Scheme & Syllabus of

Master of Science in Information Technology

M. Sc. (IT)

Batch 2019 onwards

By

Board of Study Computer Applications

Department of Academics

IK Gujral Punjab Technical University

Master of Science in Information Technology (M. Sc (IT))
It is a Post Graduate Programme of 2 years duration (4 semesters)

Eligibility: All those candidates who have passed any recognized bachelor's degree of minimum three years duration with Mathematics / Statistics / Business Mathematics / Business Statistics / Quantitative Techniques / Computer Science/ Information Technology as compulsory / Optional / additional paper as one of the subjects either at 10+2 or at graduation level. OR PGDCA / BCA / B.Sc. (IT)

or

M.Sc. (IT) (Lateral Entry): It is a Post Graduate Programme of 1 year duration (2 semesters)

Eligibility: All those candidates who have passed PGDCA or equivalent with 50% Marks (45% marks in case of candidate belonging to Reserved Category) in aggregate from a University recognized by UGC.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

PROGRAM OUTCOMES (POs)

1. **Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

2. **Problem Analysis:** Identify, formulate, research literature, and solve computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

3. **Design /Development of Solutions:** Design and evaluate solutions for computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

4. **Conduct investigations of Computing problems:** User research-based knowledge and research methods including design of experiments, analysis and interpretation of data ,and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage:** Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to computing activities, with an understanding of the limitations.

6. **Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

7. **Life-long Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

8. **Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about computingactivitiesbybeingabletocomprehendandwriteeffectivereports, design documentation, make effective presentations, and give and understand clear instructions.

9. **Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

10. **Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

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First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1901	Core Theory	Mathematics	4	0	0	30	70	100	4
PGCA1902	Core Theory	Fundamentals of Computer and Programming in Python	4	0	0	30	70	100	4
PGCA1903	Core Theory	Operating System	4	0	0	30	70	100	4
PGCA1904	Core Theory	Relational Database Management System	4	0	0	30	70	100	4
PGCA1905	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	30	70	100	3
PGCA1906	Core Practical/Laboratory	Fundamentals of Computer and Programming in Python Laboratory	0	0	4	70	30	100	2
PGCA1907	Core Practical/Laboratory	Relational Database Management System Laboratory	0	0	4	70	30	100	2
PGCA1908	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	0	0	2	30	20	50	1
	TOTAL		**19**	**0**	**10**	**320**	**430**	**750**	**24**

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1909	Core Theory	Web Technologies	4	0	0	30	70	100	4
PGCA1910	Core Theory	Computer Networks	4	0	0	30	70	100	4
PGCA1911	Core Theory	Object Oriented Programming using C++	4	0	0	30	70	100	4
PGCA1912	Core Theory	Software Engineering	4	0	0	30	70	100	4
PGCA1913	Core Theory	Data Structures	4	0	0	30	70	100	4
PGCA1914	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	70	30	100	2
PGCA1915	Core Practical/Laboratory	Object Oriented Programming using C++ Laboratory	0	0	4	70	30	100	2
PGCA1916	Core Practical/Laboratory	Data Structures Laboratory	0	0	4	70	30	100	2
	TOTAL		**20**	**0**	**12**	**360**	**440**	**800**	**26**

Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
PGCA1917	Core Theory	Discrete Structures & Optimization	4	0	0	30	70	100	4
PGCA1919	Core Theory	Computer Graphics	4	0	0	30	70	100	4
PGCA1921	Core Theory	E- Commerce & Digital Marketing	4	0	0	30	70	100	4
PGCA1937	Core Theory	Cloud Computing	4	0	0	30	70	100	4
PGCA1923	Core Practical/ Laboratory	Computer Graphics Laboratory	0	0	4	70	30	100	2
PGCA1938	Core Practical/ Laboratory	Cloud Computing Laboratory	0	0	4	70	30	100	2
PGCA1949		Minor Project	0	0	8	140	60	200	4
	TOTAL		**16**	**0**	**16**	**400**	**400**	**800**	**24**

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Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
PGCA1939	Core Theory	Java Technologies	4	0	0	30	70	100	4
	Elective – I		4	0	0	30	70	100	4
	Elective – II		4	0	0	30	70	100	4
PGCA1940	Core Practical/ Laboratory	Java Technologies Laboratory	0	0	4	70	30	100	2
	Elective – II Laboratory		0	0	4	70	30	100	2
PGCA1950		Major Project	0	0	16	280	120	400	8
	TOTAL		**12**	**0**	**24**	**510**	**390**	**900**	**24**

Elective – I	
Course Code	**Course Title**
PGCA1927	Theory of Computation
PGCA1932	Information Security & Cyber Law
PGCA1941	Data Warehousing and Data Mining
PGCA1942	Business Intelligence

Elective – II	
Course Code	**Course Title**
PGCA1926	Artificial Intelligence & Soft Computing
PGCA1943	IoT and Its Applications
PGCA1945	Machine Learning
PGCA1947	Big Data Analytics

Elective – II Laboratory	
Course Code	**Course Title**
PGCA1929	Artificial Intelligence & Soft Computing Laboratory
PGCA1944	IoT and Its Applications Laboratory
PGCA1946	Machine Learning Laboratory
PGCA1948	Big Data Laboratory

Total Credits: 98
Total Marks:3250

Course Code: PGCA1901
Course Name: Mathematics

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Student must have the knowledge of Basic Mathematics.
Co requisite: Students should have the fundamental knowledge of logical decisions.
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course outcomes
CO1	Represent data using various mathematical notions.
CO2	Explain different terms used in Basic Calculations
CO3	Describe various Operations and Formulas used to solve variety of Mathematical Problems.

Detailed contents	Contact hours
Part-A **Number System:** Introduction to (Natural number, Integer Number, Real Number, Rational Number and Irrational number), Sum and Products of Rational numbers, Multiplying & Dividing Powers (Integer Exponents), Powers of Products & Quotients (Integer Exponents), Radicals (Introduction to Square Root, Simplifying Square Root, Introduction to Cube Root, Simplifying Cube Root). **Set:** Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set), Universal Sets, Complement of a Set.	22 hours

Part-B	
Logic Statement: Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions. **Matrices :** Matrices Introduction, Objectives, Meaning, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Triangular Matrix, Null Matrix, Comparable Matrix, Equal Matrix) Algebra of Matrices (Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix).	22 hours

Text Books:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, Mc Graw Hill, 6th Edition.
2. College Mathematics, Schaum's Series, TMH.

Reference Books:

1. Elementary Mathematics, Dr. RD Sharma
2. Comprehensive Mathematics, Parmanand Gupta
3. Elements of Mathematics, ML Bhargava

E Books/ Online learning material

1. www.see.leeds.ac.uk/geo-maths/basic_maths.pdf
2. www.britannica.com/science/matrix-mathematics
3. www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html

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Course Code: PGCA1902
Course Name: Fundamentals of Computer and Programming in Python

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
CO2	Understand an operating system and its working, and solve common problems related to operating systems
CO3	Familiar with Python environment, data types, operators used in Python.
CO5	Compare and contrast Python with other programming languages.
CO6	Learn the use of control structures and numerous native data types with their methods.
CO7	Design user defined functions, modules, and packages.
CO8	Identify and handle the exceptions in programs through appropriate exceptions handling methods

Detailed contents	Contact hours
Part A **Functional Units of Computer System:** Concepts of Hardware and Software; Data and Information, CPU, registers, system bus, main memory unit, cache memory, Motherboard, Ports and Interfaces, expansion cards, memory chips, processors. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter.	22 hours

Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, storage disks. **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) **Concept of Computing:** Types of Languages: Machine, assembly and High level Language; Operating system as user interface, utility programs. **Applications of IT and Impact of Internet on Society** Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Internet of Things (IoT) **Introduction to Python Programming Language:** Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages. **Python Data Types & Input/Output:** Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. **Operators and Expressions:** Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. **Control Structures:** Decision making statements, Python loops, Python control statements. **Python Native Data Types:** Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	**f**
<u>Part-B</u> **Python Functions:** Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.	22 hours

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages. **Exception Handling:** Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. **File Management in Python:** Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. **Classes and Objects:** The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.	

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Fundamentals of Computers, P. K.Sinha & P. Sinha, BPB Publishers.
3. Computer Fundamentals, A. Goel, 2010, Pearson Education.
4. Programming in Python, Pooja Sharma, BPB Publications, 2017.
5. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.
6. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Reference Books:

1. "Introduction to Computers", Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. "Computers", Larry long & Nancy long, Prentice Hall.
4. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.

E Books/ Online learning material:

1. www.sakshat.ac.in
2. https://swayam.gov.in/course/4067-computer-fundamentals

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Course Code: PGCA1903
Course Name: Operating System

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** core

Prerequisite: Basic understanding of computer system.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	Identify the role of different components of operating systems.
CO2	Implement various strategies for task management in operating systems.
CO3	Explain various implementation issues in operating systems.
CO4	Discuss how various resource managements are implemented in operating systems.

Detailed contents	Contact hours
Part-A	22 hours
Fundamentals of Operating system: What is Operating system? Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. **Process management**: Definition of process, process states, Process Control Block, Scheduling Queues, Schedulers, context switch. **Inter Process Communication:** Communication/message passing mechanisms, threading, multithreading models, multicore programming, Fundamental concepts of OpenMP. **Process Synchronization**: Cooperating process, critical section problem, mutex locks, semaphores, deadlock and starvation, bounded buffer problem, reader-writer problem. **CPU scheduling**: Basic concepts, Scheduling criteria, single processor scheduling, multiprocessor scheduling, real time scheduling, Algorithm Evaluation. **Deadlock**: Definition, necessary conditions, Resource Allocation Graph, Prevention, Avoidance, Detection and Recovery.	

Part-B **Memory Management**: Address binding, Dynamic linking and loading, Contiguous memory allocation techniques (fixed and variable sized partitions), Fragmentation and its types, Non-Contiguous memory allocation techniques, Paging, Segmentation, paging with segmentation, Need of Virtual memories, Demand paging, performance measuring of demand paging, Page replacement Algorithms, allocation of frames, Concept of Thrashing **Device Management**: Secondary storage structure, disk scheduling, Disk management, RAID structure, Role of I/O traffic controller, scheduler. **File Management**: File concepts, access methods, directory and disk structure, file system structure, file system and directory implementation, Protection and Security.	22 hours

Case Studies:
LINUX Operating System and Windows Operating System.
*** These cases studies can be taken as part of tutorial and assignment work. Case studies will not be considered while setting up the end semester examination.**

Text Books:

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.
2. Operating Systems by Stuart E. Madnick, John J. Donovan, Published by Mac-Graw-Hill.

Reference Books:

1. Principals of Operating System by Naresh Chauhan, Published by OXFORD University Press, India.
2. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.

3. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)

Course Code: PGCA1904
Course Name: Relational Database Management System

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand the basic concepts of RDBMS.
CO2	Formulate, using SQL, solutions to a broad range of query and data update problems.
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4	Apply the concept of Transaction Management in RDBMS.

Detailed contents	Contact hours
Part A **Introduction:** Purpose of Database Systems, Database-System Applications, Database Management System (DBMS) Fundamentals (View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database Users and Administrators), Relational Database Management System (RDBMS) Fundamentals (Structure of Relational Databases, Database Schema, Keys, Relational Query Languages, Relational Operations). **SQL:** Types of SQL (DCL- DDL- DML)- SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the	22 hours

Database, Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization, Accessing SQL From a Programming Language, Functions and Procedures, Triggers, Introduction to Database Application Development (Embedded SQL, Dynamic SQL, JDBC, SQLJ).	
Part B **Database Design:** The Entity-Relationship Model, Entity-Relationship Diagrams, Features of Good Relational Designs, Atomic Domains and First Normal Form, Functional-Dependency and Second Normal Form, Transitive Dependency and Third Normal Form, Boyce–Codd normal form (BCNF), Multivalued Dependency and Fourth Normal Form, join dependency and Fifth normal form (5NF), Domain-key normal form (DKNF). **Transaction Management:** Query Processing, Concurrency Control, Database Security, Database Recovery.	22 hours

Text Books:

1. Database System Concept, Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition, 2013, McGraw-Hill

Reference Books:

1. An Introduction to Database System, Bipin C. Desai, Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi;
2. Database Management Systems, Raghu Ramakrishnan, Third Edition, 2014, McGraw-Hill;
3. SQL, PL/SQL The Programming Language of Oracle, Ivan Bayross, 4th Revised Edition,2009, BPB Publications;
4. An Introduction to Database Systems, C.J.Date, A.Kannan, S.Swamynathan, 8th Edition, 2006, Pearson Education.

Course Code: PGCA1905
Course Name: Technical Communication

Program: M.Sc.(IT)	**L:** 3 **T:** 0 **P:** 0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.
CO3	Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.
CO4	They will be able to converse fluently.
CO5	They will be able to produce on their own clear and coherent texts.

Detailed contents	Contact hours
Part A **Basics of Technical Communication:** Functions of Communication- Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7C's and other principles), Non-verbal Communication. **Basic Technical Writing:** Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters– Format &various types.	17 Hours
Part B **Advanced Technical Writing:** Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical	16 Hours

Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography. **Verbal Communication:** Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. **Technical Communication:** MS-Word, Adobe Frame maker and ROBO Help * Lab Exercises based on Listening and Speaking skills	

Text Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi.
2. K K Ramchandran, et al Business Communication, Macmillan, New Delhi.
3. Swati Samantaray, Business Commnication and Commnicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD).

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Course Code: PGCA1906
Course Name: Fundamentals of Computer and Programming in Python Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours**: 4 hours per week
Internal max. marks: 70	**Theory/Practical**: Practical
External max. marks: 30	**Duration of end semester exam (ESE)**: 3hrs
Total marks: 100	**Elective Status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - Maintain practical note book as per the instructions given by the instructor.

Course Outcomes:

CO#	Course outcomes
CO1	Solve simple to advanced problems using Python language.
CO2	Develop logic of various programming problems using numerous data types and control structures of Python.
CO3	Implement different data structures using Python.
CO4	Implement modules and functions using Python.
CO5	Design and implement the concept of object oriented programming structures.
CO6	Implement file handling

Instructions: All programs are to be developed in *Python* programming language.

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.

12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x-x^2/2!+x^3/3!-x^4/4!+\ldots x^n/n!$ b. $x-x^3/3!+x^5/5!-x^7/7!+\ldots x^n/n!$
14.	Print all possible combinations of 4, 5, and 6.
15.	Determine prime numbers within a specific range.
16.	Count number of persons of age above 60 and below 90.
17.	Compute transpose of a matrix.
18.	Perform following operations on two matrices. 1) Addition 2) Subtraction 3) Multiplication
19.	Count occurrence of vowels.
20.	Count total number of vowels in a word.
21.	Determine whether a string is palindrome or not.
22.	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23.	Display word after Sorting in alphabetical order.
24.	Perform sequential search on a list of given numbers.
25.	Perform sequential search on ordered list of given numbers.
26.	Maintain practical note book as per their serial numbers in library using Python dictionary.
27.	Perform following operations on dictionary 1) Insert 2) delete 3) change
28.	Check whether a number is in a given range using functions.
29.	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.
30.	To find the Max of three numbers using functions.
31.	Multiply all the numbers in a list using functions.
32.	Solve the Fibonacci sequence using recursion.
33.	Get the factorial of a non-negative integer using recursion.
34.	Write a program to create a module of factorial in Python.
35.	Design a Python class named *Rectangle*, constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named *Circle* constructed by a radius and two methods which will compute the area and the perimeter of a circle.
37.	Design a Python class to reverse a string 'word by word'.
38.	Write a Python program to read an entire *text file*.
39.	Design a Python program to read first n lines of a *text file.*
40.	Construct a Python program to write and append text to a file and display the text.

Text Books:

1. Core Python Programming, R. Nageswara Rao, 2nd Ediiton, Dreamtech.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Reference Books:

Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.

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Course Code: PGCA1907
Course Name: Relational Database Management System Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical:** Practical
External max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Out comes:

CO#	Course outcomes
CO1	Able to understand various queries and their execution
CO2	Populate and query a database using SQL DML/DDL commands.
CO3	Declare and enforce integrity constraints on a database
CO4	Programming PL/SQL including stored procedures, stored functions, cursors
CO5	Able to design new database and modify existing ones for new applications and reason about the efficiency of the result

Assignments:

1.	Implementation of DDL Commands to perform creation of table, alter, modify and drop column operations.
2.	Implementation of Constraint • Check Constraint • Entity Integrity Constraint • Referential Integrity Constraint • Unique Constraint • Null Value Constraint
3.	Implementation of DML and DCL Commands.
4.	Implementation of Data and Built in Functions in SQL.
5.	Implementation of Nested Queries and Join Queries.
6.	Implementation of Cursors.
7.	Implementation of Procedures and Functions.
8.	Implementation of Triggers.
9.	Implementation of Embedded SQL.
10.	Database design using E-R model and Normalization:

	• Pay Roll System • Banking System • Library Management System
11.	For the following University Database applications, Design and Develop Conceptual Data Model (E-R Diagram) with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints. *University Database* - The IKGPTU is a University with several campuses scattered across Punjab. Academically, the university is divided into a number of Departments, such as Department of CSE, Department of Architecture, Department of Management etc. Some of the Departments operate on a number of campuses. Each Department is headed by a Head and has a number of teaching and non-teaching staff. Each Department offers many courses. Each course consists of a fixed core of subjects and a number of electives from other courses. Each student in the University is enrolled in a single course of study. A subject is taught to the students who have registered for that subject by a teacher. A student is awarded a grade in each subject taken.

Reference Books:

1. SQL, PL/SQL The Programming Language of Oracle, Ivan Bayross, 4th Revised Edition, 2009, BPB Publications;
2. Oracle PL/SQL Programming, Steven Feuerstein and Bill Pribyl, 5th Edition, 2009, O'Reilly Media;
3. Database System Concept, Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition, 2013, McGraw-Hill.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1908
Course Name: Technical Communication Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 2 hours per week
Internal max. marks: 30	**Theory/Practical:** Practical
External max. marks: 20	**Duration of end semester exam (ESE):** 3hrs
Total marks: 50	**Elective status:** Ability Enhancement

Prerequisite: --
Co requisite: --
Additional material required in ESE: --

Course Outcomes:

CO#	Course outcomes
CO1	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in listening and speaking skills.
CO3	Students will be able to understand spoken English language, particularly the language of their chosen technical field.
CO4	They will be able to converse fluently
CO5	They will be able to produce on their own clear and coherent texts.

Assignments:

Interactive practice sessions in Language Lab on Oral Communication	
1.	Listening Comprehension
2.	Self-Introduction, Group Discussion and Role Play
3.	Common Everyday Situations: Conversations and Dialogues
4.	Communication at Workplace
5.	Interviews
6.	Formal Presentations

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1909
Course Name: Web Technologies

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Student must have the basic knowledge of any text editor like Notepad, Notepad++ and Edit plus etc.
Co requisite: Student must know the background of Markup Language.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the basics of Internet and Web Services.
CO2	Describe and differentiate Programming Language and Markup Language.
CO3	Connect various web pages and web sites together.
CO4	Capture user input from the remote users.
CO5	Learn connectivity concepts of Front End and Back End.

Detailed Contents	Contact hours
Part-A **Internet Basics:** Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, How IP addressing came into existence? A brief overview TCP/IP and its services, transmission control protocol. **Introduction To HTML:** Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags), Commonly Used HTML Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines).	24 hours

Basic Formatting Tags: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. **Basic Formatting Tags**: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. Lists **Type of Lists** (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. **Adding Graphics To HTML Documents:** Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. **Tables:** Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes Tag.	
Part-B **Linking Documents:** Links (External Document References, Internal Document References), Image As Hyperlinks. **Frames:** Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style **Introduction to JavaScript:** Introduction to JavaScript: JavaScript in Web Pages (Netscape and JavaScript, Database Connectivity, Client side JavaScript, Capturing User Input); The Advantages of JavaScript (an Interpreted Language, Embedded within HTML, Minimal Syntax -Easy to Learn, Quick Development, Designed for Simple, Small Programs, Performance, Procedural Capabilities, Designed for Programming User Events, Easy Debugging and Testing, Platform Independence/Architecture Neutral); Writing JavaScript into HTML.	20 hours

Forms Used by a Web Site: The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element) Other Built-In Objects in JavaScript (The String Object, The Math Object, The Date Object), User Defined Objects (Creating a User Defined Object, Instances, Objects within Objects).	

Text Books:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. RajKamal, "Internet& Web Technologies",edition Tata McGraw-Hill Education.2009.
4. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
5. A Beginner's Guide to Html Http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/html/html_tutorial.pdf
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/html/
4. https://www.cs.uct.ac.za/mit_notes/web_programming.html
5. http://www.pagetutor.com/table_tutor/index.html

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1910
Course Name: Computer Networks

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Familiar with the different Network Models.
CO2	Understand different protocols working at Medium Access Sublayer.
CO3	Learn the concept of network routing through algorithms.
CO4	Learn and understand Internet protocols and network security.

Detailed contents	Contact hours
Part A **Computer Networks**: Uses of computer Networks, Goals and applications of networks, Computer Network Structure and Architecture, Reference models: OSI model, TCP/IP model, Comparison of TCP/IP and OSI models. **Medium Access Sublayer:** Static and dynamic channel allocation for LAN and MAN ALOHA Protocols, LAN Protocols: CSMA, CSMA/CD, Collision Free protocol **Networking and Internetworking devices:** Repeater, bridges, routers, gateways, switches.	22 Hours
Part B **High speed LAN:** FDDI, Fast Ethernet, HIPPI, Fiber channel. LAN IEEE 802.x standards. **Routing:** Static vs. Dynamic Routing, various Routing Algorithms. Congestion Control: Causes of Congestion, Various Congestion Control Strategies and Algorithms	22 Hours

Internet protocols: Principles of Internetworking, connectionless internetworking, Internet protocols, IPv6. **Network Security:** Security requirements and attacks, Encryption Public key encryption and digital Signatures. distributed applications: SNMP, SMTP, HTTP.	

Text Books:

1. A.S. Tannenbaum, “Computer Networks", 3rd Edition, Prentice Hall, 1999.
2. Data Communications & Networking by Forouzan, Tata McGraw Hills.

Reference Books:

1. D.E. Cormer," Computer Networks and Internet”, 2nd Edition, Addison Wesley Publication, 2000.
2. D. Bertsekas and R.Gallagar, “Data Networks”, 2nd Edition, Prentice-Hall, 1992.
3. Stevens W.R.," UNIX Network Programming," Prentice Hall, 1990.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1911
Course Name: Object Oriented Programming using C++

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand Object oriented approach for finding solutions to various problems with the help of C++ language.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	Create computer based solutions to various real-world problems using C++

Detailed contents	Contact hours
Part A **Fundamentals of Object Oriented Programming:** Introduction to Object Oriented Programming (OOP) and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure oriented Language (C) and Object Oriented Language. **Fundamentals of C/C++:** I/O statements, Assignment Statements, Constants, Variables, Operators and Expressions, Standards and Formatted statements, Keywords, Data Types and Identifiers. **Control Structures:** Introduction, Decision making with if – statement, if – else and Nested if, while and do-while, for loop. Jump statements: break, continue, switch Statement. **Arrays:** Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings and String handling functions. Structures and Union.	22 hours

Part B **Classes & Objects:** Classes & Functions, Scope Resolution Operator, Private, Protected and Public Member Functions, Nesting of Member Functions. Creating Objects, accessing class data members, Accessing member functions. **Concept of Constructors:** Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors. **Inheritance:** Constructors/ destructors under inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance and Hybrid inheritance. **Operator Overloading:** Function, Unary and Binary operators. Binding, Friend and Virtual Functions. **Introduction to file handling:** Opening and Closing files, Various modes, Various methods on files.	22 hours

Text Books:

1. Object Oriented Programming with C++, E. Balaguruswami, Fourth Edition, Tata Mc-Graw Hill
2. Programming using C++, D. Ravichandran, Tata Mc-Graw Hill
3. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing

Reference Books:

1. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia Publications.
2. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.

E Books/ Online learning material:

1. www.sakshat.ac.in

Course Code: PGCA1912
Course Name: Software Engineering

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Aware about the engineering approach to analysis, design and built the software
CO2	Understand the phases and activities involved in the software life cycle models
CO3	Analyse problems, and identify and define the computing requirements appropriate to its solution.
CO4	Apply design and development principles in the construction of software systems of varying complexity
CO5	Apply current techniques, skills, and tools necessary for computing practice.
CO 6	Apply various testing techniques to test a software
CO7	Measure various characteristics of software.
CO8	Compare and choose between maintenance and reengineering of software, when there is requirement to make changes in the software.

Detailed contents	Contact hours
Part A Introduction to the Discipline, The Software Process, Software Engineering Practice, Software Development Myths. Prescriptive Process Models (The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models), Specialized Process Models (Component-Based Development, The Formal Methods Model, Aspect-Oriented Software Development), The Unified Process, Phases of the Unified Process, Personal and Team Process Models (Personal Software Process, Team Software Process).	22 hours

Requirements Engineering, Understanding of Software Requirements, Building the Analysis Model, The Design Process, Design Concepts, The Design Model (Data Design Elements, Architectural Design Elements, Interface Design Elements, Component-Level Design Elements, Deployment-Level Design Elements).	
Part B Approach to Software Testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging, Software Testing Fundamentals, White-Box Testing, Basis Path Testing, Control Structure Testing, Black-Box Testing. A Framework for Product Metrics, Metrics for the Requirements Model, Metrics for the Design Model, Metrics in the Process and Project Domains, Software Measurement. Software Maintenance, Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, The Economics of Reengineering.	22 hours

Text Books:

1. Software Engineering–A Practitioner's Approach, Roger S. Pressman and Bruce R. Maxim, Eighth Edition, 2015, McGrawHill.

Reference Books:

1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, 2005, Narosa Publishing House;
2. Software Engineering, Ian Sommerville, Ninth Edition, 2011, Addison-Wesley.

Course Code: PGCA1913
Course Name: Data Structures

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks:70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Student will be able to

CO#	Course outcomes
CO1	Choose appropriate data structure as applied to specified problem definition.
CO2	Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
CO3	Apply concepts learned in various domains like DBMS, compiler construction, computer graphics etc.
CO4	Use linear and non-linear data structures like stacks, queues , linked list etc.
CO5	Develop his/her logics and programming skills

Detailed contents	**Contact hours**
Part-A **Stack and Queue:** contiguous implementations of stack, various operations on stack, various polish notations-infix, prefix, postfix, conversion from one to another-using stack; evaluation of post and prefix expressions. Contiguous implementation of queue: Linear queue, its drawback; circular queue; various operations on queue; linked implementation of stack and queue- operations **General List and Trees:** list and it's contiguous implementation, it's drawback; singly linked list-operations on it; doubly linked list-operations on it; circular linked list; linked list using arrays. Tree definitions-height, depth, order, degree, parent and child relationship etc; Binary Trees- various theorems, complete binary tree, almost complete binary tree; Tree traversals-preorder, in order and post order traversals, their recursive and non recursive implementations; expression tree- evaluation; linked representation of binary tree-operations. Threaded binary trees; forests, conversion of forest into tree. Heap-definition.	24 hours

Part-B	20 hours
Searching, Hashing and Sorting: requirements of a search algorithm; sequential search, binary search, indexed sequential search, interpolation search; hashing-basics, methods, collision, resolution of collision, chaining; Internal sorting- Bubble sort, selection sort, insertion sort, quick sort, merge sort on linked and contiguous list, shell sort, heap sort, tree sort. **Graphs: related definitions:** graph representations- adjacency matrix, adjacency lists, adjacency multilist; traversal schemes- depth first search, breadth first search; Minimum spanning tree; shortest path algorithm; kruskals & dijkstras algorithm.	

Text Books

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Data Structures, Schaum Series, TMH.
3. Kruse R.L. Data Structures and Program Design in C; PHI
4. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", AddisonWesley

Reference Books:

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.
2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

Course Code: PGCA1914
Course Name: Web Technologies Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical**: Practical
External max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.
Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand Static and Dynamic concepts of web designing.
CO2	Develop ability to retrieve data from a database and present it online.
CO3	Design web pages that apply various dynamic effects on the web site.
CO4	Solve complex and large problems using Scripting Language & Markup Language.

Instructions: Instructor can increase/decrease the experiments as per the requirement.
Assignments:

1.	Design index page of a book Titled Web Designing.
2.	Create a simple HTML page to demonstrate the use of different tags.
3.	Display Letter Head of your college on a web page & it must be scrolling Right to Left.
4.	Create a link to move within a single page rather than to load another page.
5.	Display “Name of University” using different Text formatting Tags.
6.	Design Time Table of your department and highlight most important periods.
7.	Use Tables to provide layout to your web page.
8.	Embed Audio and Video into your web page.
9.	Divide a web page vertically and display logo of your college in left pane and logo of university in right pane.

10.	Create Bio- Data of an employee.
11.	Design front page of a hospital with different styles.
12.	Design a web page and display horizontally two different web pages at a time.
13.	Write a program to create a login form. On clicking the submit button, the user should get navigated to a profile page.
14.	Write a HTML code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials.
15.	Write a HTML code to create website in your college or department and create link for Tutorial of specific subject.
16.	Write a program to perform following operations on two numbers input by the user: Addition 2) Subtraction 3) Multiplication 4) Division.
17.	Design a program to solve quadratic equations.
18.	Write a program to determine greatest number of three numbers.
19.	Write a script to compute, the Average and Grade of students marks.
20.	Design a scientific calculator and make event for each button using scripting language.
21.	Write a script to check whether a number is even or odd?
22.	Write a program to show whether a number is prime or not?
23.	Write a program to show multiplication table of any number.
24.	Write a program to find the factorial of any number.
25.	Write a program to show Fibonacci Series between 0 to 74.

Reference Books:

1. Greenlaw R; Hepp E, “Fundamentals of Internet and www”, 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner’s Guide to HTML Http://www.Ncsa.Nine.Edit/General/Internet/www/ html.prmter.

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1915
Course Name: Object Oriented Programming using C++ Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical:** Practical
External max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

Assignments:

Note: The instructor needs to give an overview of Editor for C++. **Write programs in C++**	
1.	To display input values using cin and cout statement with formatting.
2.	To display prime, even and odd numbers
3.	To display Fibonacci Series of 'n' numbers.
4.	To input marks and display result using nested if statement.
5.	to find the factorial of a number using interactions and recursion.
6.	To display days of week using SWITCH statement.
7.	To find largest and smallest number from three elements.
8.	To display the address and the content of a pointer variable.
9.	Using reference variables as arguments to swap the values of pair of integers.
10.	To add all ODD numbers between 10 to 100 and divisible by given number 'n'.
11.	To find number is palindrome.
Write programs in C++ using Strings	
12.	To sort the names in ascending order
13.	To copy the contents of one string to another string.
Write programs in C++ using array	
14.	To sort the elements (integers) in ascending order

15.	To sort the Names of Students in descending order
16.	To display the contents of a two dimensional array using pointer arithmetic.
Write programs in C++ using Class	
17.	to perform simple arithmetic operations using class.
18.	to assign value to the members of a class objects using a pointer structure operator (->).
Write programs in C++ using Functions	
19.	to show the use of friend function.
20.	to show the use of copy constructor.
21.	to show the use of function overloading.
22.	to show the use of abstract classes.
23.	to show the use of virtual function.
Write programs in C++ using Inheritance	
24.	to implement the concept of Single inheritance.
25.	to implement the concept of multilevel inheritance.
Write programs in C++ using Polymorphism and File handling	
26.	to show concept of unary operator overloading.
27.	to show concept of Binary operator overloading.
28.	to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.
Write programs in C++ using Files	
29.	to convert a lower case character to an upper case character of a text file.
30.	to copy the contents of a file into another.

Reference Books:

1. IT Tools, R.K. Jain, Khanna Publishing House
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning C++

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1916
Course Name: Data Structures Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical:** Practical
External max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -na-

Course Outcomes:

CO#	Course outcomes
CO1	Student will be able to apply appropriate constructs of Programming language, coding standards for application development
CO2	Students will be able to programming skills for solving problems.
CO3	Select appropriate searching and/or sorting techniques for application development.
CO4	Students will be able to learn graphs and its techniques.

Instructions: Programs may be developed in C/C++/JAVA/PYTHON.

1	Write an algorithm and program to search an element using linear search.
2	Write a program to implement Binary search tree.
3	Write Quick Short algorithm and program in language C.
4	Implement the Polynomial representation using Array.
5	Create a program to sort it in ascending order using heap sort (Min Heap and Max Heap both). Given an array of 6 elements: 15 | 19 | 10 | 7 | 17 | 16
6	Write programs for finding the element in the array using the binary search method using iteration and recursion concepts.
7	Write a program to create a link list and perform operation such as insert, delete, update and reverse.
8	Write a program to insert value in a Linear Array at Specified Position.
9	Write a program to swap two number using calls by value and call by reference.
10	Write a C program to simulate the working of a circular queue of integers using an array. Provide the following operations, Insert, Delete.
11	Write a program to sort elements using Merge Sort method.

12	Write a program to design a priority queue which is maintained as a set of queues (maximum of three queues). The elements are inserted based upon the given priority; the deletion of an element is to be done starting from the first queue, if it is not empty. If it is empty then second queue will be deleted and so on.
13	Write a program to support the following operations on doubly link list where each node consists of integers.
14	Write a program to construct a stack of integers and to perform the following options on it PUSH POP The program should print appropriate messages for stack overflow, stack underflow and stack empty.
15	Write a program to find shortest path using Dijkstra's Algorithm
16	Write a C program using dynamic variables and pointers to construct a queue of integers using singly link list and perform the following operations. Insert Delete
17	The program should print appropriate messages for queue full and queue empty conditions
18	Write a program to arrange words in dictionary order using Binary Search Tree (In order Traversal) and implement binary search tree for word representation and make in order traversal for sorting in dictionary order
19	Write a program to implement Breadth First Search and Depth First Search Algorithm.
20	Write a program to implement any one hashing techniques in c and also measure its complexity.

Reference Books:

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", AddisonWesley
3. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

Course Code: PGCA1917
Course Name: Discrete Structures & Optimization

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic Mathematical Knowledge
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion
CO2	Apply rules of inference, proof by contradiction, proof by cases, and write proofs using symbolic logic and Boolean Algebra
CO3	Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle.
CO4	Determine if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

Detailed contents	Contact hours
Part A **Sets, relations, and functions:** Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations. **Rings and Boolean algebra:** Rings, Subrings, Morphism of rings ideals and quotient rings. Euclidean domains, Integral domains and fields, Boolean Algebra, Direct product morphisms, Boolean sub-algebra, Boolean Rings, Application of Boolean algebra (Logic Implications, Logic Gates, Karnaugh map)	24 Hours

Combinatorial Mathematics: Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application	
Part B **Monoids and Groups:** Groups, Semigroups and monoids, Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups. **Graph Theory:** Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications.	20 Hours

Text Books:

1. Discrete Mathematics (Schaum series), Lipschutz (McGraw Hill).
2. Applied Discrete Structures for Computer Science, Alan Doerr and Kenneth Levarseur (Creative Commons) 2012.

Reference Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen.(McGraw Hill)
2. Discrete Mathematics and Graph Theory, Sartha, (Cengage Learning)
3. Elements of discrete mathematics. C L Liu (McGraw Hill)

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1919
Course Name: Computer Graphics

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the working of various display devices.
CO2	Familiarize themselves with the working of algorithms using 2-D & 3-D transformations.
CO3	Understand the concept of shading algorithms.

Detailed contents	Contact hours
Part A **Introduction:** Overview of Computer Graphics, Computer Graphics applications, Different I/O devices with specialized graphics features, **Display technologies**- Storage Tube graphic displays, Raster Scan Systems, Random Scan Systems, LCD and LED displays, Cathode ray tube, Color CRT, Video basics – Video controller, Random-scan display processor. Color Models (RGB and CMY), color lookup Table. **2D Primitives:** Scan conversion basics, Algorithm for scan converting a point, Scan converting a line – Direct Method, Digital differential Analyser Algorithm, Bresenham's Line algorithm with derivation, Scan converting Circle – Bresenham's circle drawing algorithm with derivation, Midpoint circle drawing algorithm with derivation, Scan converting Ellipse with derivation. **2D Viewing**: Window to viewport transformations, 2D transformations– Scaling, Translation, Rotation, Reflection, Shear, Matrix representations and homogeneous coordinates, Composite transformations.	22 Hours

Part B	22 Hours
Clipping and Filling Techniques: Algorithm for point clipping, Line clipping (Cohen Sutherland, Liang Barsky algorithms), Polygon clipping, Text clipping. Boundary fill, Floodfill algorithms. **3D Concepts and Object Representation:** Representation of 3D transformations, 3D viewing, Viewing pipeline, Viewing coordinates, Parallel and perspective transformations with their classifications. **Visible-Surface Determination**: Techniques for efficient visible-surface algorithms, Categories of algorithms, Back face removal, The z-Buffer algorithm, Scan-line method, Painter's algorithms (depth sorting), Area sub-division method. **Rendering Methods**: Light sources, Illumination and shading models for polygons, Ray tracing, Reflectance properties of surfaces, Types of reflections- Ambient, Specular and Diffuse reflections, Phong's model, Gouraud shading.	

Text Books:

1. D. Hearn and M.P. Baker, "Computer Graphics", PHI/Pearson Education.
2. Zhigand Xiang, Roy Plastock, **"**Computer Graphics", Tata Mc-Graw Hill.

Reference Books:

1. C. Foley, VanDam, Feiner and Hughes, "Computer Graphics Principles & Practice", Pearson Education.
2. Amarendra N Sinha, Arun D Udai, "Computer Graphics", Tata Mc-Graw Hill.
3. Rogers, Adams, "Mathematics Elements for Computer Graphics", Tata Mc-Graw Hill.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1921
Course Name: E-Commerce & Digital Marketing

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand various applications and scope of ecommerce.
CO2	Acquire knowledge of various payment modes used in ecommerce today.
CO3	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan
CO4	Describe how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy, Developing effective digital and social media strategies
CO5	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media

Detailed contents	Contact hours
Part A Introduction to Electronic Commerce: Technical Components of E-commerce, E-Commerce Framework, E-Commerce Applications and Electronic Business. Internet Service provider and World wide web. Architectural Framework for Electronic Commerce, WWW as the Architecture and Hypertext publishing. Electronic payment System : Types and Traditional payment, Value exchange system, Electronic funds transfer, Digital Token Based Electronic Payment System, Smart Cards – Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems. Electronic Data Interchange : Concepts and applications of EDI and Limitation. EDI and Electronic Commerce standardization and EDI – EDI	22 Hours

Software Implementation. EDI Applications in Business – EDI: Legal, Security and Privacy issues. E- Governance for India : Indian customer EDI system and Service centres.	
Part B Introduction to Digital Marketing : Components of Online Marketing (Email, Forum, Social network, Banner, Blog) , Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing, Online Advertising, Mobile Marketing, Web analytics and Email Marketing. Search Engine Optimization (SEO) and Social Engine Marketing (SEM).: Importance of Internet and Search Engine and Role of Keywords in SEO, On-Page Optimization (Onsite) and Off Page Optimization. Introduction to Social Media Marketing (SMM). Website Planning & Creation : Content Marketing Strategy, Keywords Research and Analysis, Web Presence and Creating content. Successful content marketing strategies and case studies.	22 Hours

Text Books:

1. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
2. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
3. Damian Ryan, Calvin Jone. Kogan Page; "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation".

Reference Books:

1. Seema Gupta, Digital Marketing, McGraw Hill
2. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.
4. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
5. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1937
Course Name: Cloud Computing

Program: M.Sc.(IT)	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 30	**Duration of end semester exam (ESE):**
External max. marks: 70	**Elective status:** Core
Total marks:100	

Prerequisite:
Co requisite:
Additional material required in ESE:
Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Understand the basic concept and importance of cloud computing.
CO2	Access the suitability of migrating to a cloud solution for different applications.
CO3	Compare and evaluate the virtualization technologies.
CO4	Monitor and manage the cloud resources, applications and data while addressing the security concerns.
CO5	Use cloud solutions offered by industry leaders for various applications.

Detailed contents	Contact hours
Part A **Overview of Computing Paradigm:** Recent trends in Computing -Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. **Introduction to Cloud Computing:** Vision of Cloud Computing, Defining a Cloud, Cloud Reference Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing. **Migrating into a Cloud:** Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud. **Virtualization:** Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of	22 hours

Virtualization, Technology Examples- Xen, VMware, Microsoft Hyper-V. **Capacity Planning:** Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	
Part B **SLA Management in Cloud Computing:** Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management. **Securing Cloud services:** Cloud Security, Securing Data-Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. **Cloud Storage:** Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management, **Advance Topics in Cloud:** Energy Efficiency in cloud, Market Oriented Cloud Computing, Federated Cloud Computing, Mobile Cloud Computing, Fog computing, BigData Analytics, Basics of IoT. **Cloud Platforms in Industry:** Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	22 hours

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India,Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3,New Delhi, India, 2011**.**
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6,New Delhi, India, 2011

Reference Books:

1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

E Books/ Online learning material:

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in:Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P.Mell and T. Grance, "The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

Course Code: PGCA1923

Course Name: Computer Graphics Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand & visualize the working of algorithms behind display of 2-D & 3-D objects.
CO2	Design structured, well-commented, understandable programs and implement algorithms in any programming language.
CO3	Possess the skills to test and debug programs in the laboratory.

S.No.	Name of Experiment
1.	Write a program to plot a pixel on the screen in a particular color.
2.	Write a program for creating a simple two-dimensional shape of any object using lines, circle, etc.
3.	Using different graphics functions available for text formatting, write a program for displaying text in different sizes, different colors, font styles.
4.	Implement the DDA algorithm for drawing line (programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants)

5.	Write a program to input the line coordinates from the user to generate a line using Bresenham's method and DDA algorithm. Compare the lines for their values on the plotted line.
6.	Write a program to generate a complete moving wheel using Midpoint circle drawing algorithm and DDA line drawing algorithm.
7.	Write a program to draw an ellipse using the Midpoint ellipse generation algorithm for both the regions.
8.	Write a program to draw any 2-D object and perform the transformations on it according to the input parameters from the user, namely: Translation, Rotation or Scaling**.**
9.	Write a program to rotate a triangle about any one of its end coordinates.
10.	Write program to draw a house like figure and perform the following operations. a. Scaling about the origin followed by translation. b. Scaling with reference to an arbitrary point.
11.	Write a program for filling a given rectangle with some particular color using boundary fill algorithm.
12.	Write a program for filling a polygon using Scan line Polygon fill algorithm.
13.	Write a program to perform clipping on a line against the clip window using any line clipping algorithm. The output must be twofold showing the before clipping and after clipping images.
14.	Write a program to implement the Sutherland Hodgeman Polygon Clipping algorithm for clipping any polygon.

Text Books:

1. Zhigang Xiang, Roy A. Plastock, "Schaum's Outline of Computer Graphics 2/E", 2nd Edition, Tata Mc-Graw Hill
2. Yashavant Kanetkar, "Graphics under C", BPB Publications.

Reference Books:

1. C. Foley, VanDam, Feiner and Hughes, "Computer Graphics Principles & Practice", Pearson Education.
2. Amarendra N Sinha, Arun D Udai, "Computer Graphics", Tata Mc-Graw Hill.
3. Rogers, Adams, "Mathematics Elements for Computer Graphics", Tata Mc-Graw Hill.

Course Code: PGCA1938

Course Name: Cloud Computing Laboratory

Program: M.Sc.(IT)	**L:** 0 **T:**0 **P:**4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:**4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: -**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status: core/elective** Core
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system

Co requisite:

Additional material required in ESE:

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Learn the use of cloud computing tools offered by industry leaders.
CO2	Develop and deploy cloud applications using popular cloud platforms.
CO3	Configuration of the virtual machines on the cloud and building of a private cloud.

Sr. No.	Experiment Name
1.	Enlist various companies in cloud business and the corresponding services provided by them and tag them under SaaS , PaaS & IaaS.
2.	Create a warehouse application using tools supplied by any SaaS provider.
3.	Implementation of Para-Virtualization using VM Ware‘s Workstation/ Oracle‘s Virtual Box and Guest O.S. Learn creation, migration, cloning and managing of virtual machines.
4.	Using public cloud service providers tools for exploring the usage of IaaS, PaaS and SaaS cloud services.
5.	Interact with Cloud Storage and conduct typical management tasks such as bucket creation, file transfers, Access Control Lists (ACL) permissions and Identity and Access Management (IAM) configuration.
6.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Reference Books:

1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

Course Code: PGCA1949
Course Name: Minor Project

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 8
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 8 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 140	**Duration of end semester exam (ESE):** -
External max. marks: 60	**Elective status:** Core
Total marks: 200	

Prerequisite: Software Engineering
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Attain detailed understanding on Software Development Life Cycle
CO2	Learn significance and method feasibility analysis of project
CO3	Understand significance and methodologies for software Design
CO4	Implement Programming Skills to develop project
CO%	Implement basic testing procedures

- ✓ Minor Project will be carried out by students in 3rd semester.
- ✓ In Minor project the main aim should be the Problem identification or formulation (for which project need to be carried out), its Feasibility Study on various parameters, SRS document preparation, Design of project with DFDs (& ER diagrams if required) or Use case diagrams.
- ✓ After Design prototype implementation need to be done.
- ✓ Various initial or basic level of testing like validation checks etc. need to be implemented

- ✓ It should be tried and also motivated by assigned mentor that problem chosen should be from real life scenario. The stress hereby should be given on the concept that students must have complete understanding of software development life cycle with effort estimation at each stage of SDLC.
- ✓ Students may do the projects in groups of 2-3 students depending upon the problem size.
- ✓ Mentor must be assigned to each group of students according to specialization.

Minor project: 01	**Semester:** 3rd	**Mentor:** Yes
Group size: 2-3 students (depending upon problem size)	**Problem:** Real World small Problem	**Technology/Language:** Basic or as per choice of student.
SDLC: To be followed	**Feasibility Study & SRS :** Yes (Detailed)	**Design:** Detailed (including DFD or Use cases with ER diagram (if required))
End Product: Prototype	**Testing:** Initial level/Basic	**Documentation:** Must

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Course Code: PGCA1939
Course Name: Java Technologies

Program: M.Sc.(IT)	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of programming concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the concept of Object Oriented programming using Java.
CO2	Use an appropriate programming environment to design, code, compile and test Java programs.
CO3	Apply the Java reusability features using classes and objects.

CO4	Handle multiple data types , design and use design built-in and user defined functions/methods, interfaces and packages etc.
CO5	Produce robust and effective java programs by applying concepts of exception handling, multithreading and Java Applets.
CO6	Familiarize themselves with advanced concepts of Java such as Event handling, AWT, Java Servlets, JDBC and develop projects.

Detailed contents	**Contact hours**
Part A **Java Programming Fundamentals:** Introduction to Java, Importance of Java to Internet, Java Origin, Challenges and Features, Java Program Development, Object Oriented Programming. **Java Essentials:** Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables & Blocks, Types of Comment in Java. **Control Statements:** Decision making statements (if, if-else, nested if, else if ladder, switch, conditional operator), Looping statements (while, do-while, for, nested loops), Jumping statements (Break and Continue). **Classes and Objects:** Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection. **Arrays and Strings:** Introduction to array, Processing Array Contents, Passing array as argument, Returning array from methods, Array of objects, 2D arrays, Array with three or more dimensions. String class, string concatenation, Comparing strings, Substring, Difference between String and String Buffer class, String Tokenizer class. **Inheritance:** Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class. **Interface and Packages:** Packages, Access Protection, Importing Packages, Interfaces, Defining, Implementing, Applying Interfaces, Extending Interfaces.	22 Hours
Part B **Exception Handling:** Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions	22 Hours

Multithreading: The Java Thread Model, Thread Priorities, Synchronization, Interthread communication, Suspending Resuming and Stopping Threads. **Applets:** Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event-Handling. **AWT:** Window Fundamentals, Working with Frame Windows, Graphics, Color and Fonts. **Servlets:** Life Cycle of a Servlet, The Servlet API, Reading Servlet Parameters, Handling HTTP Requests and Responses, Cookies & Session Tracking. **JDBC:** Database Programming, Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data.	

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.
2. Balagurusamy: Programming in JAVA, Tata McGraw Hill, 2019.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.
2. The Java Handbook by Patrick Naughton, Michael Morrison Publisher: Osborne/McGraw-Hill
3. Horstmann, "Computing Concepts with Java 2 Essentials", John Wiley
4. Bert Bates,Kathy Sierra ,"HeadFirst Java", O'Reilly Media.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1940
Course Name: Java Technologies Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Implement object oriented concepts using classes and objects.
CO2	Solve computational problems while working with multiple data types, control structures and function.
CO3	Design and code solutions to complex problems using concepts of multithreading, packages, interfaces and exception handling.
CO4	

S.No.	Practical Assignments
1.	Write a Java program to print 'Hello' on screen and then print your name on a separate line.
2.	Write a Java program to print the sum (addition), multiply, subtract, divide and remainder of two numbers.
3.	Write a Java program to print the result of the following operations. a. -5 + 8 * 6 b. (55+9) % 9 c. 20 + -3*5 / 8 d. 5 + 15 / 3 * 2 - 8 % 3
4.	Write a Java program that takes three numbers as input to calculate and print the average of the numbers.
5.	Write a program to compute the volume of cone, cube and cylinder.
6.	Write a Java program that takes a number as input and prints its multiplication table upto 10.
7.	Write a Java program to check if a given number is prime or not.
8.	Write a simple Java program which will print Fibonacci series, e.g. 1 1 2 3 5 8 13 ... up to a given number.
9.	Write a java program to print factorial of a number.
10.	Write a Java program to solve quadratic equations (use if, else if and else).
11.	Write a Java program that keeps a number from the user and generates an integer between 1 and 7 and displays the name of the weekday.
12.	Write a Java program to display Pascal's triangle.

13.	Write a Java Program to print the elements of an array
14.	Write a Java program to sort the elements of an array in ascending order.
15.	Write a Java program to right rotate the elements of an array.
16.	Write a Java program to compute the sum and difference of two matrices.
17.	Write a program to determine if a given matrix is a sparse matrix.
18.	Write a program to compute the product of two matrices.
19.	Write a program to compute the number of vowels and consonants in a given string.
20.	Write Java programs to implement various types of inheritance supported in Java.
21.	Write a Java program to demonstrate the usability of access specifiers.
22.	Write a Java program to demonstrate the implementation of multiple inheritance using interfaces.
23.	Write a Java program to demonstrate the creation and usage of Java packages.
24.	Write a Java program to handle various built-in exceptions in Java.
25.	Write a Java program to implement the Java thread model.
26.	Write a Java program to demonstrate thread priority and synchronization.
27.	Create a Java applet that includes a text field and three buttons. When you press each button, make some different text appear in the text field.
28.	Create an applet/application with a JButton and a JTextField. Write and attach the appropriate listener so that if the button has the focus, characters typed into it will appear in the JTextField.
29.	Create a Servlet to handle HTTP Requests and Responses.
30.	Implementation of the concept of Cookies and Session Tracking.

Text Books:

1. Herbert Schildt , “The Complete Reference Java 2” , Tata McGraw -Hill.
2. Balagurusamy: Programming in JAVA, Tata McGraw Hill, 2019.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., “Core Java”, Sun Microsystems Press.
2. The Java Handbook by Patrick Naughton, Michael Morrison Publisher: Osborne/McGraw-Hill
3. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley
4. Bert Bates,Kathy Sierra ,”HeadFirst Java”, O’Reilly Media.

Course Code: PGCA1927
Course Name: Theory of Computation

Program: M.Sc.(IT)	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4

Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 30	**Duration of end semester exam (ESE):**
External max. marks:70	**Elective status:** Elective
Total marks:100	

Prerequisite: NA
Co requisite: NA
Additional material required in ESE: NA
Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Use basic concepts of formal languages of finite automata techniques.
CO2	Design Finite Automata's for different Regular Expressions and Languages.
CO3	Construct context free grammar for various languages.
CO4	**S**olve various problems of applying normal form techniques, push down automata and Turing Machines.
CO5	**S**olve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Detailed contents	Contact hours
Part A Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox. **Theory of Automata:** Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata. **Regular Sets and Regular Grammars:** Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis. **Context Free Language:** Properties of Context Free Language, Chomsky Classification of Languages, Context Free Grammar, Simplification of Context Free Grammar, Chomsky Normal Form, Greibach Normal Form.	22 hours
Part B	22 hours

Push Down Automata: Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA). **Turing Machines (TM):** Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis. **Recursive and Recursively-Enumerable Languages;** Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems. **Unsolvable Problems and Computational Complexity:** Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.	

Text Books:

1. Jeffrey Ullman and John Hopcroft, Introduction to Automata Theory, Languages, and Computation, 3e, Pearson Education India (2008).
2. K.L.P. Mishra, Theory of Computer Science: Automata, Languages and Computation, Prentice Hall India Learning Private Limited (2006).
3. John Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill Higher Education (2007).

Reference Books:

1. Introduction to Computer Theory, Daniel. I.A. Cohen , John Wiley & Sons.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1932
Course Name: Information Security and Cyber Law

Program: M.Sc.(IT)	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Acquire knowledge about various Information Systems.
CO2	Understand the key security requirements of Confidentiality, Integrity &Availability.
CO3	Demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO4	Apply Symmetric Encryption techniques.
CO5	Describe the concept of Security policies and Cyber Laws.

Detailed contents	Contact hours
Part A Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability),Security Functional Requirements. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. **Access Control:** Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, File Access Control, Role-Based Access Control. **Database Security:** The Need for Database Security, Database Access Control, Database Encryption.	22 Hours

Malicious Software: Types of Malicious Software (Malware)-Viruses, Worms,SPAM E-mail, Trojans, Zombie, Bots, Keyloggers, Phishing, Spyware, Backdoors, Rootkits, Preventive Measures.Denial-of-Service Attacks: Types of DoS attacks, Defenses Against Denial-of-Service Attacks.	
Part B **Intrusion Detection:** Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots. **Firewalls & Intrusion Prevention Systems:** The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. **Cryptographic Algorithms:** Symmetric Encryption Principles, Data Encryption Standards (DES) **Introduction to Internet Security Protocols & Standards:** SSL, TLS, HTTPS, IPv4 and IPv6 Security protocols. **Security Policies and Cyber Laws:** Concept of Information Security Policy, ISO Standards, various Indian Cyber Laws, Information Technology Act 2000, Electronic Record and E-Governance, Classification and Provisions of Cyber Crimes, Regulation of Certifying Authorities, Patent, Copyright, Digital signature, Introduction to Cyberspace.	22 Hours

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.
2. Surya Prakash Tripathi, Ritendra Goel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India, 2014.

Reference Books:

1. Christof Paar , Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010
2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.
3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

Course Code: PGCA1941
Course Name: Data Warehousing and Data Mining

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Express data warehouse concepts, architecture, business analysis and tools
CO2	Analyze data pre-processing and data visualization techniques
CO3	Demonstrate algorithms for finding hidden and interesting patterns in data
CO4	Apply various classification and clustering techniques.
CO5	Incorporate the Data mining Algorithms using Open Source tools.

Detailed contents	Contact hours
Part A Data warehousing Components – Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture. The need for data warehousing, Operational & Informational Data Stores, Data Warehouse Characteristics, Data Warehouse Role & Structure; Introduction to OLAP & OLTP, Difference between OLAP & OLTP. OLAP Operations. Building a Data Warehouse : Design/Technical/Implementation Considerations, Data Pre-processing Overview. Data Summarization, Data Cleaning, Data Transformation, ETL Process, Multidimensional Data Model, Schemas for Multidimensional Data (Star Schema, Snowflake Schema, Fact Constellation), Data Warehouse Architecture, Data Warehouse Design, OLAP Three-tier Architecture, Indexing & Querying in OLAP, Efficient Methods of Cube Computation, Discovery Driven Exploration of Data Cubes, Data Marts.	22 Hours
Part B	22 Hours

Introduction to Data Mining functionalities, Mining different kind of data, Pattern/ Context based Data Mining, Classification vs Clustering. Predictive vs descriptive data mining. **Mining of Frequent Patterns:** Association Rule Mining, Market Basket Analysis, Apriori Algorithm. **Bayesian Classification:** Bayes theorem, Bayesian belief networks Naive Bayesian classification, Introduction to classification by Back propagation and its algorithm, Other classification methods: k-Nearest Neighbour, Support Vector Machine. Introduction to prediction: linear and multiple regression, **Clustering:** types of Data in cluster analysis: interval scaled variables, Binary variables, Nominal, ordinal, and Ratio-scaled variables; Major Clustering Methods: Partitioning Methods: K-Mean and K-Mediods, Hierarchical methods: Agglomerative, Density based methods: DBSCAN Introduction to Weka open Source tool/ Python to implement the algorithms.	

Text Books:

1. J.Han and M.Kamber, "Data Mining: Concepts and Techniques", Publisher Morgan Kaufmann Publishers
2. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.
4. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.
5. Paulraj Ponniah, "Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals", 2001 John Wiley & Sons, Inc. ISBNs: 0-471-41254-6 (Hardback); 0-471-22162-7 (Electronic).

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1942
Course Name: Business Intelligence

Program: M.Sc.(IT)	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Warehousing & Mining.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the basic tools of Data Mining
CO2	Generate Reports for Business Analysts
CO3	Handle Multi-dimensional Data Models

Detailed contents	Contact hours
Part A Introduction to Business Intelligence, Introduction to digital data and its types – structured, semi-structured and unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions & Concepts, BI Framework, Data Warehousing concepts and its role in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices. Basics of Data Integration (Extraction Transformation Loading), Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data - types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL.	22 Hours
Part B	22 Hours

Introduction to Multi-Dimensional Data Modeling, Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Introduction to business metrics and KPIs, creating cubes using Microsoft Excel. Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards.	

Text Books:

1. R.N. Prasad and Seema Acharya, Fundamentals of Business Analytics, Wiley India Ltd.
2. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional.

Reference Books:

1. David Taniar, Progressive methods in data warehousing and business intelligence: concepts and competitive analytics, Idea Group Inc (IGI).
2. Data warehousing: the ultimate guide to building corporate business intelligence, Birkhäuser.

Course Code: PGCA1926
Course Name: Artificial Intelligence & Soft Computing

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the significance and domains of Artificial Intelligence and knowledge representation.
CO2	Examine the useful search techniques; learn their advantages, disadvantages and comparison.
CO3	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO4	Apply artificial neural networks and fuzzy logic theory for various problems.
CO5	Determine the use of Genetic algorithm to obtain optimized solutions to problems.

Detailed contents	Contact hours
Part A **Introduction**-What is intelligence? Foundations of artificial intelligence (AI).History of AI. AI problems: Toy Problems, Real World problems- Tic-Tac-Toe, Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions. **Knowledge Representation:** Propositional Logic, Propositional Theorem proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First order Logic. **Informed (Heuristic) Search Strategies-** Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search. **Natural language processing:** Grammars, Parsing, Semantic Analysis and Pragmatics.	22 Hours
Part B **Introduction:** What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. **Neural Networks:** Introduction, What is Neural Network, Learning rules and various activation functions, Supervised Learning Networks, Single	22 Hours

layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications. Unsupervised Learning Networks. **Fuzzy Systems:** Fuzzy Set theory, Fuzzy vs. Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification. **Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization. Introduction to Hybrid Systems.	

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed.,Tata McGraw-Hill.
3. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Artificial Intelligence-A new Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
3. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

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I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1929
Course Name: Artificial Intelligence & Soft Computing Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO2	Apply artificial neural networks and fuzzy logic theory for various problems.
CO3	Determine the use of Genetic algorithm to obtain optimized solutions to problems.

Instructions: Develop the assignments in MATLAB/Python.

Assignments:

1.	Use logic programming in Python to check for prime numbers.
2.	Use logic programming in Python parse a family tree and infer the relationships between the family members.
3.	Python script for building a puzzle solver.
4.	Implementation of uninformed search techniques in Python.
5.	Implementation of heuristic search techniques in Python.
6.	Python script for tokenizing text data.
7.	Extracting the frequency of terms using a Bag of Words model.
8.	Predict the category to which a given piece of text belongs.
9.	Python code for visualizing audio speech signal
10.	Python code for Generating audio signals
11.	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
12.	Implement AND function using ADALINE with bipolar inputs and outputs.
13.	Implement AND function using MADALINE with bipolar inputs and outputs.
14.	Construct and test auto associative network for input vector using HEBB rule.

15.	Construct and test auto associative network for input vector using outer product rule.
16.	Construct and test heteroassociative network for binary inputs and targets.
17.	Create a back propagation network for a given input pattern. Perform 3 epochs of operation.
18.	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
19.	Maximize the function $f(x)=x^2$ using GA, where x ranges form 0-25. Perform 6 iterations.

Text Books:

1. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
2. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
2. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

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I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1943
Course Name: IoT and Its Applications

Program: M.Sc.(IT)	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand internet of Things and its hardware and software components
CO2	Interface I/O devices, sensors & communication modules
CO3	Remotely monitor data and control devices
CO4	Develop real life IoT based projects

Detailed contents	Contact hours
Part A **Introduction to IoT:** Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways. **IoT Enabled Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Templates, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT. **Hardware Components:** Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. **Software Components:** Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.	22 Hours
Part-B **IoT Application Development:** Solution framework for IoT applications-	22 Hours

Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices. **IoT Case Studies:** IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation	

Text Books:

3. Vijay Madisetti, ArshdeepBahga, İnternet of Things, "A Hands on Approach", University Press
4. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
5. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
6. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media

Reference Books:

1. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
3. Adrian McEwen, "Designing the Internet of Things", Wiley.

Course Code: PGCA1944
Course Name: IoT and Its Applications Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the concept of Internet of Things and familiarize themselves with the hardware and software components of IoT.
CO2	Work with sensor generated data and analyze the same.

CO3	Use IoT devices and interface with cloud servers.
CO4	Design and develop small real life IoT projects.

S.No.	Practical Assignments
1.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3.	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6.	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
8.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9.	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
10.	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
11.	To install MySQL database on Raspberry Pi and perform basic SQL queries.
12.	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

Text Books:

1. Vijay Madisetti, ArshdeepBahga, İnternet of Things, "A Hands on Approach", University Press
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
4. CunoPfister, "Getting Started with the Internet of Things", O Reilly Media

Reference Books:

1. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
3. Adrian McEwen, "Designing the Internet of Things", Wiley

Course Code: PGCA1945
Course Name: Machine Learning

Program: M.Sc.(IT)	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: Knowledge of Mathematics, Artificial Intelligence, and Programming.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop knowledge of various learning models of data.
CO2	Understand a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Detailed contents	Contact hours
Part A What is Machine Learning, problems, data and tools, types of learning, performance evaluation measures: accuracy, precision, recall, F measures, etc. various error metrics, data visualization. Linear regression, gradient descent, closed form, normal equations,	22 Hours

Features, Overfitting and complexity; training, validation, test data Classification problems; decision boundaries; K Nearest Neighbor, Logistic Regression Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class-conditional distribution	
Part B Bagging, decision trees and random forests, boosting A more detailed discussion on Decision Tree and Boosting Clustering, k-means, hierarchical agglomeration, Support Vector Machines, Principal Component Analysis. Time series, Markov models, autoregressive models, Introduction to Neural nets and Deep Learning.	22 Hours

Text Books:

1. Introduction to Machine Learning, Third Edition, Ethem Alpaydin, MIT Press.
2. An Introduction to Statistical Learning, Gareth James, Springer.

Reference Books:

1. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.

I. K. Gujral Punjab Technical University
Master of Science in Information Technology (M.Sc. (IT))

Course Code: PGCA1946
Course Name: Machine Learning Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop knowledge of various learning models of data.
CO2	Understand a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Instructions:

1. **Students may develop the assignments in Python/R/Matlab.**
2. **Standard data sets or assumed data sets may be used for developing ML programs.**

Assignments:

1.	Design and evaluate a data model using Linear Regression.
2.	Design and evaluate a data model using Logistic Regression.
3.	Design and evaluate a data model using KNN.
4.	Design and evaluate a data model using K Means Clustering.
5.	Design and evaluate a data model using SVM.
6.	Design and evaluate a data model using PCA.
7.	Design and evaluate a data model using Decision Trees.
8.	Design and evaluate a data model using Random Forest.
9.	Design and evaluate a data model using Deep Learning.
10.	Compare the performance of all the above ML techniques on a similar data set.

Reference Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
2. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: PGCA1947
Course Name: Big Data Analytics

Program: M.Sc.(IT)	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Warehousing & Mining.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the fundamental processes, concepts and techniques of data mining and develop an appreciation for the inherent complexity of the data- mining task
CO2	To develop skills for analyzing Knowledge based Systems
CO3	Implement various high performance Architectures

Detailed contents	Contact hours
Part A Evolution of Big data – Best Practices for Big data Analytics, Big data characteristics, Validating – The Promotion of the Value of Big Data ,Big Data Use Cases, Characteristics of Big Data Applications, Perception and Quantification of Value, Understanding Big Data Storage, A General Overview of High-Performance Architecture – HDFS, Map Reduce and YARN – Map Reduce Programming Model. Advanced Analytical Theory and Methods: Overview of Clustering – K-means, Use Cases, Overview of the Method, Determining the Number of Clusters,	22 Hours

Diagnostics, Reasons to Choose and Cautions, Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm – Decision Tree Algorithms, Evaluating a Decision Tree, Decision Trees in R, Naïve Bayes, Bayes‘ Theorem, Naïve Bayes Classifier.	
Part B Advanced Analytical Theory and Methods: Association Rules – Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules, Finding Association & finding similarity, Recommendation System: Collaborative Recommendation- Content Based Recommendation, Knowledge Based Recommendation, Hybrid Recommendation Approaches. Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating moments, Counting oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) applications, Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics. Hadoop Implementation and Deployment: Introducing Hadoop, Hadoop cluster components, Hadoop Architecture, Hadoop Ecosystem, Evaluation criteria for distributed Map Reduce runtimes, Enterprise-grade Hadoop Deployment, Hadoop Implementation.	22 Hours

Text Books:

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann
2. M. Kantardzic, “Data mining: Concepts, models, methods and algorithms”, John Wiley & Sons Inc.
3. Robert D. Schneider , Hadoop for Dummies, Wiley India.

Reference Books:

1. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson
2. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
3. Pieter Adriaans, Dolf Zantinge , "Data Mining", Pearson Education Asia

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Course Code: PGCA1948
Course Name: Big Data Analytics Laboratory

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**Elective status:** Elective
Total marks: 100	

Prerequisite: -Basic concepts of Data Warehousing & Mining-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Analyze Data in various scenarios.
CO2	Identify Big Data and its Business Implications.
CO3	Access and Process Data on Distributed File System.
CO4	Manage Job Execution in Hadoop Environment.

S.No.	Name of Experiment
31.	Design and Create Cube by identifying measures and dimensions for Star Schema, Snowflake
32.	Design and Create Cube by identifying measures and dimensions for Design storage for cube using storage
33.	Process Cube and Browse Cube Data by replacing a dimension in the grid, filtering and drilldown using cube browser
34.	Process cube to browse dimension data and view dimension members, member properties, member property values
35.	Create and use Excel Pivot Table Report based on data cube
36.	Design and Create data mining models using Analysis Service of SQL server 2005

37.	Design and Build targeted mailing data mining model using analysis service of SQL server and compare their predictive capabilities using the Mining Accuracy Chart View and Create predictions using Prediction Query Builder.
38.	Perform various steps of Preprocessing on the given relational database / warehouse
39.	To implement Data Mining Extensions (DMX) language and MDX query language
40.	Perform various steps of Preprocessing using WEKA software
41.	Creating Data Mining Structure & Predictive Models (Neural Networks and Decision Tree) using the Excel Add-In for SQL Server.
42.	To setup Hadoop
43.	To run sample program using Hadoop

Text Books:-

1. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

Reference Books:-

1. Jay Liebowitz, "Big Data and Business Analytics", Auerbach Publications, CRC press (2013)
2. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Course Code: PGCA1950
Course Name: Major Project

Program: M.Sc.(IT)	**L**: 0 **T**: 0 **P**: 16
Branch: Computer Applications	**Credits:** 8
Semester: 4th	**Contact hours:** 16 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 250	**Duration of end semester exam (ESE):** -
External max. marks: 120	**Elective status:** Core
Total marks: 400	

Prerequisite: Software Engineering & Programming skills
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Analyze real world problems
CO2	Evaluate various development models and Chose best according to requirement
CO3	Understand various design techniques
CO4	Implement some latest technology in project
CO%	Implement extensive testing techniques

- ✓ Major Project will be carried out in 4th semester.
- ✓ The major Project may or may not be extension of minor project done in 3rd semester.
- ✓ In Major project some real world problem must be chosen.
- ✓ In major project also complete SDLC must be followed with an analysis that which development model to be chosen according to requirement of the project .
- ✓ But design & implementation must be done in efficient manner such that project may be implemented in some real time problem may be in their college or some other part of society.
- ✓ Extensive Testing must be done.
- ✓ Complete documentation related to project may be done in efficient manner.
- ✓ It is recommended that some latest technology like AI, Machine Learning, Blockchain, Machine Learning, Big Data or any other latest technology must be used in Major Project so that it can be implemented in real world Problem efficiently.
- ✓ Students may do the projects in groups of 4-5 students depending upon the problem size.

✓ Mentor must be assigned to each group of students according to specialization.

Major Project: 01	**Semester:** 4th	**Extension of Minor:** May be
Mentor: Yes	**Group size:** 4-5 students (depending upon problem size)	**Problem:** Some real world Problem
Software design Model: To be Chosen according to project requirement	**Feasibility/SRS/Design:** Detailed (but at rapid pace)	Technology/Language: Some latest advanced technology to be used so that project may be implemented in some real time situation
End Product: Workable Project in real situation	**Testing:** Extensive	**Documentation:** Must (as per development model Chosen)