Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE

Of Arts, Science & Commerce, Baramati

Class :F.Y.B.Sc. (Computer Science)			
Semester I		**Semester II**	
CSCO 1101	Basic Programming using C	CSCO 1201	Advanced Programming using C
CSCO1102	DBMS-I	CSCO 1202	DBMS-II
Practicals (Yearly)			
CSCO 1203	Lab Course I : Basics of C &Advanced C		
CSCO 1204	Lab Course II : DBMS I & II		

Class :S.Y.B.Sc. (Computer Science)			
Semester I		**Semester II**	
CSCO 2101	Data Structures using C	CSCO 2201	Object Oriented Concepts using Java
CSCO2102	Introduction to Web Technology	CSCO2202	Software Engineering
Practicals (Yearly)			
CSCO2203	Lab Course I based On CSCO2101 & 2201		
CSCO2204	Lab Course II: based On CSCO2102 & CSCO2202 with Mini Project		

Class :T.Y.B.Sc. (Computer Science)			
Semester I		**Semester II**	
CSCO3101	System Programming & Operating System	CSCO3201	Computer Graphics
CSCO 3102	Theoretical Computer Science	CSCO3202	Compiler Construction
CSCO3103	Computer Networks	CSCO3203	Advanced Networks and Network Administrations
CSCO3104	Internet Programming – I	CSCO3204	Internet Programming–II
CSCO3105	Advanced Programming in Java	CSCO3205	Java Frameworks
CSCO3106	Object Oriented Software Engineering	CSCO3206	Software Metrics & Project Management
Practicals (Yearly)			
CSCO3207	Lab Course I: Based on CSCO3101 , CSCO3201& CSCO3203		
CSCO3208	Lab Course II: Based on CSCO3105, CSCO3205 & Mini Project using JAVA		
CSCO3209	Lab Course III: Based on CSCO3104, CSCO3204 & Mini Project using PHP.		

Scheme of Course Structure M.Sc.(Computer Science)

Sr.No.	Class	Semester	Code	Paper	Paper Title
1	M.Sc. - I	I	COMP4101	Theory	Principles of Programming Languages (C)
2	M.Sc. – I	I	COMP4102	Theory	Cryptography & Network Security (C)
3	M.Sc. – I	I	COMP4103	Theory	Database Technologies (C)
4	M.Sc. – I	I	COMP4104	Theory	Design and Analysis of Algorithms (C)
5	M.Sc. – I	I	COMP4105	Theory	Programming with DOT NET (C)
6	M.Sc. – I	I	COMP4106	Practical	Lab Course on DOT NET and PPL (C)
7	M.Sc. – I	I			Skill Development (Latex, Content Management)
8	M.Sc. – I	I			Certificate Course
Note: Minimum credit: 24 and Maximum Credit:24 Core subjects is compulsory and Extra credits (2+2) is also compulsory.					
9	M.Sc. - I	II	COMP4201	Theory	Digital Image Processing (C)
10	M.Sc. - I	II	COMP4202	Theory	Data Mining and Data Warehousing (C)
11	M.Sc. - I	II	COMP4203	Theory	Python Programming (C)
12	M.Sc. - I	II	COMP4204	Theory	**Advanced Operating System (Elective I)**
13	M.Sc. - I	II	COMP4205	Practical	Lab Course on Python Programming and Advance Operating System (C)
14	M.Sc. - I	II	COMP4206	Practical	**Project (Elective II)**
15	M.Sc. - I	II	COMP4207	Theory	**Artificial Intelligence (Elective III)**
16	M.Sc. - I	II			Skill Development
17	M.Sc. - I	II			Introduction Cyber Security – I
18	M.Sc. - I	II	COMP4208	Theory	Modeling and Simulation **(Elective IV)**
Note: : Minimum credit: 28 and Maximum Credit:32 Core subjects is compulsory and Extra credits (2+2) is also compulsory. From elective courses 3 subjects for Minimum Credits and 4 for Maximum Credit					
19	M.Sc. - II	III	COMP5301	Theory	Mobile Technology (C)
20	M.Sc. - II	III	COMP5302	Theory	Soft Computing (C)
21	M.Sc. - II	III	COMP5303	Theory	Web Services (C)
22	M.Sc. - II	III	COMP5304	Theory	**Software Architecture (Elective I)**
23	M.Sc. - II	III	COMP5305	Practical	Lab Course-on Mobile Technology and Web Services (C)
24	M.Sc. - II	III	COMP5306	Practical	**Project (Elective II)**
25	M.Sc. - II	III	COMP5307	Theory	**Recent Trends in IT (Internet of Things) (Elective III)**

26	M.Sc. - II	III			Human Rights
27	M.Sc. - II	III			Certificate Course
28	M.Sc. - II	III	COMP5308	Theory	Machine Learning **(Elective IV)**
29	M.Sc. - II	III	COMP5309	Theory	Network Programming **(Elective V)**
Note: : Minimum credit: 28 and Maximum Credit:36. Core subjects is compulsory and Extra credits (2+2) is also compulsory. From elective courses 3 subjects for Minimum Credits and 5 for Maximum Credit					
30	M.Sc. - II	IV	COMP5401	Project	Industrial Training/ Institutional Project (**IT) (Core)**
31	M.Sc. - II	IV	COMP5402	Theory	Cloud Computing **(Elective I)**
32	M.Sc. - II	IV	COMP5403	Theory	Evolutionary Algorithm **(Elective II)**
33	M.Sc. - II	IV			Introduction Cyber Security – II

Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce, Baramati
Autonomous

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

- F.Y.B.Sc. (Computer Science) Credit Structure -

Subject	Semester I		Semester II		Annual		Total
	Paper I	Paper II	Paper I	Paper II	Paper III Practical	Paper IV Practical	
Computer Science	2	2	2	2	4	**Grade**	12
Mathematics	2	2	2	2	4	---	12
Electronics	2	2	2	2	4	---	12
Statistics	2	2	2	2	4	---	12
Physical Education	---	---	---	---	---	---	2

Total Number of Credits = 48(Core) + 2 (Physical Education) = 50

1 Theory Credit = 18 Lectures

- S.Y.B.Sc. (Computer Science) Credit Structure -

Subject	Semester I		Semester II		Annual		Total
	Paper I	Paper II	Paper I	Paper II	Paper III Practical	Paper IV Practical	
Computer Science	3	3	3	3	4	**Grade**	16
Mathematics	3	3	3	3	4	--	16
Electronics	3	3	3	3	4	--	16
English	3	--	3	--	--	--	6
Evs.	------		----		--	--	4
Certificate Courses	2		2		--	--	4

Total Number of Credits = 54 (Core) + 4 (EVS) + 4 (Certificate Courses) = 62

1 Theory Credit = 16 Lectures

- T.Y.B.Sc. (Computer Science) Credit Structure -

Semester V

Subject	I	II	III	IV	V	VI	Total
Computer Science	3	3	3	3	3	3	18
Certificate Course	2						2

- T.Y.B.Sc. (Computer Science) Credit Structure –

Semester VI

Subject	Theory						Practical			Total
	I	II	III	IV	V	VI	Lab Course I	Lab Course II	Lab Course III	
Computer Science	3	3	3	3	3	3	4	4	4	30
Certificate Courses	2									2

Total Number of Credits = 48 (Core) + 4 (Certificate Courses) = 52

1 Theory Credit = 16 Lectures

B.Sc. (Computer Science): Total credits = 50 + 62 + 52 = 164

Course Structure For F. Y. B. Sc. (Computer Science)
Subject: Computer Science

Semester	Paper Code	Title of Paper	No. of Credits
I	CSCO1101	Basic Programming using C	2
	CSCO 1102	DBMS - I	2
II	CSCO 1201	Advanced Programming using C	2
	CSCO 1202	DBMS - II	2
Annual	CSCO 1203	Practical – I Basics on C & Advanced C	4
	CSCO1204	Practical – II Basics on DBMS (PL/PgSql)	Grade

SYLLABUS(CBCS) FOR F. Y. B. Sc. (Computer Science)
(w.e.f from June, 2019)
Academic Year 2019-2020

Class : F.Y. B. Sc.(Computer Science) (Semester- I)
Subject : Computer Science Paper Code : CSCO1101
Title of Paper: Basic Programming Using C Paper : I
Credit: 2 No. of lectures: 36

Learning Objectives : Students successfully completing this course will be able:

1. To understand and design algorithm for problem solving
2. To develop Problem Solving abilities using computers
3. To develop skills for writing programs using 'C'

Learning Outcome : Problem solving and programming capability.

Chapter	Topic Contents	No. of Lectures
Unit – I	**Problem-Solving Using Computer** 1.1 Problem Solving 1.2 Algorithms & Flowcharts (More Problems covered) 1.3. Programming Languages Machine language Assembly language High level languages	8
Unit – II	**Introduction to C** 2.1 History 2.2 Structure of a C program 2.3 Application Areas 2.4 C Program development life cycle 2.5 Sample programs	2
Unit – III	**C Tokens** 3.1 Keywords 3.2 Identifiers 3.3 Variables 3.4 Constants – character, integer, float, string, escape sequences 3.5 Data types – built-in and user defined 3.6 Operators and Expressions Operator types (arithmetic, relational, logical,assignment, bitwise, conditional , other operators), precedence and associatively rules.	5
Unit – IV	**Control Structures** 4.1 Decision making structures If, if-else, switch 4.2 Loop Control structures While, do-while, for 4.3 Nested structures 4.4 break, continue and goto	8

Unit – V	**Functions in C** 5.1 What is a function 5.2 Advantages of Functions 5.3 Standard library functions 5.4 User defined functions :Declaration, definition, function call, parameter passing (by value), return keyword 5.5 Scope of variables, storage classes 5.6 Recursion	8
Unit – VI	**Arrays** 6.1 Array declaration, initialization 6.2 Types – one, two and multidimensional 6.3 Passing arrays to functions	5

References:

1. Yashavant Kanetkar : Let Us C 7th Edition, PBP Publications
2. E Balaguruswamy : Programming in ANSI C 4th Edition, Tata Mc-Graw Hill Publishing Co.Ltd.-New Delhi
3. Brian W. Kernighan and Dennis M. Ritchie : The C Programming Language 2nd Edition, Prentice Hall Publication
4. The Complete Reference to C, Herbert Schildt
5. Problem Solving with C, Harrow
6. Yeshwant Kanitkar :Graphics using C- BPB Publication.

Class : F.Y. B. Sc.(Computer Science) (Semester- I)
Subject : Computer Science Paper Code: **CSCO1102**
Title of Paper: DBMS-I Paper : II
Credit: 2 No. of lectures: 36

Learning objective : Students successfully completing this course will be able to:

- Understand design and implementation of a database system.
- Study the physical, logical database designs and database modeling.
- Understanding and development for essential DBMS concepts.
- Understand creations, manipulation and querying of data in databases.

Learning Outcomes:

- Master the basics of database concepts and database management system
- Model an application's data requirements using conceptual modeling tools like ER model, relational model.
- Write SQL commands to create tables, insert, update, delete and querying data.

Units	Title & Content	No. Of lecture
Unit I	**1. Introduction to File organization & DBMS** 1.1 Introduction 1.2 Types of file organization 1.3 File system Vs DBMS 1.4 Data models 1.5 Levels of abstraction 1.6 Data independence 1.7 Structure of DBMS 1.8 Users of DBMS 1.9 Advantages of DBMS	**04**
Unit II	**2.Conceptual Design (E-R model)** 2.1 Overview of DB design 2.2 ER data model (entities , attributes, entity sets, relations,relationship sets) 2.3 Additional constraints (Key constraints, Mapping constraints), 2.4 Conceptual design using ER modelling 2.4 Case studies	**10**
Unit III	**3. Relational data model** 3.1 Structure of Relational Databases (concepts of a table, a row, a relation, a Tuple and a key in a relational database) 3.2 Conversion of ER to Relational model 3.3. Integrity constraints (primary key, referential integrity, unique constraint, Null constraint, Check constraint)	**04**
Unit IV	**4. Relational algebra** 4.1 Preliminaries 4.2 Relational algebra (selection, projection set operations, renaming, joins, division) 4.3 Problems.	**04**
Unit V	**5. Introduction to SQL** 5.1 Introduction 5.2 Basic structure 5.3 Set operations 5.4 Aggregate functions 5.5 Null values 5.6 PL/PgSqL: Data types, Language structure	**08**

Unit VI	**6. Operations with SQL** 6.1 Nested Subqueries 6.2 Modifications to Database 6.3 DDL and DML commands with examples 6.4 SQL mechanisms for joining relations (inner joins, outer joins and their types) 6.5 Examples on SQL (case studies)	**06**

References

1. Shamkant B. Navathe, Ramez Elmasri, Database Systems, ,ISBN:9780132144988,PEARSON HIGHER EDUCATION
2. Richard Stones, Neil Matthew, Beginning Databases with PostgreSQL: From Novice to Professional, ISBN:9781590594780, Apress
3. Korry Douglas,PostgreSQL, ISBN:9780672327568, Sams
4. JohnWorsley, Joshua Drake , Practical PostgreSQL(BCD),ISBN:9788173663925 Shroff/O'reilly

5. Joshua D. Drake, John C Worsley , Practical Postgresql , **(O'Reilly publications)**

6**.**Bipin C Desai , "An introduction to Database systems" , Galgotia Publications

7. Henrey Korth, Sudarshan, Silberschatz "Database System Concepts" (4th Ed), McGraw Hill,.

Class : F.Y. B. Sc. (Computer Science) (Semester- II)
Subject : Computer Science Paper Code: CSCO1201
Title of Paper: Advanced Programming using C Paper : I
Credit: 2 No. of lectures: 36

Learning Objectives: Students successfully completing this course will be able to:

1. Understand and design Programs through advanced C Concepts
2. Design graphics Programming.

Learning Outcome: Todevelopadvancedas well as Graphics programming capability.

Units	**Topics Contents**	**No. of Lectures**
Unit – I	**Pointers** 1.1 Pointer declaration, initialization 1.2 Dereferencing pointers 1.3 Pointer arithmetic 1.4 Pointer to pointer 1.5 Arrays and pointers 1.6 Functions and pointers – passing pointers to functions, function returning pointers 1.7 Dynamic memory allocation	8
Unit – II	**Strings** 2.1 Declaration and initialization, format specifiers 2.2 Standard library functions 2.3 Strings and pointers 2.4 Array of strings 2.5 Command Line Arguments	6
Unit – III	**Structures and Unions** 3.1 Creating structures 3.2 Accessing structure members (dot Operator) 3.3 Structure initialization 3.4 Typedef 3.5 Array of structures 3.6 Passing structures to functions 3.7 Nested structures 3.8 Pointers and structures 3.9 Self referential structure 3.10 Unions 3.11 Difference between structures and unions	10
Unit – IV	**File Handling** 4.1 Streams 4.2 Types of Files 4.3 Operations on files 4.4 Random access to files	6
Unit – V	**C Preprocessor** 4.1 Format of Preprocessor directive 4.2 File Inclusion directive	2

	4.3 Macro substitution, nested macro, augmented macro	
Unit – VI	**Graphics programming using C** 6.1 Graphics driver and mode 6.2 Drawing simple graphical objects – line, circle, rectangle etc. 6.3 Outputting text, curves & Polygons	4

References:

1. Yashavant Kanetkar : Let Us C 7th Edition, PBP Publications
2. E Balaguruswamy : Programming in ANSI C 4th Edition, Tata Mc-Graw Hill Publishing Co. Ltd.-New Delhi
3. Brian W. Kernighan and Dennis M. Ritchie : The C Programming Language 2nd Edition, Prentice Hall Publication
4. Herbert Schildt,The Complete Reference to C,
5. Harrow , Problem Solving with C

Class : F.Y. B. Sc.(Computer Science) (Semester- II)
Subject : Computer Science Paper Code : CSCO1202
Title of Paper : DBMS-II Paper : II
Credit: 2 No. of lectures: 36

Prerequisites: Knowledge of DBMS

Learning Objectives:-Students successfully completing this course will be able to:

- Understand fundamental concepts of RDBMS (PL/PgSQL)
- Understand data security and its importance
- Understand client server architecture

Learning Outcomes:

- Develop the database design by normalization.
- Knowing functional dependencies and design of the relational database.
- Design concept of Transaction and Query processing.

Unit	Title & Content	No. Of lecture
Unit I	1. **Relational Database Design** 1.1 Preliminaries 1.2 Normalization (1NF,2NF,3NF,BCNF,4NF, 5 NF) 1.3 Controlling the program flow, conditional statements, loops 1.4 Handling errors and exceptions, Cursors 1.5 Views, Stored Functions, Stored Procedures, Triggers	**12**
Unit II	2 **Transaction Concepts and concurrency control** 2.1 Transaction, properties of transaction, state of the transaction. 2.2 Executing transactions concurrently associated problem in concurrent execution. 2.3 Schedules, types of schedules,Serializability, precedence graph for Serializability. 2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations. 2.5Basic timestamp method for concurrency, Thomas Write Rule. 2.6Locks with multiple granularity, dynamic database concurrency (Phantom Problem). 2.7 Timestamps versus locking. 2.8 Deadlock handling methods 2.8.1 Detection and Recovery (Wait for graph). 2.8.2 Prevention algorithms (Wound-wait, Wait-die)	**10**
Unit III	3 **Database Integrity and Security Concepts** 3.1 Domain constraints 3.2 Referential Integrity 3.3 Introduction to database security concepts 3.4 Methods for database security 3.4.1Discretionary access control method 3.4.2Mandatory access control and role base access control for multilevel security. 3.5 Use of views in security enforcement. 3.6 Overview of encryption technique for security. 3.7 Statistical database security.	**06**
Unit IV	4 **Crash Recovery** 4.1 Failure classification 4.2 Recovery concepts 4.3 Log base recovery techniques (Deferred and Immediate update)	**04**

	4.4 Checkpoints 4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit) 4.6 Database backup and recovery from catastrophic failure.	
Unit V	5. **Client-Server Technology** 5.1 Describe client-server computing. 5.2 Evolution of Client - Server information systems. 5.3 Client – Server Architecture benefits. 5.4 Client Server Architecture - Components, Principles, Client Components, Communication middleware components, Database middleware components, Client Server Databases	**04**

References:-

1. Elmasri and Navathe,Fundamentals of Database Systems (4th Ed)
2. Henrey Korth, Sudarshan, Silberschatz,Database System Concepts (4th Ed)
3. Practical PostgreSQL O'REILLY
4. Richard Stones , Neil Matthew,Beginning Databases with PostgreSQL, From Novice to Professional, 2nd Edition, Apress

Class : F.Y. B. Sc.(Computer Science) (Annual)
Subject : Computer Science Paper Code : CSCO1203
Title of Paper:Basic C & Advanced C Paper : III(Lab Course)
Credit: 4 No. of Practicals: 10 /Semester

Learning Objectives: Students successfully completing this course will be able to:

1. Design and implement a 'C' programs for different problems
2. Understand appropriate use of language structure.
3. Understand use of appropriate Graphics Functions.

Learning Outcome: Problem solving and programming capability and develop Advanced as well as Graphics programming capability.

Semester I (Credits – 02) No. of Practicals – 10)	
	Title of Experiment/ Practical
1	Assignment to demonstrate use of data types, simple operators & expressions.
2	Assignment to demonstrate decision making statements (if and if-else, nested structures)
3	Assignment to demonstrate decision making statements (switch - case)
4	Assignment to demonstrate use of simple loops
5	Assignment to demonstrate use of nested loops
6	Assignment to demonstrate menu driven programs.
7	Assignment to demonstrate writing C programs in modular way (use of user defined functions)
8	Assignment to demonstrate recursive functions.
9	Assignment to demonstrate use of arrays (1-d arrays) and functions
10	Assignment to demonstrate use of arrays (1-d arrays) and functions
Semester II (Credits – 02) No. of Practicals – 10)	
	Title of Experiment/ Practical
1	Assignment to demonstrate use of pointers.
2	Assignment to demonstrate concept of strings (string & pointers)
3	Assignment to demonstrate array of strings.
4	Assignment to demonstrate use of bitwise operators.
5	Assignment to demonstrate structures and unions.
6	Assignment to demonstrate structures (using array and functions).
7	Assignment to demonstrate command line arguments and preprocessor directives.
8	Assignment to demonstrate file handling (text files & binary files)
9	Assignment to demonstrate graphics programming.
10	C Programming – Case study (Menu Driven Application Base) in Groups

Class : F.Y. B. Sc.(Computer Science) (Annual)
Subject : Computer Science Paper Code : CSCO1204(Grade)
Title of Paper :**DBMS & RDBMS** Paper : IV(Lab Course)
Credit : Grade No. of Practicals: 10 /Semester

Learning Objectives: Students successfully completing this course will be able to:

- Define & Manipulate the database Concepts.
- Understand SQL with DDL and DML Commands.
- Understand RDBMS concepts.

Learning Outcome: To know the DBMS& RDBMS Concepts and to operate Database Software.

Semester I No. of Practicals – 10	
	Title of Experiment/ Practical
1	Create simple tables , with only the primary key Constraint
2	Create more than one table with integrity constraint
3	Create more than one table, with referential integrity constraint.
4	Drop a table from database, Alter the table.
5	Insert/Update/Delete statements.
6	Query for the tables using simple form of Select Statement
7	Query solving for tableoperations(Aggregate function)
8	Nested Query solving for tableoperations(Union, Intersect, Except)
9	Nested Query solving for tableoperations(Set membership, Cardinality, Comparison)
10	To Small Case Studies.
Semester II No. of Practicals – 10	
	Title of Experiment/ Practical
1	Simple Queries
2	Nested Queries
3	Queries using aggregate functions
4	Queries using Views
5	Cursors
6	Exception Handling
7	Stored Function
8	Triggers
9	Case Study(1)
10	Case Studies (2)

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

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

Subject	Semester I	Semester II	Total
Paper – I	4 (Core)	4 (Core)	8
Paper – II	4 (Core)	4 (Core)	8
Paper – III	4 (Core)	4 (Core)	8
Paper - IV	4 (Core)	4 (Elective)	8
Paper – V	4 (Core)	4 (Elective)	8
Practical	4 (Core)	4 (Core)	8
Practical (Project)	---	4 (Elective)	4
Skill Development	2	2	4
Introduction to Cyber Security – I	--	2	2
Certificate Course	2	--	2
Total ====	**28**	**32**	**60**

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

Subject	Semester III	Semester IV	Total
Paper – I	4 (Core)	4 (Elect) (Opt)	4
Paper – II	4 (Core)	4 (Elect) (Opt)	4
Paper – III	4 (Core)	-----	4
Paper - IV	4 (Elective)	**Industrial Training Project (IT) 16**	8
Paper – V	4 (Elective)		8
Practical / Paper VI (Sem IV)	4 (Core)		8
Practical (Project)	4 (Elective)		8
Human Rights	2	--	2
Introduction to Cyber Security – II	--	2	2
Certificate Course	2	--	2
Total ====	**32**	**18**	**50**

Extra Credits:

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

Note: Core subject is compulsory, if students had completed 80 credits within three semesters then no need to select any elective course at IV Semester otherwise students should select appropriate number of elective course to minimum complete 96 credits.

TotalCredits:

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

Paper wise Course Structure For M.Sc. (Computer Science) – Iyear

Sr.No.	Code	Paper Title	Credit	Exam	Marks
Semester – I					
1	COMP4101	Principles of Programming Languages (C)	4	I / E	50 + 50
2	COMP4102	Cryptography & Network Security(C)	4	I / E	50 + 50
3	COMP4103	Database Technologies (C)	4	I / E	50 + 50
4	COMP4104	Design and Analysis of Algorithms (C)	4	I / E	50 + 50
5	COMP4105	Programming with DOT NET (C)	4	I / E	50 + 50
6	COMP4106	Lab Course on DOT NET, PPL&Database Technologies (C)	4	I / E	50 + 50
7		Skill Development	2		
8		Certificate Course	2		
Note: Minimum credit: 24 and Maximum Credit:24 Core subjects is compulsory and Extra credits (2+2) is also compulsory.					
Semester – II					
9	COMP4201	Digital Image Processing (C)	4	I / E	50 + 50
10	COMP4202	Data Mining and Data Warehousing (C)	4	I / E	50 + 50
11	COMP4203	Python Programming (C)	4	I / E	50 + 50
12	COMP4204	**Advanced Operating System (Elective I)**	4	I / E	50 + 50
13	COMP4205	Lab Course on Python Programming and Advance Operating System (C)	4	I / E	50 + 50
14	COMP4206	**Project (Elective II)**	4	I / E	50 + 50
15	COMP4207	**Artificial Intelligence (Elective III)**	4	I / E	50 + 50
16	COMP4208	Modeling and Simulation **(Elective IV)**	4	I / E	50 + 50
17		Skill Development	2		
18		Introduction Cyber Security – I	2		
Note: : Minimum credit: 28 and Maximum Credit:32 Core subjects is compulsory and Extra credits (2+2) is also compulsory. From elective courses 3 subjects for Minimum Credits and 4 for Maximum Credit					

SYLLABUS (CBCS) FOR M.Sc. (Computer Science)
(w.e.f from june 2019)
Academic Year 2019-2020

Class: M.Sc. (Computer Science)(Semester-I) Paper Code: **COMP4101**
Title of paper: Principles of Programming Language Paper: **I**
Credit -4 No. of Lectures 48

Prerequisites:

It is assumed that student learning this course have the following background:

- Experience with an OOP language (such as Java or C++)
- Experience with a procedural language (such as C)
- Working knowledge of C, C++, and Java programming.
- Basic algorithms and data structure concepts.
- Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms

Objectives:

• This course will prepare you to think about programming languages analytically:
- Separate syntax from semantics
- Compare programming language designs
- Learn new languages more quickly
- Use standard vocabulary when discussing languages
- Understand basic language implementation techniques

• **This course focuses on both:**
- Theory is covered by the textbook readings, lectures, and on the tests
- Implementation is covered by the homework assignments

Unit	Title and Contents	No.of lecture
Unit -I	**Introduction** ✓ The Art of Language Design ✓ The Programming Language Spectrum ✓ Why Study Programming Languages? ✓ Compilation and Interpretation ✓ Programming Environments	2
Unit-II	**Non-Imperative Programming** **Models: Functional,Logic Languages** Common LISP ✓ Basic LISP Primitives (FIRST,REST,SETF,CONS,APPEND, ✓ LIST,NTHCDR,BUTLAST,LAST,LENGTH,REVERSE,ASSC) ✓ Procedure definition and binding, DEFUN, LET ✓ Predicates and Conditional, EQUAL, EQ, EQL, =, MEMBER, LISTP, ATOM,NUMBERP, SYMBOLP, NIL, NULL, IF, WHEN,UNLESS,COND, CASE ✓ Procedure Abstraction and RecursionTurbo Prolog ✓ Introduction, facts, Objects and Predicates, Variables, ✓ Using Rules, Controlling execution fail and cut predicates.	**10**
Unit-III	**Names, Scopes, and Bindings** ✓ The Notion of Binding Time ✓ Object Lifetime and Storage Management: Static Allocation, Stack-Based Allocation, Heap-Based Allocation, Garbage Collection	5

	✓ Scope Rules ✓ Static Scoping, Nested Subroutines, Declaration Order, Dynamic Scoping ✓ The meaning of Names in a Scope-Aliases, Overloading, Polymorphism and Related Concepts ✓ The Binding of Referencing Environments-Subroutine Closures, First-Class Values and Unlimited Extent, Object Closures ✓ Macro Expansion	
Unit-IV	**Data Types** ✓ Introduction ✓ Primitive Data Types-Numeric Types, Integer, Floating point, Complex, Decimal, Boolean Types,Character Types, Character String Types-Design Issues, Strings and Their Operations, String Length Operations, Evaluation, Implementation of Character String Types. ✓ User defined Ordinal types-Enumeration types, Designs, Evaluation, Subrange types, Ada's design, Evaluation, Implementation of user defined ordinal types ✓ Array types-Array initialization, Array operations, Rectangular and Jagged arrays, Slices, Evaluation, Implementation of Array Types ✓ Associative Arrays-Structure and operations, Implementing associative arrays ✓ Record type-Definitions of records, References to record fields, Operations on records, Evaluation, Implementation of Record types ✓ Union Types-Design issues, Discriminated versus Free unions, Evaluation, Implementation of Union types ✓ Pointer and Reference Types-Design issues, Pointer operations, Pointer problems-Dangling pointers, Lost heap dynamic variables, Pointers in C and C++, Reference types, Evaluation, Implementation of pointer and reference types, Representation of pointers and references, Solution to dangling pointer problem, Heap management	**8**
Unit - V	**Control Flow** ✓ Expression Evaluation-Precedence and Associativity, Assignments, Initialization, Ordering Within Expressions, Short-Circuit Evaluation ✓ Structured and Unstructured Flow-Structured Alternatives to goto Sequencing ✓ Selection-Short-Circuited Conditions, Case/Switch Statements ✓ Iteration-Enumeration-Controlled Loops, Combination, Loops, Iterators, Logically Controlled Loops ✓ Recursion-Iteration and Recursion, Applicative and Normal - Order Evaluation	**5**
Unit -VI	**Subroutines and Control Abstraction** ✓ Fundamentals of Subprograms ✓ Design Issues for subprograms ✓ Local Referencing Environments ✓ Parameter-Passing Methods	**5**

	✓ Parameters That are Subprograms ✓ Overloaded Subprograms ✓ Generic Subroutines-Generic Functions in C++, Generic Methods in Java ✓ Design Issues for Functions ✓ User-Defined Overloaded Operators ✓ Coroutines ✓ The General Semantics of Calls and Returns ✓ Implementing "Simple" Subprograms ✓ Implementing Subprograms with Stack-Dynamic Local ✓ Variables ✓ Nested Subprograms ✓ Blocks ✓ Implementing Dynamic Scoping	
Unit-VII	**Data Abstraction and Object Orientation** ✓ Object-Oriented Programming ✓ Encapsulation and Inheritance-Modules, Classes, Nesting (Inner Classes), Type, Extensions, Extending without Inheritance ✓ Initialization and Finalization-Choosing a Constructor, References and Values,Execution Order, Garbage Collection ✓ Dynamic Method Binding-Virtual- and Non-Virtual Methods, Abstract, Classes, Member Lookup, Polymorphism,Object Closures ✓ Multiple Inheritance-Semantic Ambiguities, Replicated Inheritance, Shared Inheritance, Mix-In Inheritance	**8**
Unit-VIII	**Concurrency** ✓ Introduction-Multiprocessor Architecture, Categories of concurrency, Motivations for studying concurrency ✓ Introduction to Subprogram-level concurrency-Fundamental concepts, Language Design for concurrency, Design Issues ✓ Semaphores-Introduction, Cooperation synchronization, Competition Synchronization, Evaluation ✓ Monitors-Introduction, Cooperation synchronization, Competition Synchronization, Evaluation ✓ Message Passing-Introduction, The concept of Synchronous Message Passing ✓ Java Threads-The Thread class, Priorities, Competition Synchronization, Cooperation Synchronization	**5**

References:

1. Scott, Programming Language Pragmatics, 3e(With CD) ISBN 9788131222560 Kaufmann Publishers, An Imprint of Elsevier, USA
2. Robert W. Sebesta, Concepts of Programming Languages, Eighth Edition, Pearson Education
3. Carl Townsend, Introduction to Turbo Prolog
4. Patrick Henry Winston & Berthold Klaus Paul Horn ,LISP 3rd edition –BPB
5. M. Gabbrielli, S. Martini, , Programming Languages: Principles and Paradigms, Springer ISBN: 9781848829138

Class: M.Sc. (Computer Science)(Semester-I) Paper Code: COMP4102
Title of paper: Cryptography and Network Security Paper: II
Credit -4 No. of Lectures :50

Learning Objectives:

- To enable students to get sound understanding of Info-Sys-Security, Network Security, Cryptography.
- To equip with knowledge and skills necessary to support for their career in Network Security.
- To develop attitude and interest along with necessary knowledge and skills among the students to encourage them to do further academic studies / research in this area, after the completion of their PG Course.

Learning Outcomes: Learn the security concepts and techniques.

Chapters	**Title & Contents**	**No. of Lectures**
Unit – I	**Introduction to Security:** The Need for Security, Security Approaches, Principles of Security, Types of Attacks	02
Unit – II	**Cryptography and techniques:** Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric key cryptography, steganography.	06
Unit – III	**Symmetric Key Algorithms and AES:** Algorithm Types and Modes, Overview of Symmetric Key Cryptography, DES, IDEA, Blowfish	06
Unit – IV	**Asymmetric Key Algorithms, Digital Signature and RSA:** Brief History of Asymmetric Key Cryptography, overview, RSA Algorithm, Comparison between Symmetric & Asymmetric Key Algorithms, Digital Signature	06
Unit – V	**Digital Certificates and Public Key Infrastructure (PKI):** Introduction, Digital Certificates, private key management,	03
Unit – VI	**Internet Security Protocols:** Basic Concepts, SSL, TLS, SHTTP, TSP, SET, SSL v/s SET, 3-D Secure Protocol, Electronic Money, Email Security, WAP Security, Users Authentication and Kerberos: Authentication Basics, Password, Authentication Tokens, Certificate based Authentication, Biometric Authentication, Kerberos, Security Handshake pitfalls, SSO Approaches.	14
Unit – VII	**Network Security**, Firewalls and Virtual Private Network (VPN): Brief introduction to TCP/IP, Firewalls, IP Security, VPN, Intrusion	05
Unit – VIII	**Case studies on Cryptography and Security:** Introduction, Cryptographic solutions, Secure inter branch payment transaction, Denial of services(DOS) attacks, IP Spooling	08

	Attack, Cross site scripting vulnerability(CSSV), Contract Signing, Secret Splitting, Virtual Electronics, Cookies and Privacy.	

Reference:

- Cryptography and Network Security : Atul Kahate
- Computer Network Security : Kizza, Springer
- Network Security , Harrington, Elsevier

Class: M.Sc. (Computer Science)(Semester-I) Paper Code: COMP4103

Title of paper: Database Technologies Paper: III

Credit -4 No. of Lectures 52

Prerequisites:

Knowledge of RDBMS

Course objectives :

1. To study the usage and applications of Parallel and Distributed databases, Object relational database and emerging systems.
2. To acquire knowledge on NoSQL databases.

Course outcomes :

1. Compare different database technologies.
2. Compare and contrast NoSQL databases with RDBMS.

Chapters	Title & Contents	No. of Lectures
Unit – I	**Parallel and Distributed Databases** 1.1 Database System Architectures: Centralized and Client-Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems 1.2 Parallel Databases : I/O Parallelism, Inter and Intra Query Parallelism, Inter and Intra operation Parallelism 1.3 Distributed Database Concepts: Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control, Distributed Query Processing, Three Tier Client Server Architecture, Case Studies	10
Unit – II	**Object and Object Relational Databases** 2.1 Concepts for Object Databases: Object Identity, Object Structure, Type Constructors, Encapsulation of Operators, Methods, Persistence, Type and Class Hierarchies, Inheritance, Complex Objects, Object Database Standards 2.2 Languages and Design : ODMG Model, ODL, OQL 2.3 Object Relational and Extended Relational Systems: Object Relational features in SQL/Oracle 2.4 Case Studies	10
Unit – III	**XML Databases** 3.1 XML Data Model 3.2 DTD 3.3 XML Schema 3.4 XML Querying 3.5 Web Databases 3.6 Information Retrieval 3.7 Data Warehousing 3.8 Data Mining	06
Unit – IV	**Mobile Databases** 4.1 Location and Handoff Management 4.2 Effect on Mobility on Data Management 4.3 Location Dependent Data Distribution	10

	4.4 Mobile Transaction Models 4.5 Concurrency Control 4.6 Transaction Commit Protocols 4.7 Mobile Database Recovery Schemes 4.8 Examples: Oracle Database Lite, Microsoft SQL Server Compact	
Unit – V	**Introduction to NoSQL** 5.1 Concepts and and evolution 5.2 History of NoSQL 5.3 Different NoSQL products : MongoDB, Couch DB, Cassandra 5.4 Exploring MongoDB 5.5 Advantages of MongoDB over RDBMS 5.6 Interfacing and Interacting with NoSQL 5.7 Sharding 5.8 Replication	08
Unit – VI	**Working with NoSQL** 6.1 NoSQL Storage Architecture 6.2 CRUD operations with MongoDB 6.3 Querying, Modifying and Managing NoSQL data stores 6.4 Indexing and ordering datasets 6.5 Surveying database internals 6.6 Migrating from RDBMS to NoSQL 6.7 Implementing NoSQL with PHP	08

References:

1. Henry Korth, Abraham Silberschatz and S. Sudarshan, “Database System Concepts”, Sixth Edition ,McGraw Hill, 2011.
2. M. Tamer Ozsu and Patrick Valduriez, “Principles of Distributed Database Systems”, Third Edition, Springer, 2011.
3. Thomas Connolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Fourth Edition, Pearson Education, 2008, Fifth Edition, Pearson Education, 2010, Sixth Edition, Pearson Education, 2015.
4. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.
5. C.J.Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
6. Dan Sullivan, “NoSQL for Mere Mortals”, First Edition, Pearson Education, 2015.
7. Kristina Chodorow, “MongoDB-The Definitive Guide”, Second Edition, O’Reilly, 2013.

Class:M.sc.(Computer science) (Semester-I) Paper Code:COMP4104

Title of Paper:Design & Analysis of Algorithm Paper: IV

Credit:4 No. of lectures:48

Learning Objectives: Student successfully completing this course will be able to

- Understand Basic Algorithm Analysis techniques and the use o- asymptotic notation
- Understand different design strategies
- Understand the use of data structures in improving algorithm performance
- Understand classical problem and solutions
- Learn a variety of useful algorithms
- Understand classification of problems

Learning Outcome

- Basic algorithms and data structure concepts.
- Basic programming concepts

Chapter	Title and Contents	No. of Lectures
Unit –I	**Design strategies** Algorithm definition, space complexity, time complexity, worst case –best case –average casecomplexity, asymptotic notation, sorting algorithms (insertion sort, heap sort) sorting in linear time, searching algorithms, recursive algorithms (Tower of Hanoi , Permutations). **Divide and conquer** control abstraction, binary search, merge sort, Quick sort, Strassen's matrix Multiplication	**12**
Unit –II	**Advanced Design and Analysis Techniques** **Greedy method** knapsack problem, job sequencing with deadlines, minimum-cost spanning trees**,** Kruskal and Prim's algorithm, optimal storage on tapes, optimal merge patterns, Huffman coding **-Dynamic programming** matrix chain multiplication,single source shortest paths, Dijkstra's algorithm, Bellman- ford algorithm , all pairs shortest path, longest common subsequence, string editing, 0/1 knapsack problem, Traveling salesperson problem.	**16**
Unit – III	**Decrease and conquer** DFS and BFS, Topological sorting, connected components	**6**
Unit – IV	**Backtracking** General method, 8 Queen's problem, Sum of subsets problem, graph coloring problem, Hamiltonian cycle	**4**
Unit – V	**Branch and Bound Technique** FIFO, LIFO, LCBB, TSP problem, 0/1 knapsack Problem	**4**

Unit – VI	**Transform and conquer** Horner's Rule and Binary Exponentiation – Problem Reduction	**4**
Unit – VII	**Problem classification** Nondeterministic algorithm, The class of P, NP, NP-hard and NP-Complete problems, significance of Cook's theorem	**2**

References:

1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms,Galgotia.

2. T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990 1

3. A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms,Addison Wesley, 1974

4. Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81),Addison Wesley

5. Steven Skiena, The Algorithm Manual, Springer ISBN:9788184898651

6. Jungnickel, Graphs, Networks and Algorithms, Springer, ISBN: 3540219056

Class: M.sc. (Computer science) (Semester-I) Paper Code:COMP4105
Title of Paper: Programming with DOTNET Paper: V
Credit:4 No.of lectures:48

Prerequisites –

- Knowledge of object-oriented programming concepts such as data abstraction, encapsulation, inheritance, and polymorphism.
- Familiarity with programming language such as C++ and/or Java.
- Knowledge of web development

Learning Objectives:

Able to understand the DOTNET framework, C# language features and Web development using ASP.NET

Learning Outcome:

Ability to write the Visualized programming and design different real life problems.

Part I : C#		
1.	**Introduction to DOTNET Framework** **a. Introduction to DOTNET** **b. DOT NET class framework** **c. Common Language Runtime** i. Overview ii. Elements of .NET application iii. Memory Management iv. Garbage Collector : Faster Memory allocation, Optimizations **d. Common Language Integration** i. Common type system ii. Reflection API **e. User and Program Interface**	**2**
2.	**Introduction to C#** **a. Language features** i. Variables and Expressions, type conversion ii. Flow Control iii. Functions, Delegates iv. Debugging and error handling, exception handling (System Defined and User Defined) **b. Object Oriented Concepts** i. Defining classes, class members, Interfaces, properties ii. Access modifiers, Implementation of class, interface and properties iii. Concept of hiding base class methods, Overriding iv. Event Handling **c. Collections, Comparisons and Conversions** i. Defining and using collections, Indexers, iterators ii. Type comparison, Value Comparison iii. Overloading Conversion operators, as operator **d. Generics** i. Using generics, ii. Defining Generics, generic Interfaces, Generic methods, Generic Delegate	**8**

3.	**Window Programming** **a. Window Controls** i. Common Controls ii. Container Controls iii. Menus and Toolbars iv. Printing v. Dialogs vi. **Data tools** **b. Deploying Window Application** i. Deployment Overview ii. Adding setup project iii. Building the project : Installation	**6**
4.	**Data Handling** **a. File System Data** **b. XML Data** **c. Databases and ADO.NET**	**6**
5.	**Reporting Tools** **a. Data Report** **b. Crystal Report**	**4**
6.	**Dot NET Assemblies** a. Components b. .NET Assembly features c. Structure of Assemblies d. Calling assemblies, private and shared assemblies	**3**
Part II : ASP.NET		
1.	**Introduction to ASP.NET** **a. History of Web Programming** **b. Basic of Web programming**	**1**
2.	**Server Controls and Variables, control Structures & Functions** **a.** Forms, webpages, HTML forms, Webforms **b.** Request & Response in Non-ASP.NET pages **c.** Using ASP.NET Server Controls **d.** Datatypes : Numeric, text, arrays, datacollections **e.** Overview of Control structures	**4**
3.	**Even Driven Programming and PostBack** **a.** HTML events **b.** ASP.NET page events **c.** ASP.NET Web control events **d.** Event driven programming and postback	**3**
4.	**Reading from Databases** **a.** Data pages , **b.** ADO.NET	**3**
5.	**ASP.NET Server Controls** **a.** ASP.NET Web Controls **b.** HTML Server Controls **c.** Web Controls	**4**
6.	**DOTNET assemblies and Custom Controls** **a.** Introduction to Cookies, Sessions **b.** Session events **c.** State management Recommendations	**2**

7.	**Web Services** **a.** HTTP, XML & Web services **b.** SOAP **c.** Building ASP.NET web service **d.** Consuming a web service	**2**

Recommended Text and Reference books:

1. Beginning Visual C#, Wrox Publication
2. Professional Visual C#, Wrox Publication
3. Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press Â© 2001, 403 pages
4. Beginning ASP.NET 3.5, Wrox Publication
5. Programming ASP.NET 3.5 by Jesse Liberty, Dan Maharry, Dan Hurwitz, O'Reilly
6. Illustrated C# 2008, Solis, Publication APRESS, ISBN 978-81-8128-958-2
7. Professional C# 4.0 and .NET 4by Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson,
8. Morgan Skinner, WROX
9. Beginning C# Object-Oriented Programming By Dan Clark , Apress
10. ADO.NET Examples and Best Practices for C# Programmers, By Peter D. Blackburn Apress
11. Database Programming with C#, By Carsten Thomsen, Apress

Class:M.sc.(Computer science) (Semester-I) Paper Code:COMP4106
Title of Paper: Practical On DOT NET, PPL, Database Technoloiges
Paper: VI (Lab Course) Credit:4 No.of Practicals:12

Console Application	
Assignment 1	Parameter Modifiers (ref , out , params)
Assignment 2	Delegate and Events
Assignment 3	Properties and Indexers
Assignment 4	Inheritance and Interface
Assignment 5	Polymorphism (Method Overloading , Operator Overloading and Method Overriding
Assignment 6	Exception Handling
Assignment 7	Collections
Assignment 8	Generics
Windows Application	
Assignment 1	Use of Basics Form Controls
Assignment 2	Use of List Box
Assignment 3	Event Handling (Calculator)
Assignment 4	Use of Dialogue Boxes
Assignment 5	Simple Database Operations
Assignment 6	Advanced Database Operations
Assignment 7	Simple Crystal Report
Assignment 8	Advanced Crystal Report
ASP.Net Web Applications	
Assignment 1	Use of Web Controls
Assignment 2	Validation Controls
Assignment 3	Use of CSS
Assignment 4	Database Connectivity
Assignment 5	Database Connectivity (Stored Procedure)
Assignment 6	Use of Master Pages
Assignment 7	Use of Master Pages
Assignment 8	Use of State Management (Cookies , Sessions…)
PPL Assignments	
Assignment 1	LISP
Assignment 2	PROLOG
Database Technologies Assignments	
Assignment 1	Creating database, collections, insert, update & delete documents in NoSQL
Assignment 2	Querying documents in NoSQL

Class: M.Sc.I (Computer Science) Semester-II Paper Code: COMP4201
Title of Paper : Digital Image Processing Paper: I
Credit : 04 No.Of Lecture: 48

Learning Objectives:

- To understand the relation between human visual system and machine perception and processing of digital images.
- To provide a detailed approach towards image processing applications like enhancement, segmentation, and compression.

Learning outcome:

- Review the fundamental concepts of a digital image processing system.
- Analyze images in the frequency domain using various transforms.
- Evaluate the techniques for image enhancement and image restoration.
- Interpret image segmentation and representation techniques

Unit No.	Contents	No. Of Lectures
1	**Introduction to DIP** • Introduction to Digital Image Processing • The origins of Digital Image Processing • Examples of Fields that use Digital Image Processing • Gamma-Ray Imaging • X-Ray Imaging • Imaging in the Ultraviolet Band • Imaging in the Visible and Infrared Bands • Imaging in the Microwave Band • Imaging in the Radio Band • Fundamental steps in Digital Image Processing • Components of an Image Processing System	03
2.	**Digital Image Fundamentals** • Elements of Visual Perception • Light and the Electromagnetic Spectrum • Image sensing and Acquisition • Image Sampling and Quantization • Some Basic Relationships between Pixels • An Introduction to the Mathematical Tools Used in Digital Image Processing o Array versus Matrix Operations o Linear versus Nonlinear Operations o Arithmetic Operations o Set and Logical Operations	06
3.	**Intensity Transformation and Spatial Filtering** • Background • Some Basic Intensity Transformation Functions • Histogram Processing o Histogram Equalization o Histogram Matching (Specification)	07

	○ Local Histogram Processing • Fundamentals of Spatial Filtering • Smoothing Spatial Filters • Sharpening Spatial Filters • Combining Spatial Enhancement Methods	
4.	**Filtering in the Frequency Domain** • Background • Preliminary Concepts • Sampling and the Fourier Transform of Sampled Functions • The Discrete Fourier Transform (DFT) of One variable • Extension to Functions of Two Variables • Some Properties of the 2-D Discrete Fourier Transform • The Basics of Filtering in the Frequency Domain • Image Smoothing Using Frequency Domain Filters • Image Sharpening Using Frequency Domain Filters • Selective Filtering	10
5.	**Image Restoration and Reconstruction** • A Model of the Image Degradation / Restoration Process • Noise Models • Restoration in the Presence of Noise Only-Spatial Filtering • Periodic Noise Reduction by Frequency Domain Filtering ○ Bandreject Filters ○ Bandpass Filters ○ Notch Filters • Estimating the Degradation Function • Inverse Filtering • Minimum Mean Square Error(Wiener) Filtering • Geometric Mean Filter	06
6.	**Morphological Image Processing** • Preliminaries • Erosion and Dilation • Opening and Closing • The Hit-or-Miss Transformation • Some Basic Morphological Algorithms ○ Boundary Extraction ○ Hole Filling ○ Extraction of Connected Components ○ Convex Hull	05

	○ Thinning ○ Thickening ○ Skeletons ○ Pruning ○ Morphological Reconstruction	
7.	**Image Segmentation** • Fundamentals • Point, Line, and Edge Detection ○ Background ○ Detection of Isolated Points ○ Line Detection ○ Edge Models ○ Basic Edge Detection ○ Edge Linking and Boundary Detection • Thresholding ○ Foundation ○ Basic Global Thresholding ○ Optimum Global Thresholding Using Otsu's Method ○ Using Image Smoothing to Improve Global Thresholding ○ Using Edges to Improve Global Thresholding • Region-Based Segmentation	07
8.	**Representation and Description** • Representation ○ Boundary (Border) Following ○ Chain Codes ○ Polygonal Approximations Using Minimum-Perimeter Polygons ○ Other Polygonal Approximation Approaches ○ Signatures ○ Boundary Segments ○ Skeletons • Boundary Descriptors ○ Some Simple Descriptors ○ Shape Numbers ○ Fourier Descriptors • Regional Descriptors ○ Some Simple Descriptors ○ Topological Descriptors ○ Texture	04

Reference Books:

1. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2nd edition),PWS Publishing, or (3rd edition) Thompson Engineering, 2007

2. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nded., Gatesmark Publishing, Knoxville, TN.

3. Anil K. Jain [2001], Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ

4. Willian K. Pratt [2001], Digital Image Processing (3rd Edition), , John Wiley & Sons, NY

5. Burger, Willhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic IntroductionUsing Java, Springer

6. Digital Image Analysis (With CD-ROM), Kropatsch, Springer, ISBN 978038795066

7. Digital Image Processing, 6e (With CD), Jähne, Springer, ISBN:978-3-540-24035-8 2

Class : M.Sc. (Computer Science)(Semester – II) Paper Code :COMP4202
Title of Paper : Data Mining and Data Warehousing Paper: II
Credit : 4 No. of Lectures :55

Prerequisites :

- Basic Knowledge of databases handling.

Learning Objectives :

- To study different data preprocessing techniques.
- To introduce the core concepts of data warehousing techniques and implementation.
- To introduce the core concepts of data mining techniques and applications.
- To study advanced data mining techniques.
- To use data mining software on various data sets by using proper algorithms.

Learning Outcomes :

- Students will understand both the theoretical and practical aspects data mining.
- Understand basic data mining algorithms, methods, and tools
- Understand data mining principles and techniques:
- Understanding the basic concepts of OLAP.
- Understanding the basic concepts of Data Warehouse.

Unit	Title and Contents	No. of Lectures
Unit – I	**1. Data Preprocessing** 1.1 Introduction 1.2 Data Processing prerequisites 1.3 Data Objects and Attribute Types 1.3.1 Attribute 1.3.2 Nominal Attributes 1.3.3 Binary Attributes 1.3.4 Ordinal Attributes 1.3.5 Numeric Attributes 1.3.6 Discrete Attributes 1.3.7 Continuous Attributes 1.4 Need for Preprocessing 1.5 Major Tasks in Data Preprocessing 1.5.1 Data Cleaning 1.5.2 Data Integration 1.5.3 Data Reduction 1.5.4 Data Transformation 1.5.5 Data Discretization 1.6 Missing Values 1.7 Noisy Data	**4**
Unit – II	**2. Introduction to Data Warehousing** 2.1 Introduction 2.2 Data Warehouse: Basic Concepts 2.2.1 Datawarehouse definition 2.2.2 Comparison of OLTP and OLAP 2.2.3 Datamart 2.2.4 Metadata Repository	**7**

	2.3 Architecture of Data Warehouse 2.4 Data Warehouse Models 2.4.1 Enterprise Warehouse 2.4.2 Data Mart 2.4.3 Virtual Warehouse 2.5 Data Cube and OLAP 2.5.1 Dimension 2.5.2 Fact 2.5.3 Measures 2.5.4 Dimension Table 2.5.5 Fact Table 2.5.6 Data Cube 2.5.7 Cuboid, Apex Cuboid, Base Cuboid 2.5.8 OLAP operations 2.6 Dimensional Data Modeling 2.6.1 Star Schema 2.6.2 Snowflake Schema 2.6.3 Fact Constellation Schema	
Unit – III	**3. Introduction to Data Mining** 3.1 Introduction 3.2 Data Mining : Basic Concepts 3.3 Knowledge Discovery in Databases Process 3.4 Data Mining Tasks 3.4.1 Descriptive 3.4.2 Predictive 3.5 Data Mining Issues 3.6 Data Mining Metrics 3.7 Social Implications of Data Mining 3.8 Applications of Data Mining	**6**
Unit – IV	**4. Data Mining Techniques** 4.1 Introduction 4.2 Frequent item-sets and association rule mining 4.2.1 Itemset 4.2.2 Frequent Pattern 4.2.3 Support 4.2.4 Confidence 4.2.5 Downward-Closure Property 4.2.6 Market Basket Analysis 4.2.7 Horizontal Data format 4.2.8 Vertical Data format 4.2.9 Apriori algorithm 4.3 FP-Tree algorithm 4.4 Graph Mining 4.4.1 Frequent Sub-graph mining 4.4.2 Apriori-based Approach 4.4.3 Pattern growth Approach 4.6 Tree mining	**8**
Unit - V	**5. Classification & Prediction** 5.1 Introduction 5.2 Decision Tree Learning	**12**

	5.2.1 Construction 5.2.2 Basic Decision Tree Algorithm 5.2.3 Performance 5.2.4 Attribute Selection 5.2.5 Issues 5.2.6 Classification and Regression Tree(CART) 5.3 Bayesian Classification 5.3.1 Bays Theorem 5.3.2 Navie Baysian Classfier 5.3.3 Bayesian Network 5.3.4 Inference 5.3.5 Parameter Learning 5.3.6 Structure Learning 5.4 Linear Classification 5.4.1 Least Squares 5.4.2 Perceptron 5.4.3 Support Vector Machine(SVM) 5.5 Prediction 5.5.1 Linear Regression 5.5.2 Nonlinear Regression	
Unit – VI	**6. Accuracy Measures** 6.1 Introduction 6.2 Precision 6.3 Recall 6.4 F-measure 6.5 Confusion Matrix 6.6 Cross Validation 6.7 Bootstrap	**3**
Unit – VII	**7. Clustering** 7.1 Introduction 7.2 K-means 7.3 Expectation Maximization (EM) algorithm 7.4 Hierarchical clustering 7.5 Correlation clustering	**5**
Unit - VIII	**8. Data Mining Trends and Research Frontiers** 8.1 Introduction 8.2 Text mining 8.2.1 Text Mining Approaches 8.2.2 Text Mining Applications 8.3 Web Mining 8.3.1 Web Mining Tasks 8.3.2 Web Mining Applications 8.3.3 Basic introduction of Mining Sequence Data a) Mining of Time-Series Data b) Mining of Symbolic Sequences Data c) Mining of Biological Sequences Data d) Mining of Spatial Data e) Mining of Visual and Audio Data	**6**
Unit – IX	**9. Software for data mining** 9.1 Introduction	**4**

	9.2 The Explorer 9.3 The Knowledge flow interface 9.4 Experimenter 9.5 Command Line Interface 9.6 Decision Tree with the help of weka 9.7 Apriori Algorithm with the help of weka	

References :

1. Data Mining: Concepts and Techniques , Jiawei Han, Micheline Kamber, Jian Pei, Elsevier Morgan Kaumann Publishers.
2. Introduction to data mining : Pang Ning Tan, Michael Steinbach, Vipin Kumar
3. The WEKA Workbench Eibe Frank, Mark A. Hall, and Ian H. Witten Online Appendix for “Data Mining: Practical Machine Learning Tools and Techniques” Morgan Kaufmann, Fourth Edition, 2016
4. [Research-Papers]: Some of the relevant research papers that contain recent results and developments in data mining field

Class : M.Sc. (Computer Science)(Semester – II) Paper Code :COMP4203
Title of Paper : Python Programming Paper: III
Credit : 4 No. of Lectures : 48

Prerequisites:

- To introduce various concepts of programming to the students using Python.
- Students should be able to apply the problem solving skills using Python

Learning Objectives: Student successfully computing this course will be able to understand and gain the knowledge of the subject

Units	Title and Contents	No. of Lectures
Unit -I	**Introduction to Python Scripting** • Why Scripting is Useful in Computational Science • Classification of Programming Languages • Productive Pairs of Programming Languages • Gluing Existing Applications • Scripting Yields Shorter Code, Efficiency • Type-Specification (Declaration) of Variables • Flexible Function Interfaces • Interactive Computing • Creating Code at Run Time • Nested Heterogeneous Data Structures • GUI Programming • Mixed Language Programming • When to Choose a Dynamically Typed Language • Why Python? Script or Program? • Application of Python • Concept (immutable)	**04**
Unit -II	**Basic Python** • Python identifiers and reserved words • Lines and indentation, multi-line statements • Comments • Input/output with print and input functions, • Command line arguments and processing command line arguments • Standard data types - basic, none, Boolean (true & False), numbers • Python strings • Data type conversion • Python basic operators (Arithmetic, comparison, assignment, bitwise logical) • Python membership operators (in & not in) • Python identity operators (is & is not) • Operator precedence • Control Statements, Python loops, Iterating by • subsequence index, loop control statements (break, continue, pass) • Mathematical functions and constants (import math),	**06**

	Random number functions	
Unit – III	**Python strings** • Concept, escape characters • String special operations • String formatting operator • Single quotes, Double quotes, Triple quotes • Raw String, Unicode strings, Built-in String methods. • Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse • Indexing, slicing and Matrices • built-in List functions • Functional programming tools - filter(), map(), and reduce() • Using Lists as stacks and Queues, List comprehensions	**06**
Unit - IV	**Python tuples and sets** • Creating & deleting tuples • Accessing values in a tuple • Updating tuples, delete tuple elements • Basic tuple operations • Indexing, slicing and Matrices, built- in tuple functions. • Sets - Concept, operations.	**06**
Unit – V	**Python Dictionary** • Concept (mutable) • Creating and accessing values in a dictionary • Updating dictionary, delete dictionary elements • Properties of dictionary keys • built-in dictionary functions and methods.	**04**
Unit – VI	**Functions** • Defining a function (def) • Calling a function • Function arguments - Pass by value, Keyword Arguments, default arguments • Scope of variable - basic rules • Documentation Strings • Variable Number of Arguments • Call by Reference • Order of arguments (positional, extra & keyword) • Anonymous functions • Recursion • Treatment of Input and Output Arguments • Unpacking argument lists • Lambda forms • Function Objects • function ducktyping & polymorphism • Generators (functions and expressions) and iterators, list comprehensions	**08**

Unit – VII	**Files and Directories** • Creating files • Operations on files (open, close, read, write) • File object attributes, file positions, Listing Files in a Directory • Testing File Types • Removing Files and Directories • Copying and Renaming Files • Splitting Pathnames • Creating and Moving to Directories • Traversing Directory Trees • Illustrative programs: word count, copy file	**06**
Unit – VIII	**Python Classes / Objects** • Object oriented programming and classes in Python - creating classes, instance objects, accessing members • Data hiding (the double underscore prefix) • Built-in class attributes • Garbage collection : the constructor • Overloading methods and operators • Inheritance - implementing a subclass, overriding methods • Recursive calls to methods • Class variables, class methods, and static methods	**08**
Unit – IX	**Python Exceptions** • Exception handling : assert statement • Except clause - with no exceptions and multiple exceptions • Try - finally, raising exceptions, user-defined exceptions.	**02**

Reference Books:

1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O„Reilly Publication
2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress
3. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014
4. Introduction to Computer Science Using Python- Charles Dierbach, Wiley Publication Learning with Python ", Green Tea Press, 2002
5. E-Books : python_tutorial. pdf, python_book_01.pdf
6. Beginning Programming with Python for Dummies Paperback – 2015 by John Paul Mueller
7. A Beginner‟s Python Tutorial: http://en.wikibooks.org/wiki/A Beginner%27s Python Tutorial.
4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing, by Dan Patterson

Class: M.Sc. (Computer Science)(Semester-II) PAPER CODE: COMP4204
Title of paper: Advanced Operating System PAPER –IV
Credit -4 No. of Lectures 50

Prerequisites:

• Working knowledge of C programming.
• Basic Computer Architecture concepts.
• Basic algorithms and data structure concepts.

Learning Objectives:

Students successfully computing this course will be able to:

- Teaches Advanced Operating Systems Concepts using Unix/Linux and Windows as Representative examples.
- Strikes a delicate balance between theory (covered in TextBook-2,3) and practical applications (covered in TextBook-1, 4).
- In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program.
- Describes the programming interface to the Unix/Linux system - the system call interface.
- It is intended for anyone writing C programs that run under Unix/Linux.it concludes with an overview of Windows Threads Management.
- Finally it includes with an overview of Android Operating System.

Learning Outcome:

This course provides an understanding of the functions of Operating Systems. It also provides an insight into functional modules of Operating Systems.

Unit	Title and Contents	No. of lectures
Unit-1	**Introduction to UNIX/Linux Kernel** • System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System, • Introduction to kernel, Types of kernel (monolithic, micro) • Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication.	**03**
Unit-2	**File and Directory I/O** • Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup ,creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd,stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size,file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files. • Mapping Files into Memory, Advice for Normal File I/O, I/O Schedulers and I/O Performance, Directories, Copying and Moving files.	**13**

Unit-3	**Process Environment, Process Control and Process Relationships** • Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling • Process termination, environment list, memory layout of a C program, shared libraries,environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork,vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs,system function, user identification, process times • The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, Processor Affinity	**13**
Unit 4	**Memory Management** • The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation, Swapping, Demand Paging. • Disk Management- Disk Structure ,Disk Scheduling algorithm, Numerical exercise based on Disk algorithms, Disk management, Swap Space concept and Management, RAID structure, Disk performance issues	**09**
Unit 5	**Signal Handling** • Signal concepts, signal function, unreliable signals, interrupted system calls,SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited,sleep • Basic Signal Management, Sending a Signal, Signal Sets, Blocking Signals, Advanced Signal Management, Sending a Signal with a Payload.	**05**
Unit 6	**Windows Thread Management** • Thread Internals ✓ Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity : Limitations on Protected Process Threads, Worker Factories (Thread Pools) • Thread Scheduling ✓ Overview of Windows Scheduling, Priority Levels, Windows Scheduling APIs, Relevant Tools, Real-Time Priorities, Thread States, Dispatcher Database, Quantum, Scheduling Scenarios, Context Switching,	**03**

Unit 7	**Android Operating System** • Architecture of the Android Operating System:- ✓ The Android Software Stack, The Linux Kernel – its functions, essential hardware drivers. Libraries - Surface Manager, Media framework, SQLite, WebKit, OpenGL. Android Runtime - Dalvik Virtual Machine, Core Java Libraries. Application Framework - Activity Manager, Content Providers, Telephony Manager, Location Manager, Resource Manager. Android Application – Activities and Activity Lifecycle, applications such as SMS client app, Dialer, Web browser, Contact manager	**04**

References:

1.Operating System Concepts, 8th Edition by GREG GAGNE, PETER BAER GALVIN, ABRAHAM SILBERSCHATZ
2. Linux System Programming, O'Reilly, by Robert Love.
3. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Soloman.
4. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
5. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens

Web links:

Kernel:
https://github.com/nu11secur1ty/Kernel-and-Types-of kernels/blob/master/Kernel%20and%20Types%20of%20kernels.md
Android Developers:
https://www.edgefxkits.com/blog/android-operating-system-advantages/
https://developer.android.com/index.html

Class: M.sc.(Computer science) (Semester-II) Paper Code:COMP4205
Title of Paper: Practical On Python Programming & AOS
Paper: V (Lab Course) Credit:4 No.of Practicals:12

Python Assignments	
Assignment 1	Basic python programs
Assignment 2	Strings
Assignment 3	Tuples and sets
Assignment 4	Dictionary
Assignment 5	Functions
Assignment 6	Files and Directories
Assignment 7	Classes/objects
Assignment 8	Exception Handling
AOS Assignments	
Assignment 1	Process management
Assignment 2	Memory Management
Assignment 3	Signal Handling
Assignment 4	Disk Scheduling

Class: M.sc.(Computer science) (Semester-II) Paper Code:COMP4206
Title of Paper: Project Paper: VI (Lab Course)
Credit:4 No.of Practicals:12

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

The format of Progress Report is :

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

Sr. No.	**Date**	**Details of Project Work**	**Project Guide Sign (With Date)**
1			
2			
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Project Guide

Class: M.sc.(Computer science) (Semester-II) Paper Code:COMP4207
Title of Paper: Artificial Intelligence Paper:VI I
Credit:4 No.of lectures:48

Learning Objectives: Student successfully completing this course will be able to

- Understand and gain the knowledge of the subject

Learning Outcome: Concepts of Data structures and Design and Analysis of algorithms

Units	Title and Contents	No. of Lectures
Unit –I	**Introduction** - What is AI -Goals of AI -AI & related fields -AI technique -Introduction to robotics -Robot components (embodiment, sensors, states, action, brains & brawn, autonomy, arms, legs, wheels, tracks) -languages use in robotics. -latest trends (ASIMO,SOPHIA…..)	**8**
Unit –II	**Problem,Problem Spaces & Search** -state space search -production system -search & control strategies -problem characterstics -issues in the design of search program.	**6**
Unit –III	**Heuristics Search Techniques** -Heuristics search technique -Generate and test algorithm -Hill climbing(Simple hill climbing,Steepest hill climbing,Simulated annealing) -Best First Search(A* algorithm) -Problem Reduction(AND-OR-Graphs,AO* algorithm) -Constraint Satisfaction -Mean-Ends Analysis	**8**
Unit - IV	**Knowledge Representation** -Knowledge representation and mapping -Approaches to knowledge representation -Types of knowledge -Propositional Logic -Predicate Logic -CNF -Resolution -Forward & Backward chaining system	**8**
Unit – V	**Slot & Filler Structures** -Introduction ✓ Semantic network ✓ Inference in semantic net ✓ Partitioned semantic net -Frames	**6**

	-CD(conceptual dependency) -Script -CYC(CYC Motivation,CYCL)	
Unit – VI	**Game Playing** -Introduction -Min-Max algorithm -Adding alpha-beta cutoff -Uncertainty Reasoning(Basic probability axioms, Baye's rule,Certainty theory,Bayesian classification,Dempster-Shafer Theory)	**6**
Unit – VII	**Learning** -Introduction -Rote learning -Learning by Taking Advice -Learning in problem solving(Learning by parameter adjustment,Learning by macro operators,Learning by chunking) -Learning from Example-Induction -Winston Learning Program(Version Spaces,Decision trees) -Explanation Based Learning(EBL)(EBL Architecture,EBL System Schematic)	**6**

References:

1. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832

2. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901

3. Artificial Intelligence, Tata McGraw Hill, 2nd Edition, by Elaine Rich and Kevin Knight

4. Introduction to Artificial Intelligence and Expert System, Prentice Hall of India Pvt. Ltd., New Delhi, 1997, 2nd Printing, by Dan Patterson

Class: M.sc.(Computer science) (Semester-II) Paper Code:COMP4208
Title of Paper: Modeling & Simulation Paper: VIII
Credit:4 No.of Lectures:48

Unit	Title and Contents	No. of Lectures
Unit – I	**Simulation Concepts:** Systems, modeling, general system theory, concept of simulation, simulation as a decision making tool, types of simulation.[	**05**
Unit – II	**Random numbers.:** Pseudo random numbers, methods of generating random verities, discrete and continuous distributions, testing of random numbers.	**06**
Unit – III	**Design of simulation experiments:** problem formulation , data collection and reduction, time flow mechanism , key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation	**08**
Unit – IV	**Simulation language:** comparison, and selection of simulation languages, study of any one simulation language	**14**
Unit - V	**Case studies:** Development simulation models using the simulation language studied for systems like queuing systems, production systems , inventory systems	**15**

Reference Books:

1. Jerry Banks and John, S. Carson, " Discrete event system simulstion" PHI

2. Shannon, R.E., "Systems Simulation, The art and science" , PHI