENT		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	**The Course aims to** • Learn about different types of mobile devices • Explain about modern mobile operating systems • Design the various kinds of mobile applications		

UNIT	CONTENTS	Lecture Schedule
I	Getting Started - Overview of Android and Android SDK - Getting to know your Android development environment - Writing your first Android application - Running and debugging your application - Test your application on device	8
II	Android Applications - The Big Picture: Android architecture - Android application model - Overview of Android application building blocks - Application design guidelines - Application lifecycle	8
III	Building User Interface: Overview of Android's view structure - Android built-in layouts - Defining a layout in XML - Android built-in Views - Event handling - Building custom views andlayouts	8
IV	Building Android Applications: AndroidManifest.xml file - thecontrol file - Building activities - Building intents - Building and using services – Notifications - Building and using content providers	8
Total Contact Hours		**32**

Text Book:

John Lombardo, Blake Meike, Rick Rogers, Zigurd Mednieks, "Android Application Development" , O"Reilly Media, Inc, 2009

Reference:

Barry Burd, "All-in-one for Dummies – 2nd Edition", 2015

Course Outcomes	**On successful completion of the course, the students will be able to** **CO1:** Describe the types of mobile devices and mobile platforms **CO2:** Summarize the basic structure of mobile operating systems and theirarchitecture **CO3:** Setup programming tools for a mobile application developer **CO4:** Design various mobile application **CO5:** Recognize runtime environment for mobile application

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	3
CO2	3	2	3	2	3
CO3	3	3	1	3	3
CO4	3	3	3	3	2
CO5	1	1	3	3	3

Course Code & Title	21CSCU05S2 SKILL DEVELOPMENT FOR EMPLOYABILITY		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	**The Course aims to** • Develop the knowledge of Aptitude • Enable the critical reasoning ability • Induce the skills for the preparation of competitive examinations		

UNIT	CONTENTS	Lecture Schedule
I	**General English 1** Verbs- Synonyms- Antonyms- Articles- Prepositions - Idioms and Phrases - Cloze test – Substitution –Spotting Errors.	8
II	**General English 2** Vocabulary – Comprehension – spelling - Active Voice and Passive Voice - Sentence Arrangement-Para Completion - Joining Sentences.	8
III	**Aptitude** Number Systems- Decimals and Fractions – Percentage - Ratio & Proportion - Profit & Loss - Simple & Compound Interest - Discount – Time & Work - Time & Distance-H.C.F. and L.C.M. - Problems on Ages.	8
IV	**Reasoning** Analogy -Letter and Symbol Series – Arithmetic Reasoning Blood Relation Qualms - Classification – Coding Decoding –Direction – Series Completion.	8
	Total Contact Hours	32

Text Books:
1. Hari Mohan Prasad & Uma Rani Sinha ,"Objective English for Competitive Examinations", , Tata McGraw Hill Edition Pvt. Ltd, 2013 (Unit 1 & 2)
2. R.S. Agarwal ,"Quantitative Aptitude", S. Chand Publications, 2017 (Unit 3 & 4)

References:
1. R.S. Agarwal,Objective General English, S.Chand Publications, 2017
2. R.V.Praveen,Quantitative Aptitude and Reasoning, PHI Publishers, 2016

Mapping COs with PSOs:

CO Vs PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	3	2	3	2
CO3	3	3	2	3	3
CO4	3	2	3	3	3
CO5	2	3	2	3	3

Course Code & Title	**21CSCU06M1** **INTRODUCTION TO R** **PROGRAMMING** **Credits: 2**		
Class	**B.Sc. (Computer Science)**	**Semester**	**IV**
Course Objectives	**The Course aims to** • Teach the basics of R. • Provide thorough understanding of the data structures used in R. • Inculcate problem solving and programming skills using R programming.		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction** Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names	6
II	**Matrices, Arrays And Lists** Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists	6
III	**Data Frames and Programming Constructs** Creating Data Frames- Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames Factors and Tables – factors and levels – Common functions used with factors – Working with tables Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions and objects – Math and Simulations in R	6
IV	**Input/Output and Graphics** Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three-dimensional plots.	7

	Interfacing	
V	Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models –Non-linear models – Time Series and Auto-correlation – Clustering	7
	Total Contact Hours	32

Text Book:

1. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

References:

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013

Course Outcomes	On completion of the course, students will be able to
	CO1: Learn fundamentals of R. **CO2**: Use appropriate data structure for storing data **CO3**: Gain knowledge on use of data frames and programming constructs **CO4**: Use Graphics functions to create graphs **CO5:**Understand and implement interfacing methods in R.

Mapping COs with PSOs:

CO Vs PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	1	2	3
CO3	3	3	1	1	3
CO4	3	3	1	1	3
CO5	3	3	1	2	3

Course Code & Title	21CSCU06M2 FUNDAMENTALS OF STATISTICS AND SPSS		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to • Discuss basic descriptive and inferential statistics • Learn the main features of SPSS • Perform statistical analysis with SPSS		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction to statistics** SPSS introduction and overview, Statistical terms-mean, median, mode, standard deviation, variance, frequency, hypothesis, nominal and ordinal variable and standard error. Windows in SPSS – Data editor, output viewer, syntax editor etc., Basic filetypes – different file types in SPSS.	8
II	**Types of windows in SPSS** Data editor organization - variable view - data view, Entering and editing data in SPSS data editor, Reading data from spreadsheet, database and text file, Data transformation-computing variable, Functions: arithmetic, statistical and string functions, Recode: into same variable, into different variable - Automatic Recode.	8
III	**File Handling Techniques** File handling and file transformation introduction - Sort cases, Merging data files – variable merge and case merge, Splitting a data file and apply different analysis, Different ways to select cases from a data set, Working with output viewer and draft viewer, formatting output. Pivot table basics and [5]advantages of pivot table.	8
IV	**Analyzing Data** Analyzing data: frequencies - descriptive – crosstabs,Multiple response analysis, T-tests: one-sample, independent and paired test, One way analysis of variance - Linear regression, Charts:introduction - types - creating and editing.	8
Total Contact Hours		32

Text Book:

1. R.SN. Pillai and Bhagavathi,"Statistical Methods", S.Chand and Company Limited, Reprint 2007.

Reference:

1. Kiran Pandya , SmrutiBulsari , Sanjay Sinha, "SPSS in Simple Steps" Dreamtech Press,2011

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Analyze the basic workings of SPSS and perform basic statistical analyses **CO2:** Perform data checking and create tables and charts **CO3:** Demonstrate the data management tasks in SPSS application **CO4:** Recognize the various file handling techniques in SPSS **CO5:** Perform advanced analysis in SPSS

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	1
CO2	3	1	2	2	3
CO3	3	3	3	3	3
CO4	3	3	2	3	3
CO5	2	2	3	3	3

Course Code & Title	21CSCUO6M3 **FINANCIAL ACCOUNTING SOFTWARE**		
Class	**B.Sc. (Computer Science)**	**Semester**	**V**
Course Objectives	**The Course aims to** • Prepare financial statements in accordance with appropriate standards. • Interpret the business implications of financial statement information • Establish accounting information for planning and control		

UNIT	CONTENTS	Lecture Schedule
I	Basics of Accounting, Type of accounts , Rules of Debit and Credit, Voucher Entry, Ledger Posting, Final Accounts Preparation - Cash Book, Ratio Analysis, Depreciation, Stock Management, Adjustment Entries - Cash/Funs flow – GST	8
II	Introduction to Tally, features and Advantages – Implementingaccounts in Tally - Familiarization with the Tally interface Company creation, Account Creation, Voucher Entry in Tally.	8
III	Inventory Information - Creating Stock groups- Stock categories -Creating Stock items - Creating Godowns - Voucher type - Pure Inventory Vouchers - Purchase/Sales orders and invoices	8
IV	Reports - Trial Balance- Balance Sheet - Profit and Loss account -Stock summary - Ratio analysis - Day Book - Bank Reconciliation Statement - Payroll Module - TDS Module - GST Module.	8
Total Contact Hours		**32**

Text Book:

Dr. Namrata Agrawal, Tally 9, , Dreamtech Press, New Delhi, Dream Tech Press, 2007

Reference:

Official Guide to Financial Accounting Using Tally. ERP 9 with GST (Release 6.4), Tally Education, Kindle Edition, 2018

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Develop practical skills in using a computerized accounting system
	CO2: Understand the concepts of the integrated structure of a computerized accounting system
	CO3: Analyze the procedure of preparing account transactions
	CO4: Apply the skills to develop an appreciation and expertise in the use of other accounting software
	CO5: Develop the capacity to apply the above skills to practical Accounting Problems and procedures

Mapping COs with PSOs:

CO VsPSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	2	2	3	3	2
CO3	2	2	3	3	3
CO4	1	3	2	3	3
CO5	3	3	3	2	3

Course Code& Title	**21CSCU06M4** **INFORMATION TECHNOLOGY FOR RURALDEVELOPMENT (ITRD)**		
			Credits: 2
Class	**B.Sc. (Computer Science)**	**Semester**	**VI**
Course Objectives	**The Course aims to** • Provide the basics of ICT technology • Impart the basic skills in ICT Applications • Understand the importance of ICT in Rural development		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction to ICTs for sustainable Development** Introduction to Information and Communication Technology (ICT – Role of ICTs in Sustainable Development - Current Status of ICTs in Sustainable Development – Global and India Scenario – Potential of ICTs in various fields - impact of information Technologies on GDP growth	8
II	**Information** Internet and world wide web – community radio - technology-user interface – design of relevant ICT products and services	8
III	**ICT Applications** Applications of ICT in education – Health (telehealth, telemedicine and health informatics) - Gender Equality, Agriculture	8
IV	**ICT Applications** Applications of ICT in Rural Industry - e-Governance, telecentres, Mobiles for development - climate change and disaster management - ICT Networks for water managem6ent	8
	Total Contact Hours	**32**

Text Book:

1. Dr. M. Vanaja, Dr. S. Rajasekar, Information & Communication Technology (ICT) InEducation Paperback, 2016

Reference:

1. Prof. T. Mrunalini, Prof. A. Ramakrishna, Information & Communication Technology(ICT) in Education, Paperback, 2016

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Understand various ICT tools and techniques **CO2:** Realize the importance of ICT in rural development **CO3:** Select the right tools for right applications **CO4:** Analyse various existing ICT products **CO5:** Realize the use of ICT in sustainable development

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	1	1	3	3	3
CO4	1	2	3	3	3
CO5	2	2	3	3	3

Value Added Courses

Course Code & Title	Open Source Software		
Class	**B.Sc. (Computer Science)**	**Semester**	II
Course Objectives	The Course aims to • Expose the students to the context and operation of free and open source software (FOSS) communities and associated software projects. • Familiarise and understand in a FOSS projects. • Learn fewimportant FOSS tools and techniques		

UNIT	CONTENTS	Lecture Schedule
I	**Philosophy** Notion of Community - Guidelines for effectively working with FOSS community - Benefits of Community based Software Development - Requirements for being open, free software, open source software - Four degrees of freedom - FOSS Licensing Models - FOSS Licenses - GPL- AGPL - LGPL - FDL - Implications - FOSS examples.	8
II	**LibreOffice** Introduction & Installation (Linux & Windows)- Typing-Formatting-Typing - Inserting objects & Inserting pictures - Printing-Viewing, saving **Calc:** Introduction - How to work with cells, sheets - Formatting - Basic data manipulation **Impress:** Introduction - Creating a presentation - Viewing a presentation - Inserting pictures in document[6]	8
III	**Linux OS** Linux basics - Installation - Ubuntu desktop - Synaptic packet manager - Basic commands - General Purpose utilities in Linux - File system - Working with regular files - File attributes - Redirection & pipes - Linux processes - Linux environment - Basic system administration - Simple filters	8
IV	**QCAD** Introduction to QCAD -Drawing Methods in QCAD- Using Modification Tools to stretch, Mirror, Scale & Rotate . **Blender for 3D animation :**Installing in Windows - 3D Cursor - Moving in 3D Space - Camera View - Basic Description - Change	8

	Window types - File Browser and Info Panel Windows	
	Total Contact Hours	**32**

Text Book
Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition,OReilly Media, 2009
References:
1. Philosophy of GNU URL: http://www.gnu.org/philosophy/.
2. Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin made-easy/.
3. www.spokenturorials.org
Libre office: http://www.libreoffice.org.

Course Outcomes	**On completion of the course, students will be able to** **CO1:** Promotes technology and the use of open source software **CO2:** Learn to execute project using Open source technology to meet the industryneeds & problems **CO3:** Enable Open Source awareness among the students. **CO4:** Migrating proprietary software lab to open source lab. **CO5:** Ability to build and modify one or more Free and Open Source Software packages.

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	1	1	3	3	3
CO4	1	2	3	3	3
CO5	2	2	3	3	3

Course Code & Title	Client/Server Technologies		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	**The Course aims to** • Classify the various Client Server architectures • Understand the relevant protocols used for different architectures • Know the techniques used for multiple applications		

UNIT	CONTENTS	Lecture Schedule
I	Client Server System Concepts – Introduction – Concepts - Client Server Architecture - Two-Tier Architecture – Three-Tier Architecture - N-Tier Architecture - N-Tier vs 2-Tier Architecture - Case Study of N-Tier Architecture - Client Server Models - Gartner Classification – Middleware - Characteristics and types of Server - File Server - Database Server - Communication Server - Object Server - Groupware Server - Transaction Server - Characteristics and types of Clients - Thin Client - Fat Client.	8
II	Components of Client Server Computing – Client - Role of the Client - Client Services - Request for Service - Components of Client Server Computing – Server - Role of the Server - Server Functionality in detail - Components of Client Server Applications – Connectivity – OSI - Communications Interface Technology.	8
III	Client Server System Architecture - Client Server Building Blocks – Hardware - Client Hardware - Server Hardware - Client Server Building Blocks – Software - Client Server Systems Development Methodology - Project Management - Architecture Definition - Systems Development Environment – Middleware - Types of Middleware - DCE, MOM, TP – Monitors – ODBC - Design Overview of ODBC - ODBC Architecture – Components – Applications - Driver Managers - Database Drivers - ODBC Data Sources - Network Operating System - Base Services - External Services.	8
IV	SQL Database Servers - Server Architecture - Multithread Architecture - Hybrid Architecture - Stored Procedures – Triggers - Client Server Transaction Processing - Rules of Client Server Transaction Processing - Transaction Models - Chained and Nested Transactions - Transaction Management Standards - Data	8

	Warehousing - Warehousing Techniques - Data Mining.	
V		**32**
	Client Server Protocols – RPC – IPC - Recent Trends – Intranet – Extranet – Internet - CORBA.	
Total Contact Hours		

Text Book

- Robert Orfali, Dan Harkey and Jerri Edwards: Essential Client/Server Survival Guide, John Wiley &Sons Inc 1996

References:

- Alex Berson: Client Server Architecture
- Patrick Smith, Steve Guengerich: Client Server Computing, Second Edition, Prentice Hall of India Pvt Ltd.

Course Outcomes	**On completion of the course, students will be able to** **CO1:** Gain knowledge in Basics of Client Server technologies. **CO2:** Understand the different Client Server architectures **CO3:** Learn the various transactions and processing. **CO4:** Discuss practical applications of client server architectures. **CO5:** Appreciate the protocols meant for different technologies

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	1	1	3	3	3
CO4	1	2	3	3	3
CO5	2	2	3	3	3

Course Code & Title	Document Preparation using Latex		
Class	B.Sc. (Computer Science)	Semester	II
Course Objectives	The Course aims to • Create basic types of LATEX documents (article, report, letter, book). • Format words, lines, and paragraphs, design pages, create lists, tables, references, and figures in LATEX • Import graphics, as well as: building diagrams, enhancing figures, and plotting functions, using the graphics packages. • Listing content and references: • creating a table of contents and lists of figures and tables; as well as how to cite books, create bibliographies, and generate an index		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction** • Introduces the learner to LaTeX, its installation, and different IDEs. • The learner creates the first document using LaTeX, organizes content into sections using article and book class of LaTeX.	8
II	**Styling Pages** • Reviewing different paper sizes, • Examines packages, • Formats the page by setting margins, • Customizing header and footer, changing the page orientation, • Dividing the document into multiple columns, • Reading different types of error messages.	8
III	**Formatting Content** • Formatting text (styles, size, alignment), • Adding colors to text and entire page, 6and adding bullets and numbered items. • Process of writing complex mathematics.	8
IV	**Tables and Images** • Creating basic tables, adding simple and dashed borders, merging rows and columns, and handling situations where a table exceeds the size of a page. • Add an image, explore different properties like rotate, scale, etc..	8
V	**Referencing and Indexing** • Cross-referencing (refer to sections, table, images), • Add bibliography (references), and create back index.	32
	Total Contact Hours	

Text Books:
1.David F Griffiths and Desmond J. Higham, Learning LaTex, SIAM (Society for Industrial and Applied Mathematics) Publishers, Phidel Phia, 1996.

Reference:
1. Leslie L. A Document Preparation System User's Guide and Reference Manual, Addison Wesley Publishing Company, 2001.
2. Kottwitz, S. LaTeX Beginner's Guide. Packt Publishing Ltd., UK, 2011.
3. Tantau,T. User Guide to the Beamer Class, http://latex-beamer.sourceforge.net.
4.   Oetiker,T.   The   Not   So   Short   Introduction   to LATEX2E,https://tobi.oetiker.ch/lshort/lshort.pdf.

Course Outcomes	**On completion of the course, students will be able to**
	CO1: Understand a basic types of LATEX documents
	CO2: To know more formatting a document
	CO3: To know more import graphics, packages, tables and mathematical formula
	CO4: To understand the cross reference and index
	CO5: To understand the Referencing and Indexing

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	1	1	3	3	3
CO4	1	2	3	3	3
CO5	2	2	3	3	3

Course Code & Title	Software Testing		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	**The Course aims to** - Understand the Fundamentals of Software Testing - Learn the Requirements based Test Case Design Techniques - Explain Source Code Based Test Case Generation and Test Adequacy Criteria		

UNIT	CONTENTS	Lecture Schedule
I	**Fundamentals of Software Testing** Basics of Software Testing - Test Approaches, Test Planning, Test Strategy - Defects Management .	8
II	**Requirements based Test Case Design Techniques** Requirements based test case generation introduction - Equivalence Class Portioning - Boundary value analysis -Cause effect graphing.	8
III	**Source Code Based Test Case Generation** CFG Creation - Cyclomatic Complexity - Test Paths Generation - Test Cases Generation.	8
IV	**Test Adequacy Criteria** Path Coverage, Statement Coverage - Condition Coverage - Decision Coverage.	8
Total Contact Hours		

32

Reference Books

1. Limaye M.G., "Software Testing Principles, Techniques and Tools", Second Reprint, TMH Publishers, 2010.

2. Aditya P.Mathur, "Foundations of Software Testing", 2nd Edition, Pearson Education, 2013.

3. Frank Appel ,Testing with JUnit, 1st Edition, Packt Publishing Limited, 2015

4. Unmesh Gundecha, "Selenium Testing Tools Cookbook", 2nd Revised edition, Packt Publishing Limited, 2015

5. Kees Blokland, Jeroen Mengerink, Martin Pol, "Testing Cloud Services -How to Test

SaaS, PaaS & IaaS", 1st Edition, Rocky Nook Publishers, O"Reilly Series, 2013

6. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing – Principles and Practices", 7th Reprint, Pearson Education, 2009.

Course Outcomes	On completion of the course, students will be able to
	CO1: Explain the Fundamentals of Software Testing
	CO2: Learn the Requirements based Test Case Design Techniques
	CO3: Analyze the Source Code Based Test Case Generation
	CO4: Identify the Test Adequacy Criteria

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	3	3
CO2	2	2	3	3	3
CO3	1	1	3	3	3
CO4	1	2	3	3	3
CO5	2	2	3	3	3

Course Code & Title	INTRODUCTION TO ARTIFICIALINTELLIGENCE		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to • Explain the basic concepts of ArtificialIntelligence. • Demonstrate the methods of solving problems using Artificial Intelligence. • Outline the basic issues of knowledge representation and Inference that play an important role in AIprograms. • Discuss the applications of AI such as Natural language processing, Robotics, Expert systemsetc.		

UNIT	CONTENTS	Lecture Schedule
I	**Introduction to AI**	8
	Artificial Intelligence: The AI Problems – The Underlying Assumption AI Technique- The level of the Model – Criteria for Success Problems, Problem Spaces and Search: Defining the Problem as a State Space Search – Production Systems Problem Characteristics – Production System Characteristics Issues in the Design of Search Programs	
II	**Heuristic Search Techniques**	8
	Generate-and-Test – Hill Climbing Best-First Search – Problem Reduction Constraint Satisfaction – Means-Ends Analysis.	
III	**Knowledge Representation**	8
	Representing Knowledge using Rules: Procedural versus Declarative knowledge – Logic Programming Forward versus Backward Reasoning – Matching – Control Knowledge. Knowledge Representation issues: Representations and Mappings	
IV	**Predicate Logic**	8
	Using Predicate Logic: Representing Simple Facts in Logic Representing instance and Relationships Computable Functions and Predicates – Resolution – Natural Deduction.	
V	**Introduction To NLP, Neural Nets, Game Playing, Expert Systems**	
	Game Playing: Overview – The Minimax Search Procedure Natural Language Processing: Introduction. Connectionist Models: Introduction Hopfield Networks Learning in Neural Networks: Perceptron Expert Systems: Representing and Using Domain Knowledge	
	Total Contact Hours	32

Text Book:

1. Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Elaine Rich, 3rd Edition, Tata Mc-Graw, Hill publications, 2014 Reprint.
   (Chapters : 1 - 6 , 12.1, 12.2, 15.1, 18.1, 18.2.1, 20)

References:

1. Nils J Nilson, Principles of Artificial Intelligence, Narosa Publishing House,1982.
2. Elaine Rich, Artificial Intelligence, Tata McGraw-Hill publications,2008.
3. V.S.Janakiraman, K. Sarukesi, P.Gopalakrishnan, Foundations of Artificial Intelligence and Expert System, Infinity Press, 1st Edition,2016.

Course Outcomes	On successful completion of the course, the students will be able to
	CO1: Differentiate AI method of problem solving from normal method **CO2:** Identify heuristics for a givenproblem **CO3:** Explain the various search techniques **CO4**: Explain predicatelogic **CO5**:DescribethefundamentalsofGamePlaying,NLP,NNandExpert Systems

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	2	3	3
CO2	1	2	3	3	2
CO3	1	3	2	3	1
CO4	1	2	2	3	1
CO5	1	3	3	3	3