

Annexure - II

Syllabi for B.Sc.(Computer Science)

THE GANDHIGRAM RURAL INSTITUTE (DEEMED TO BE UNIVERSITY)

Ministry of Human Resource Development (MHRD), Govt. of India

Accredited by NAAC with A Grade (3rd Cycle)

Gandhigram

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		Max. Marks		
			Theory	Practical	CFA	ESE	Total
SEMESTER I							
21TAMU0101/ 21HIDU0101/ 21MALU0101/ 21FREU0101	Language I Tamil/Hindi/Malayalam /French	3	3	-	40	60	100
21ENGU01X1	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
19MATU01B1	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
21ENGU02X2	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	Gandhi's Life, Thought And Work	2	2	-	20	30	50
21EXNU0001	Extension Education	2	2	-	20	30	50
21CSKU0201	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
21ENGU03X3	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 for Computer Science: Digital Principles	4	4	-	40	60	100
21SHSU0001	Shanthi Sena	1	2	-			
21CSAU03T1	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	2	-	-	-
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)³
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

List of Skill based Elective Courses

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

SEMESTER I

Course Code & Title	21CSCU0101 PROGRAMMING IN C			Credits: 4
Class	B.Sc. (Computer Science)	Semester	I	
Course Objectives	The Course aims to <ul style="list-style-type: none"> 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			12
	Program Structure: Identifiers – Data Types – Integer – Float – Character – Constants – Variables. Operators and Expressions, Managing Input and Output Operations.			
II	Control Structures			13
	Decision Making and Branching: <i>if</i> Statement – <i>if ... else</i> Statement – Nested <i>if ... else</i> Statements – <i>?:</i> operator – <i>switch</i> Statement – <i>go to</i> Statement Loop Statement: <i>for</i> Statement – <i>do... while</i> Statement – <i>while ... do</i> Statement			
III	Arrays and Structures			12
	Arrays: Definition – Declaration – Entering Values in Arrays – Manipulating Arrays String: Declaring, Initializing, Printing and Reading strings, String manipulation functions			
IV	Functions and Structures& Union			13
	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			
V	Pointers and File Management			14
	Pointers: Understanding Pointers – Pointers and Functions File: Defining – Opening and Closing –Input and output operations – File Random Access			
Total Conduct Hours				64
Text Book: E. Balagurusamy, Programming in ANSI C, 8/e Tata McGraw Hill, 2019.				
References: <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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 - <i>decision making, iteration, looping</i> 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
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Course Code & Title	21CSCU0102 LAB – I: C PROGRAMMING		
Class	B.Sc. (Computer Science)	Semester	I
Course Objective	The Course aims to <ul style="list-style-type: none"> • 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
	C Programming with	
1.	Control structures if, nested if, for, while and do ... while	48
2.	Array handling – Two and Three dimensional array	
3.	Pointers	
4.	Functions – Various function categories and recursive function	
5.	Structure and Union	
6.	File handlings – read and write operations	
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	

SEMESTER II

Course Code & Title	21CSCU0203 OBJECT ORIENTED PROGRAMMING WITH C++ Credits: 4		
Class	B.Sc. (Computer Science)	Semester	II
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> 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		
V	Exception Handling - Manipulating Strings		
Total Conduct Hours			
<p>Text Book: Object Oriented Programming with C++, 8/e, E. Balagurusamy, Tata McGraw Hill publishing Company Limited, September 2020.</p> <p>References:</p> <ol style="list-style-type: none"> 1. The C++ Programming Language, Bjarne Stroustrup, Addison – Wesley 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. <p>Web resources</p> <ol style="list-style-type: none"> 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.
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Course Code & Title	21CSCU0204 LAB – II: C++ PROGRAMMING			Credits: 1
Class	B.Sc. (Computer Science)	Semester	I	
Course Objective	COURSEOBJECTIVES <ul style="list-style-type: none"> • This course aims to train the students for developing C++ programs for general applications 			

Sl. No.	CONTENTS	No. of Hours
	<ul style="list-style-type: none"> • 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 OOPs concept CO4: Design real-time applications using files and exception handling CO5: Demonstrate the usage of exception handling and strings	

SEMESTER III

Course Code & Title	21CSCU0305 RELATIONAL DATABASE MANAGEMENT SYSTEMS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> Explain the concepts of database management systems Demonstrate the various data models and database systems Manipulate real time data and elicit useful information using database concepts Design database schema considering the normalization rule 		
UNIT	CONTENTS		Lecture Schedule
I	Databases and Database Users & Database System Concepts and Architecture		12
	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		
II	Data Modeling Using the Entity – Relationship (ER) Model		13
	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		
III	The Relational Data Model and Relational Database Constraints & SQL		13
	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		
IV	Complex Queries, Triggers, Views and Schema Modification		13
	Complex Queries, Triggers, Views and Schema Modification: More Complex SQL Retrieval Queries - Specifying Constraints		

	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
<p>Text Book:</p> <p>Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, New Delhi, 2016.</p> <p>References:</p> <ol style="list-style-type: none"> 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. <p>Peter Rob, Carlos Coronol, Steven A. Morris, Keeley Crockett, Database Principles, 2/e, Cengage Learning, 2013</p>		
<p>On completion of the course, students will be able to</p> <p>CO1: Discuss the components, functions and various database design techniques used for modelling the databases management system.</p> <p>CO2: Analyse the various data models and database architecture</p> <p>CO3: Examine the clauses and functions of SQL and write optimal queries in the above languages.</p> <p>CO4: Design entity-relationship diagrams to represent simple database application scenarios</p> <p>CO5: Apply the database schema normalization rules and techniques to criticize and improve the database design.</p>		

Course Code & Title	21CSCU0306 LAB III: RDBMS		Credits: 1
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	The Student should be able to <ul style="list-style-type: none"> • 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	
	<ul style="list-style-type: none"> • 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.		

Course Code & Title	21CSAU03T1 MULTIMEDIA TECHNOLOGIES Credits: 4		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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	12
	Introduction: Definition of Multimedia - Basic Multimedia Software Tools - Multimedia Authoring Tools	
II	Text and Images	13
	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	
III	Sound	13
	Digital Audio - MIDI Audio, Multimedia System Sounds - Audio File Formats, Sound recording and editing tools Adding Sound to Multimedia Project.	
IV	Animation	13
	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.	
V	The Internet and Multimedia	13
	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	
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	<p>On successful completion of the course, the students will be able to</p> <p>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</p>
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Mapping 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

SEMESTER IV

Course Code & Title	21CSCU0407 ADVANCED OPERATING SYSTEMS CONCEPTS		
	Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • 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
	<p>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.</p> <p>Operating System Structures: Services - User Operating System Interface - System Calls - System Services - Linkers and Loaders - Operating System Structure - Building and Booting - Operating-System Debugging.</p>	
II	Process Management and CPU Scheduling	12
	<p>Process: Concept - Process Scheduling - Operations on Processes – Inter-Process Communication - Shared-Memory Systems - Message-Passing Systems.</p> <p>CPU Scheduling: Basic Concepts - Scheduling Criteria - Scheduling Algorithms – Thread Scheduling - Multiple-Processor Scheduling - Real-Time CPU Scheduling - Algorithm Evaluation.</p>	
III	Process Synchronization and Deadlocks	13
	<p>Process Synchronization: Background - The Critical-Section Problem - Peterson’s Solution - Hardware Support for Synchronization - Mutex Locks - Semaphores</p> <p>Deadlocks: System Model - Multithreaded Applications - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock Detection - Recovery from Deadlock.</p>	

IV	Main Memory and Virtual Memory	14
	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.	
V	Virtual Machines and Network Distributed Systems	13
	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.	
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 traditional¹, modern and distributed OS.

Course Code & Title	21CSCU0408 DATA STRUCTURES			Credits: 4
Class	B.Sc. (Computer Science)	Semester	IV	
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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	12
	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	
II	Array, Records and Pointers	13
	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	
III	Linked List	13
	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	
IV	Stack, Queue and Recursion	13
	Introduction – Stacks - Array Representation 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	
V	Trees	13
	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	
Total Conduct Hours		64

Text Book:

Seymour Lipschutz, Data Structures, Revised First Edition, Schaum's Outlines, McGraw 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	<p>On completion of the course, students will be able to</p> <p>CO1: Describe the representation of single dimensional and multi-dimensional arrays and their applications</p> <p>CO2: Analyze the string processing and various string operations</p> <p>CO3: Formulate the data representation using linked list and its variants</p> <p>CO4: Demonstrate primitive operations of Stacks and Queues</p> <p>CO5: Relate the various types of binary trees and illustrate binary tree traversals with algorithms and examples</p>
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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 <ul style="list-style-type: none"> • 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 			
Sl.No.	CONTENTS			Hours of Work
1.	Array			48
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.			
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			

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	HUMAN VALUES & ETHICS FOR HARMONY		
	Credits: 1		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	<p>The Course aims to</p> <ol style="list-style-type: none"> 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	13
	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	
II	Understanding Harmony in the Human Being - Harmony in Sel	13
	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.	
	Harmony in Human-Human Relationship, Family and Society	

III	<p>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!.</p>	12
IV	<p style="text-align: center;">Understanding Harmony in the Nature and Existence - Whole existence as Co- existence</p> <p>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.</p>	13
V	<p style="text-align: center;">Implications of the above Holistic Understanding of Harmony on Professional Ethics</p> <p>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.</p>	13
Total Contact Hours		64

Text Book:

1. Human Values, Kshitiz Jain, Neelkanth Publishers Pvt. Ltd., 2018.
2. Human Values and Professional Ethics, Tanu Shukla, Anupam Yadav, 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 <ol style="list-style-type: none">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 prosperity3. 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 on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society5. Analyse the nature and existence of elements of harmony6. Distinguish between ethical and unethical practices,7. Design the strategies to actualize a harmonious climate in workplace.
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SEMESTER V

Course Code & Title	21CSCU0510 INTRODUCTION TO JAVA PROGRAMMING		
	Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Provide the foundation to the object oriented programming concepts • Discuss the implementation of OOP's concepts in Java language • Make learners as a good Java programmers • Import skills and knowledge to create and run Java programs for solving real time problems 		

UNIT	CONTENTS	Lecture Schedule
	Basics	
I	<p>Introduction: Object Oriented Programming Concepts - Encapsulation, Inheritance, Polymorphism, Features of Java Language, Types of Java Programs, Java Architecture.</p> <p>Literals, Data Types and Variables: Literals - Integer, Floating Point, Character, String and Boolean Literals, Data Types - Integer, Floating Point, Character and Boolean. Variables</p> <p>The Structure of A Java Program – Comments, Expressions and Statements, Type Conversion, Block Statements and Scope</p> <p>Operators – Arithmetic, Bitwise, Relational, Boolean Logical and Ternary. Operator Precedence</p> <p>Control Statements – If...Else, Switch, While, Do...While, For..., Break, Continue and Comma Statement,</p> <p>Arrays - One-Dimensional and Multi-Dimensional Arrays.</p>	13
	Classes and Packages	
II	<p>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</p> <p>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</p> <p>Packages and Interfaces: Package, The Import Statement, Access Modifier, Interfaces - Defining Interfaces, Implementing an Interface</p> <p>Wrapper Classes – The Number Class, The Character Class, The Boolean Class</p>	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
IV	Strings and Threads	13
	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	
V	Applets and Graphics	13
	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 into Applets Graphics - Drawing Lines, Rectangles, Ovals and Circles, Arcs, Polygons and Polyline.	
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 Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 <ul style="list-style-type: none"> • Explain about the creation of output 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	13
	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.	
II	Output Primitives	13
	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.	
III	Attributes of Output Primitives	12
	Attributes Of Output Primitives : Line Attributes - Curve Attributes- Colour and Gray Scale - Area Fill Attributes – Character Attributes - Bundled Attributes – Inquiry Functions Antialiasing	
IV	Two Dimensional Geometric Transformations	13
	Two Dimensional Geometric Transformations: Basic Transformations – Matrix Representation - Composite Transformations – General Fixed Point – Scaling – Other Transformations - Two Dimensional Viewing ? 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	
V	Three Dimensional Concepts	13
	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.	
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	<p>On successful completion of the course, the students will be able to</p> <p>CO1: Identify the types of graphics monitors, workstations, input devices and input techniques available to work with graphics.</p> <p>CO2: Understand the mathematical and heuristic algorithms behind the graphics object generation</p> <p>CO3: Familiarize the attributes to control the object shape and antialiasing techniques for accurate display.</p> <p>CO4: Understand the forms of 2D transformations, mapping process from worldview to display view and clipping process to select the visible portion.</p> <p>CO5: Construct the algorithms for 3D object modelling and processing</p>
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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 <ul style="list-style-type: none"> • Understand the various processes and understanding requirements and concepts • Discusses 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	12
	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.	
II	UNDERSTANDING REQUIREMENTS AND DESIGN CONCEPTS	13
	Requirements Engineering - Building the Requirements Model - 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.	
III	QUALITY CONCEPTS AND SOFTWARE QUALITY ASSURANCE	13
	Software Quality- The Software Quality Dilemma - Achieving Software Quality - Elements of Software Quality Assurance – SQA Tasks, Goals and Metrics – Formal Approaches to SQA – Statistical Software Quality Assurance – Software Reliability	
IV	SOFTWARE TESTING STRATEGIES	13
	A Strategic approach to software testing – Strategic Issues - test strategies for conventional software – Validation Testing – System Testing – The art of Debugging	
V	PROJECT SCHEDULING AND RISK MANAGEMENT	13
	Project Scheduling - Scheduling - 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	
Total Contact Hours		64
<p>Text Book:</p> <ol style="list-style-type: none"> 1. Roger S. Pressman, Software Engineering – A Practitioner’s Approach, 7/e, McGraw Hill Inc., 2014. <p>References:</p> <ol style="list-style-type: none"> 1. Alistair Cockburn, Agile Software Development, 2/e ,Pearson Education, 2007 2. Richard E.Fairley, Software Engineering concepts, Mc-Graw Hill, 1984. 3. Ian Sommerville, Software Engineering, 9/e, Addison Wesley, 2011. 		
Course Outcomes	<p>On successful completion of the course, the students will be able to</p> <p>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</p>	

Course Code & Title	21CSCU0513 LAB – VI: JAVA PROGRAMMING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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:

3

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

SEMESTER VI

Course Code & Title	21CSCU0614 WEB TECHNOLOGIES			Credits: 4
Class	B.Sc. (Computer Science)	Semester	VI	
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Provide insight into the basics of Web Technology • Design and implement a dynamic web applications using HTML, JavaScript and PHP 			

UNIT	CONTENTS	Lecture Schedule
I	Web Essentials	12
	Clients, Servers, and Communication: The Internet - Basic Internet Protocols - The World Wide Web - HTTP Request Message - HTTP Response Message - Web Clients - Web Servers	
II	Markup Language	13
	Introduction to HTML: Headings - Linking- Internal linking - Images- Special Characters and horizontal Rules - Lists- Tables- Forms-Frames- Meta elements	
III	Style Sheets	13
	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	
IV	Client-Side Programming	14
	Java Script: Introduction to Scripting -Control Statements – FunctionsObjects: Math object –Array Object-String Object Document object - Boolean and Number objects -.Window object. Dynamic HTML:Events-Using cookies	

V	Server-Side Programming	14
	PHP : Introduction – Syntax – Comments – Variables – Operators – Expression – Conditional and Branching Statement – Looping statements - Functions – Arrays - Form Elements – File Handling –	
Total Contact Hours		64
<p>Text Books:</p> <ol style="list-style-type: none"> 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 <p>References:</p> <ol style="list-style-type: none"> 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 Java Programming, 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 <p>E-Resource:</p> <ul style="list-style-type: none"> • 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	<p>On completion of the course, students will be able to</p> <p>CO1: Outline the basics of TCP/IP Protocols and IP address</p> <p>CO2: Design webpages using HTML</p> <p>CO3: Have practical experience in creating dynamic HTML.</p> <p>CO4: Generate dynamic content to webpages using JavaScript and PHP</p> <p>CO5: Develop online web applications</p>	

Course Code & Title	21CSCU0615 COMPUTER NETWORKS			Credits: 4
Class	B.Sc. (Computer Science)	Semester	VI	
Course Objectives	The Course aims to <ul style="list-style-type: none"> • Understand the basics of computer networks, with all types and models of 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	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**

- To remember the basic terminologies and concepts in computer networks.
- To 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 applications layer.

Course Code & Title	21CSCU0616 COMPUTER ORGANIZATION		Credits: 4
Class	B.Sc. (Computer Science)	Semester	VI
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • 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		12
	Basic operational concepts, Bus structures, Machine instructions, memory locations, addressing modes, assembly language		
II	Arithmetic		13
	Number representations, addition and subtraction of signed numbers, Design of fast adders, Multiplication of signed numbers, Fast multiplication and Integer division		
III	Processing Unit		13
	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		
IV	Memory & memory Input and output organization		13
	RAM, ROM, Cache Memories, and Virtual memory Input and output organization: Accessing I/O devices, Interrupts, DMA, and Interface circuits		
V	Advanced Processor Architecture		13
	RISC, Pipelining, Super Scalar Processors, VLIW, Parallel and Vector Processors.		
Total Contact Hours			64

References:

1. Carl Hamacher, Zvonko Vranesic, safwat Zaky, “Computer Organization and Embedded Systems”, 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 About computer architecture CO2: Compute simple arithmetic operations for fixed-point and floating-point addition, subtraction, multiplication & division CO3: Design combinational and sequential digital functions CO4: Construct an instruction set for simple tasks
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Course Code & Title	21CSCU0617 Lab VI: WEB TECHNOLOGIES			Credits: 1
Class	B.Sc. (Computer Science)	Semester	VI	
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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.	Web page design using HTML Tags			48
2.	Creation – Ordered List, Unordered List, Tables, Frames,			
3.	Links, Image Anchor, Image Maps			
4.	Using Form Controls with Input Tag, Cascading Style Sheets			
5.	Creating XML Document			
6.	Working with client-side scripting using JavaScript			
7.	Working with server-side scripting using PHP			
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 using JavaScript to develop dynamic webpages 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			

Discipline Centric Elective: I

Course Code & Title	21CSCU04D1 DATA MINING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • 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	12
	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	
II	Data Pre-processing	12
	Data Preprocessing: An Overview-Data Cleaning Data Integration Data Reduction Data Transformation and Data Discretization	
III	Data Warehousing	15
	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	
IV	Classification	12
	Classification – Basic Concepts Decision Tree Induction Bayes Classification Methods	
V	Cluster Analysis	13
	Cluster Analysis - Partitioning methods Hierarchical methods- BIRCH, ROCK Density based methods – DBSCAN Grid based methods : STING	

Text Book:

1. Jiawei Han, Micheline Kamber 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*, Cengage Lmg Business Press, 2010.
2. Jiawei Han, Micheline Kamber, *Data Mining: Concepts and Techniques*, 3rd Edition Morgan Kauffmann Publishers, 2011.
3. 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 Vs PSO	PSO 1	PSO 2	PSO 3	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	4 3

Course Code & Title	21CSCU04D2 BIG DATA ANALYTICS Credits: 4		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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	12
	Understanding Big Data: Concepts and Terminology Big Data Characteristics - Different types of data. Business Motivations and Drivers for Big data Adoption Big Data Analytics Lifecycle - Case Study Example	
II	Enterprise Technologies and Big Data Business Intelligence	13
	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.	
III	Big Data Processing Concepts	13
	Parallel Data Processing - Distributed Data Processing Processing Workloads - Cluster - Processing in Batch Mode Processing in Real-time Mode - Case Study Example	
IV	Big Data Tools	13
	R, R - Hadoop – Architecture – R Packages – Classification	
V	R Database	13
	R Database – R Hbase, R Hive – R Storm – MongoDB – Dataset basics	
Total Contact Hours		64

Text Book:

Thomas Erl, Wajid Khattak 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.

	<ol style="list-style-type: none"> 2. Dr. Anil Maheshwari, <i>Big Data</i>, 1st edition , Published by McGraw Hill Education (India) Private Limited, 2017. 3. Seema Acharya and Subhashini Chellappan, <i>Big Data and Analytics</i>, 2nd edition, Wiley India Private Limited, 2017. 4. Seema Acharya, <i>Data Analytics using R</i>, McGraw Hill Education publication (India) Private Limited, 2018.
Course Outcomes	<p>On successful completion of the course, the students will be able to</p> <p>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</p>

Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 <ul style="list-style-type: none"> • Provide a foundation to information system • 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 15 th 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

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 <ul style="list-style-type: none"> • Learn about the importance of mobile devices and use • Understand the merits of its communication strategies in present scenario. • Analyze and apply various tools and techniques used in mobile computing 		

UNIT	CONTENTS	Lecture Schedule
I	Introduction	12
	Need for Mobile Computing- Mobile and Wireless Devices - Applications – A short history – Market for Mobile Communications	
II	Wireless Transmission	13
	Frequencies, Signals, Antennas, Signal propagation, Multiplexing, Modulation - Spread Spectrum and Cellular Systems	
III	Medium Access Controls	13
	SDMA, FDMA, TDMA, CDMA, comparisons and GSM	
IV	Satellites and Wireless LAN	13
	Satellite Basics - Wireless LAN : IEEE 802.11 – Architecture, Physical Layer, MAC Layer, HIPERLAN 1, Bluetooth – Architecture, Link Management and Security.	
V	Mobile Network Layer ⁴	13
	Mobile Network Layer: Mobile IP – Goals, Packet Delivery Strategies, Registration, Tunneling and Reverse Tunneling, Mobile Ad-hoc Networks – Routing Strategies	
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
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	<p>their features.</p> <p>CO2: Understand different types of telecommunication systems</p> <p>CO3: Identify the types of wireless LAN architecture and protocols.</p> <p>CO4: Learn the structure, features and transmission techniques of mobile IP.</p> <p>CO5: Learn the coding used in simple mobile applications</p>
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Course Code & Title	21CSCU05D2 CLOUD COMPUTING Credits: 4		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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		12
	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		
II	CLOUD SERVICE MODELS		13
	Software as a Service (SaaS) - Infrastructure as a Service (IaaS) - Platform as a Service (PaaS) - Service Oriented Architecture (SoA) - Elastic Computing - On Demand Computing		
III	APPLICATIONS		13
	Deployment of applications on the cloud - Hypervisor - Case studies - Xen, VMware, Eucalyptus - Amazon EC2, KVM, Virtual Box, Hyper-V		
IV	CLOUD COMPUTING FOR EVERYONE		13
	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		
V	CLOUD SECURITY		13
	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		

Total Contact Hours		64
Text Book:		
<p>Anthony T.Velte, Toby J. Velte Robert Elsenpeter, Cloud Computing a Practical Approach, TATA Mc-Graw - Hill, New Delhi, 2010</p>		
References:		
<ol style="list-style-type: none"> 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	<p>On successful completion of the course, the students will be able to</p> <p>CO1: Gain knowledge in Basics of Cloud computing. CO2: Understand Cloud Computing architecture CO3: Learn frameworks such as Map Reduce. CO4: Discuss practical applications of cloud computing CO5: Know CRM management</p>	

Course Code & Title	21CSCU05D3 ENTERPRISE RESOURCE PLANNING		Credits: 4
Class	B.Sc. (Computer Science)	Semester	
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Classify the different types of business processes • Provide existing business models underlying in ERP • Impart the future trends in ERP systems 		
UNIT	CONTENTS		Lecture Schedule
I	Enterprise Resource Planning		12
	Introduction - basic concepts-benefits of ERP and limitations - Evolution of ERP - Materials Requirements Planning (MRP) - Manufacturing Resource Planning (MRP II) - Business modelling		
II	ERP and its related Technologies		13
	Data Mining - Data Warehousing - Business Process Reengineering - Decision Support System (DSS) - Management Information System (MIS) - Executive Information System (EIS) – OLAP		
III	ERP for Manufacturing Processes		13
	Distribution requirements planning (DRP) - Master production schedule - ERP for manufacturing processes - Distribution requirements planning (DRP)		
IV	Master Production Schedule		13
	J ERP software selection - Risks Factors-Role of consultants - Modules in an ERP software package - Finance-sales and distribution-plant		
V	Future Directions of ERP		13
	Mobile ERP system Case Studies of ERP implementation - Problems - challenges and software solution for the enterprises - performance indicators of an ERP package		
Total Contact Hours			
<p>Text Books:</p> <p>Alexis Leon, “Enterprise Resource Planning”, Tata Mc-Graw-Hill, 3rd Edition, 2014.</p> <p>References:</p> <p>1. Bret Wagner, Ellen Monk, “Enterprise Resource Planning”, Cengage Learning, 3rd</p>			

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

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 <ul style="list-style-type: none"> • 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 and layouts	8
IV	Building Android Applications: AndroidManifest.xml file - the control 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	<p>On successful completion of the course, the students will be able to</p> <p>CO1: Describe the types of mobile devices and mobile platforms</p> <p>CO2: Summarize the basic structure of mobile operating systems and their architecture</p> <p>CO3: Setup programming tools for a mobile application developer</p> <p>CO4: Design various mobile application</p> <p>CO5: Recognize runtime environment for mobile application</p>
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Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 <ul style="list-style-type: none"> • 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	8
	Verbs- Synonyms- Antonyms- Articles- Prepositions - Idioms and Phrases - Cloze test – Substitution –Spotting Errors.	
II	General English 2	8
	Vocabulary – Comprehension – spelling - Active Voice and Passive Voice - Sentence Arrangement-Para Completion - Joining Sentences.	
III	Aptitude	8
	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.	
IV	Reasoning	8
	Analogy -Letter and Symbol Series – Arithmetic Reasoning – Blood Relation Qualms - Classification – Coding Decoding –Direction – Series Completion.	
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	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

Modular Course: I

Course Code & Title	21CSCU06M1 INTRODUCTION TO R PROGRAMMING Credits: 2		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • 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	6
	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	
II	Matrices, Arrays And Lists	6
	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	
III	Data Frames and Programming Constructs	6
	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	
IV	Input/Output and Graphics	7
	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.	

V	Interfacing	7
	Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering	
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	<p>On completion of the course, students will be able to</p> <p>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.</p>
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Mapping COs with PSOs:

5

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	21CSCU06M2 FUNDAMENTALS OF STATISTICS AND SPSS		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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	8
	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 file types – different file types in SPSS.	
II	Types of windows in SPSS	8
	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.	
III	File Handling Techniques	8
	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 advantages of pivot table.	
IV	Analyzing Data	8
	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.	
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 Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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

Modular Course: II

Course Code & Title	21CSCUO6M3 FINANCIAL ACCOUNTING SOFTWARE		
Class	B.Sc. (Computer Science)	Semester	V
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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 – Implementing accounts 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	<p>On successful completion of the course, the students will be able to</p> <p>CO1: Develop practical skills in using a computerized accounting system</p> <p>CO2: Understand the concepts of the integrated structure of a computerized accounting system</p> <p>CO3: Analyze the procedure of preparing account transactions</p> <p>CO4: Apply the skills to develop an appreciation and expertise in the use of other accounting software</p> <p>CO5: Develop the capacity to apply the above skills to practical Accounting Problems and procedures</p>
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Mapping COs with PSOs:

CO Vs PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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 <ul style="list-style-type: none"> • 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	8
	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	
II	Information	8
	Internet and world wide web – community radio - technology-user interface – design of relevant ICT products and services	
III	ICT Applications	8
	Applications of ICT in education – Health (telehealth, telemedicine and health informatics) - Gender Equality, Agriculture	
IV	ICT Applications	8
	Applications of ICT in Rural Industry - e-Governance, telecentres, Mobiles for development - climate change and disaster management - ICT Networks for water management	
Total Contact Hours		32

Text Book:

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

Reference:

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

Value Added Courses

Course Code & Title	Open Source Software		
Class	B.Sc. (Computer Science)	Semester	II
Course Objectives	<p>The Course aims to</p> <ul style="list-style-type: none"> • Expose the students to the context and operation of free and open source software (FOSS) communities and associated software projects. • Familiarise with participating in a FOSS project • Learn some important FOSS tools and techniques 		
UNIT	CONTENTS		Lecture Schedule
I	Philosophy		8
	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.		
II	LibreOffice		8
	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		
III	Linux OS		8
	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		
IV	QCAD		8
	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		

	Window types - File Browser and Info Panel Windows	
Total Contact Hours		
<p>Text Book Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, O'Reilly Media, 2009</p> <p>References:</p> <ol style="list-style-type: none"> 1. <u>Philosophy of GNU URL: http://www.gnu.org/philosophy/.</u> 2. <u>Linux Administration URL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/.</u> 3. www.spokentutorials.org <p>Libre office: http://www.libreoffice.org.</p>		
Course Outcomes	<p>On completion of the course, students will be able to</p> <p>CO1: Promotes technology and the use of open source software</p> <p>CO2: Execute project using Open source technology to meet the industry needs & problems</p> <p>CO3: Enable Open Source awareness among the students.</p> <p>CO4: Migrating proprietary software lab to open source lab.</p> <p>CO5: Ability to build and modify one or more Free and Open Source Software packages.</p>	

Course Code & Title	Client/Server Technologies		
Class	B.Sc. (Computer Science)	Semester	III
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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			8
	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.		
II			8
	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.		
III			8
	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.		
IV			8
	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		

	Warehousing - Warehousing Techniques - Data Mining.	
V		32
	Client Server Protocols – RPC – IPC - Recent Trends – Intranet – Extranet – Internet - CORBA.	
Total Contact Hours		
<p>Text Book</p> <ul style="list-style-type: none"> Robert Orfali, Dan Harkey and Jerri Edwards: Essential Client/Server Survival Guide, John Wiley & Sons Inc 1996 <p>References:</p> <ul style="list-style-type: none"> Alex Berson: Client Server Architecture Patrick Smith, Steve Guengerich: Client Server Computing, Second Edition, Prentice Hall of India Pvt Ltd. 		
Course Outcomes	<p>On completion of the course, students will be able to</p> <p>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</p>	

Course Code & Title	Document Preparation using Latex		
Class	B.Sc. (Computer Science)	Semester	II
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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	8
	<ul style="list-style-type: none"> • 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. 	
II	Styling Pages	8
	<ul style="list-style-type: none"> • 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. 	
III	Formatting Content	8
	<ul style="list-style-type: none"> • Formatting text (styles, size, alignment), • Adding colors to text and entire page, and adding bullets and numbered items. • Process of writing complex mathematics. 	
IV	Tables and Images	8
	<ul style="list-style-type: none"> • 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.. 	
V	Referencing and Indexing	32
	<ul style="list-style-type: none"> • Cross-referencing (refer to sections, table, images), • Add bibliography (references), and create back index. 	
Total Contact Hours		

Text Books:

1. David F Griffiths and Desmond J. Higham, Learning LaTeX, SIAM (Society for Industrial and Applied Mathematics) Publishers, Philadelphia, 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
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Course Code & Title	Software Testing		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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		8
	Basics of Software Testing - Test Approaches, Test Planning, Test Strategy - Defects Management .		
II	Requirements based Test Case Design Techniques		8
	Requirements based test case generation introduction - Equivalence Class Portioning - Boundary value analysis -Cause effect graphing.		
III	Source Code Based Test Case Generation		8
	CFG Creation - Cyclomatic Complexity - Test Paths Generation - Test Cases Generation.		
IV	Test Adequacy Criteria		8
	Path Coverage, Statement Coverage - Condition Coverage - Decision Coverage.		
Total Contact Hours			
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”, 2 nd 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 about the Fundamentals of Software Testing

CO2: Learn the Requirements based Test Case Design Techniques

CO3: Apply the Source Code Based Test Case Generation

CO4: Identify the Test Adequacy Criteria

Course Code & Title	INTRODUCTION TO ARTIFICIALINTELLIGENCE		
Class	B.Sc. (Computer Science)	Semester	IV
Course Objectives	The Course aims to <ul style="list-style-type: none"> • 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, 3 rd 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, 1 st 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: Describethefundamentals ofGamePlaying,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