SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A++' Grade

Choice Based Credit System with Multiple Entries and Multiple Exit Option

(NEP-2020)

CHOICE BASED CREDIT SYSTEM

Syllabus for

B.Sc. Part – II

COMPUTER SCIENCE (ENTIRE)

SEMESTER III AND IV

(Syllabus to be implemented from Academic Year 2023-24)

SEMESTER – I																	
Sr. No.	Course Title	TEACHING SCHEME						EXAMINATION SCHEME									
		THEORY			PRACTICAL			THEORY					PRACTICAL				
								University			Internal						
		No. of lectures	Hours	Credits	No. of lectures	Hours	Credits	Hours	Max Marks	Min Marks	Max Marks	Min Marks	Hours	Max	Min		
1	DSC-101	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4	**PRACTICAL EXAMINATIONIS ANNUAL**				
2	DSC-102	3	2.4	**2**				2	40	16	10	4					
3	GEC-103	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4					
4	GEC-104	3	2.4	**2**				2	40	16	10	4					
5	GEC-105	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4					
6	GEC-106	3	2.4	**2**				2	40	16	10	4					
7	GEC-107	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4					
8	GEC-108	3	2.4	**2**				2	40	16	10	4					
9	AECC-A	4	3.2	**4**	--	--	--	2	40	16	10	4					
10	SEC-I (VBC-I)	-	-	**2**													
	TOTAL	**28**	**22.4**	**22**	**16**	**12.8**	**8**				**450**						

SEMESTER – II																	
Sr. No.	Course Title	TEACHING SCHEME						EXAMINATION SCHEME									
		THEORY			PRACTICAL			THEORY					PRACTICAL				
								University			Internal						
		No. of lectures	Hours	Credits	No. of lectures	Hours	Credits	Hours	Max Marks	Min Marks	Max Marks	Min Marks	Hours	Max	Min		
1	DSC-201	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4	**As per BOS Guide-lines**	100	40		
2	DSC-202	3	2.4	**2**				2	40	16	10	4					
3	GEC-203	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4		100	40		
4	GEC-204	3	2.4	**2**				2	40	16	10	4					
5	GEC-205	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4		100	40		
6	GEC-206	3	2.4	**2**				2	40	16	10	4					
7	GEC-207	3	2.4	**2**	4	3.2	**2**	2	40	16	10	4		100	40		
8	GEC- 208	3	2.4	**2**				2	40	16	10	4					
9	AECC-B	4	3.2	**4**	-	-	-	2	40	16	10	4					
10	SEC-II (VBC-II)	-	-	**2**													
		28	**22.4**	**22**	**16**	**12.8**	**8**				**450**		**Theory**			**Practical**	
	TOTAL	**56**	**44.8**	**44**	**32**	**25.6**	**16**				**900**		**450 + 450 = 900**			**400**	

- Student contact hours per week: 35.2 Hrs. (minimum)
- Theory and Practical Lectures: 48 Minutes Each
- Total Marks for B.Sc.-I (Including English): **1300**
- Total Credits for B.Sc.-I (Semester I & II): **60**

- DSC- Discipline Specific Core Courses
- **GEC** – Generic Elective Course: Three Courses (Electronics, Mathematics & Statistics) from the B. Sc. Part – I Computer Science Entire curriculum.
- **AECC**- Ability Enhancement Compulsory Course (A & B) – English for Communication.
- **SEC-I (VBC-I)** Election, Democracy and Good Governance
- **SEC-II (VBC-II)** Constitution of India and Local Self Government

- ***Separate passing for each theory paper of 40 marks each in University exam and 10 marks each in internal exam. Minimum 40% (16+4) marks are required for passing in each case.***
- ***Practical Examination conducted annually will be of 100 Marks for each course except English and minimum 40(40%) marks are required for passing.***
- ***The Theory examination for SEC shall be conducted internally.***
- ***Separate passing for theory and practical.***

Sr. No.	Course Title	TEACHING SCHEME						EXAMINATION SCHEME							
		THEORY			PRACTICAL			THEORY					PRACTICAL		
									University		Internal				
		No. of lectures	Hours	Credits	No. of lectures	Hours	Credits	Hours	Max Marks	Min Marks	Max Marks	Min Marks	Hours	Max	Min
S E M E S T E R – III															
1	DSC-301	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4	***PRACTICAL EXAMINATION IS ANNUAL***		
2	DSC-302	4	3.2	**3**				2	40	16	10	4			
3	GEC-303	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4			
4	GEC-304	4	3.2	**3**				2	40	16	10	4			
5	GEC-305	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4			
6	GEC-306	4	3.2	**3**				2	40	16	10	4			
7	SEC-III	--	--	--	4	3.2	**2**								
8	AECC-C	4	3.2	**4**	--	--	--	2	40	16	10	4			
	TOTAL	**28**	**22.4**	**22**	**16**	**12.8**	**8**				**450**				
S E M E S T E R – IV															
1	DSC-401	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4	**As per BOS Guide-lines**	100	40
2	DSC-402	4	3.2	**3**				2	40	16	10	4			
3	GEC-403	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4		100	40
4	GEC-404	4	3.2	**3**				2	40	16	10	4			
5	GEC-405	4	3.2	**3**	4	3.2	**2**	2	40	16	10	4		100	40
6	GEC-406	4	3.2	**3**				2	40	16	10	4			
7	SEC-IV	--	--	--	4	3.2	**2**	--	--	--	--	--	SEC-III	50	20
													SEC-IV	50	20
8	AECC-D	--	---	---	--	--	--	3	70 + 30	25+10			**Theory**	**Practical**	
	TOTAL	**24**	**19.2**	**18**	**16**	**12.8**	**08**		**100**	**35**			**300 + 400 = 700**	**400**	
		52	**41.6**	**40**	**32**	**25.6**	**16**		**400**						

• **Student contact hours per week: 44.2 Hrs. (minimum)**		• Total Marks for B.Sc.-II (Including Env. St.): 1100
• Theory and Practical Lectures: 48 Minutes Each		• Total Credits for B.Sc.-II (Semester III & IV)**: 56**

- **DSC**- Discipline Specific Core Course: Two Computer Courses (Subjects)
- **GEC** – Generic Elective Course: Two Courses (Electronics & Mathematics) from the B. Sc. Part – II Computer Science Entire curriculum.
- **SEC**: Skill Enhancement Course.
- **AECC**- Ability Enhancement Compulsory Course: Environmental Studies
- **AECC-C**: *Environmental Studies* Theory of 70 marks. Minimum 25 marks out of 70 are required for passing.
- **AECC-D**: *Project* 30 marks. Minimum 10 marks out of 30 are required for passing.
- Separate head of passing for each theory paper of 50 marks each. [40 University + 10 Internal (Out of 50)]
- Minimum 20 (40%) marks out of 50 are required for passing. [16 University + 04 Internal (Out of 20)]
- Unit Test should be conducted for Internal Evaluations [10 Marks].
- Except Environmental Studies, Practical Examination for each course shall be conducted annually for 100 marks and minimum 40 (40%) marks are required for passing.
- There shall be no theory examination for SEC courses. The practical examination for SEC shall be conducted annually of 50 marks each and 20 (40%) marks are required for passing.
- The practical examination for SEC shall be conducted internally and remuneration bill shall be paid by institute as per university norms.
- Separate head of passing for theory and practical.

B.Sc. Computer Science Entire Part-II

Year of Implementation: Revised Syllabus will be implemented from June 2023

Duration: Part- II shall be of one academic year consisting of two semesters.

Pattern: Semester Pattern.

STRUCTURE OF THE SYLLABUS

Code	Course	Course Title
SEMESTER – III		
DSC-301	Computer Science Paper - V	RDBMS With MySQL
DSC-302	Computer Science Paper - VI	Object Oriented Programming using C++
GEC-303	Electronics Paper - V	Computer Organization
GEC-304	Electronics Paper - VI	Computer Instrumentation
GEC-305	Mathematics Paper – V	Linear Algebra
GEC-306	Mathematics Paper – VI	Numerical Methods
SEC-III	Skill Enhancement Course - III	HTML & CSS (Web Technology)
AECC-C	Environmental Studies	(Environmental Studies) Theory Paper
SEMESTER – IV		
DSC-401	Computer Science Paper - VII	Data structure using C++
DSC-402	Computer Science Paper - VIII	System Analysis and Design
GEC-403	Electronics Paper - VII	Microcontroller Architecture & Programming
GEC-404	Electronics Paper - VIII	Principles of Electronics Communication
GEC-405	Mathematics Paper – VII	Computational Geometry
GEC-406	Mathematics Paper – VIII	Operation Research
SEC-IV	Skill Enhancement Course - IV	Java Script
AECC-D	Environmental Studies	Project
LAB-5	Lab Course Based on DSC-301, 401 & 302	
LAB-6	Lab Course based on GEC- 303,403 & 304, 404	
LAB-7	Lab Course based on GEC- 305,306 & 405, 406	
LAB-8	Lab Course based on SEC-III & SEC-IV	

B.Sc. Computer Science Entire Part II

Syllabus to be implemented from June 2023 onwards.

Course: Computer Science

1. Title: Computer Science Entire
2. Year of Implementation: Revised Syllabus will be implemented from June 2023 onwards.
3. Duration: Part- II shall be of one academic year consisting of two semesters.
4. Pattern: Pattern of examination will be semester.

STRUCTURE OF COURSE:

Computer Science (Semester III)			
Code	**Paper**	**Name of Paper**	**Marks**
DSC-301	Paper -V	RDBMS With MySQL	**50** (Univ 40 + 10 Internal)
DSC-302	Paper -VI	Object Oriented Programming using C++	**50** (Univ 40 + 10 Internal)
Computer Science (Semester IV)			
DSC-401	Paper- VII	Data structure through C++	**50** (Univ 40 + 10 Internal)
DSC-402	Paper- VIII	System Analysis and Design	**50** (Univ 40 + 10 Internal)
Practical Examination (Annual)			
LAB-5	Practical Examination Based on DSC-301, 401 & 302		**100**
LAB-8	Practical Examination Based on SEC-III & SEC-IV		**100**

EQUIVALENCE IN ACCORDANCE WITH TITLIES ANDCONTENTS OF PAPERS

(FOR CBCS SYLLABUS)

Sr. No.	Title of Old Paper	Code	Paper No.	Title of New Paper
SEMESTER III				
1	Paper- V Relational Database Management System	DSC-301	**V**	RDBMS With MySQL
2	Paper-VI Object Oriented Programming using C++	DSC-302	**VI**	Object Oriented Programming using C++
SEMESTER – IV				
3	Paper – VII: Data Structure using C++	DSC-401	**VII**	Data structure through C++
4	Paper –VIII: Cyber security essentials	DSC-402	**VIII**	System Analysis & Design
PRACTICAL ANNUAL PATTERN				
5	Computer Science	LAB-5	---	Lab Course Based on DSC-301, 401 & 302
6	Computer Science	LAB-8	---	Lab Course Based on SEC-III & SEC-IV

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: DSC-301: Computer Paper - V Course Title: RDBMS With MySQL

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes:

After completion of this course student should be able to

- Understand the concept of Database, Database management system Concept of Data models
- Understand of MySQL with different Commands (Create, insert, select, update, Delete)
- Understand different SQL Operators, functions and clauses
- Design & develop proper database and get Knowledge of Sub Queries and Joins

Unit	Content	Hours Allocated
1	**Introduction to RDBMS** • Definition of Database • Types of Databases: (centralized, distributed, NoSQL, Network, Cloud, Relational, Object Oriented, Hierarchical) • Definition of RDBMS • Difference between DBMS & RDBMS • Concept of Data Models (Network, Hierarchical, Relational) • RDBMS Terminologies: relation, attribute, domain, tuple, entities • DBA & Responsibilities of DBA • Relational Model: Architecture of Relational Databases, Relational Algebra	12
2	**Structured Query Language (SQL).** • Introduction to MySQL, MySQL Data types. • Data Constraints: Primary Key, Foreign key, Unique, Null, Check, Default • Classification of SQL commands: ▪ DDL: Create database, create table, alter table and drop table ▪ DML: Insert, update, delete ▪ DQL: select ▪ DCL: grant, revoke ▪ TCL: commit, rollback, savepoint	12
3	**Advanced SQL Part I** • SQL Operators: Logical, Relational, In, Between, Like • SQL Clauses: Order by, Group by, Having Clause • SQL functions: Mathematical Functions, Conversion, Aggregate, String, Date and Time Functions	12
4	**Advanced SQL Part II** • Sub queries and Nesting Sub queries. • Join: Equi join, Simple Two table Join, Outer join, Self-join • Replication	12

Text Book / Reference Book:

1. Database System Concepts- Korth Silberschartz
2. MySQL The Complete Reference Indian edition, Vikram Vawani, Mcgraw Hill Education
3. Structure Query Language-By Osborne
4. Learning MySQL by O'reilly
5. PHP & MySQL for dynamic websites: Visual QuickPro Guide , Ullman Larry, Pearson In
6. MySQL for beginners and database administrators,

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: DSC-302: Computer Paper - VI Course Title: Object Oriented Programming using C++

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course student should be able to

- Understand basic concepts of object-oriented programming and Use of various control structures to improve programming logic.
- Design classes, objects and functions.
- Use constructor and destructor.
- Implement inheritance and polymorphism concept.

Unit	Content	Hours Allocated
1	**Object Oriented Concepts:** • Difference between POP and OOP. • Concepts of OOP- Data abstraction, Encapsulation, Inheritance, Polymorphism. • Basics of C++, Terminology: Tokens, Keywords, Identifiers, constants. • Basic data types, Structure of C++ program, Input and output streams. • Operators in C++, Dynamic Memory allocation (New & Delete), this pointer. • Dynamic initialization of variable, reference variables, default argument. • Control structures: Branching and looping statements.	**12**
2	**Class, Object and Functions**: • Classes and objects- Definitions, defining class, Defining member functions within class and outside class, Nesting of member functions, static data members, static member function • Access modifiers: private, public and protected. • Array of objects, object as function argument, returning objects. • Inline function, Friend function and friend class.	**12**
3	**Constructor and Operator Overloading**: • Constructor: Definition, types- Default Constructor, Copy constructor, Parameterised constructor, Multiple constructors in class, constructor with default argument. • Destructors. • Operator overloading**:** Definition, Rules for overloading operator, overloading unary and binary operators. • Overloading operators using friend function.	**12**
4	**Inheritance and Polymorphism** • Inheritance**:** Introduction, Defining base and derived class. • Single Inheritance, Making private member inheritable, • multiple Inheritance, multilevel Inheritance, hierarchical Inheritance, hybrid Inheritance, • Abstract Class, Constructors in derived class • Polymorphism**:** Definition, Types of polymorphism: Compile Time Polymorphism, Run Time Polymorphism Virtual function.	**12**

Text Book / Reference book:

1. Object oriented programming By E. Balagurusamy.
2. C++ Programming – By D. Ravichandran
3. Let Us C++ By Yashwant Kanetkar.
4. Object Oriented Programming in C++ - Dr. G. T. Thampi, Dr. S. S. Mantha
5. Mastering C++ -By Venugopal

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: DSC-401: Computer Paper-VII Course Title: Data structure using C++

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand concept of data structure and concept of array operations and applications of array.
- Understand different sorting and searching algorithms for problem solving.
- Implement algorithms to solve problems using appropriate data structures.
- Understand implementations of linked list and basics of Trees.

Unit	Content	Hours Allocated
1	**Concepts of Data structure and Array** • Concept of Data, Data Object, Types of Data- Atomic Data, Non-atomic Data • Definition of Data Structure, types of Data Structure and advantages of Data Structure. • Array in data structure, representation of array, memory allocation of an array, multi-dimensional array	**12**
2	**Algorithm Analysis** • Space complexity, time complexity • Asymptotic notation (Big O, Omega Ω, Theta Θ) • Searching algorithms- Linear search, binary search and their algorithms • Sorting algorithm-Bubble Sort, insertion sort, selection sort, quick sort and their algorithms.	**12**
3	**Stack and Queue** **Stack**: Concept of Stack: Definition, working of stack • Operations on Stack: push, pop, peek • Array implementation of Stack • Linked List implementation of Stack • Applications of Stack- Recursion, Infix, Prefix, Postfix, conversion from Infix to Prefix and Infix to Postfix **Queue**: Concepts of queue: Definition, working of queue • Operations on Queue: Insert, Delete, peek • Array implementation of queue • Linked List Implementation of Queue • Types of Queue-Linear, Circular and Priority • Applications of Queue	**12**
4	**LinkedList and Tree** • **Linked List**: Concept of LinkedList • Memory representation of LinkedList • Operations on LinkedList: Insertion, Deletion, Display and Search • Types of LinkedList: Singly, Doubly LinkedList& Circular LinkedList • **Tree**: Definition of Tree • Tree terminology (root, child, parent, sibling, descendent, ancestor, • leaf/external node, branch node/internal node, degree, edge, path, level, depth, height of node, height of tree, forest) • Difference between Binary Tree and Binary Search Tree	**12**

Text Book /Reference book:

1. Data structure through C++- Yashwant Kanitkar (BPB Publications)
2. Principles of Data structures using c++ - Vinu V. Das (New Age International Publication)
3. Data Structures with C- SEYMOUR LIPSCHUTZ (Tata McGraw-Hill)
4. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: DSC-402: Computer Paper-VIII Course Title: System Analysis & Design

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course student should be able to

- Understand concept of system, life cycle of system, different fact-finding techniques in system analysis.
- Design different charting techniques like decision table, decision trees, ERD, DFD to develop a system
- Understand input and output design of a system and also different testing techniques.
- Design different systems using system development life cycle.

Unit	Content	Hours Allocated
1	**System Analysis and Design** • Meaning and Definition of System, Characteristics of System. • Element of system, Types of system. • System Development Life Cycle. • Feasibility Study: Operational, Technical, Economic. • Role & Skill of System Analyst. • System planning and Initial Investigation • Fact Finding Technique-Interviews, Questionnaires, Record Interviews, Observation	**12**
2	**Charting Technique and Process** • Decision Tables, Decision Trees. • Program Flowchart, System Flowchart. • Data Flow Diagram: Levels of DFDs. • Entity Relationship Diagram: Concept of Entity, Attributes, Types of relation (one to one, one to many, many to many) • Normalization- Forms of Normalization (1NF ,2NF,3NF,4NF,5NF)	**12**
3	**Input - Output Design and Testing** • Input Design, Output Design, File Design. • Hardware and software selection • System Testing Techniques (White Box, Black Box, Gray Box)	**12**
4	**System Implementation and Case Studies** • System Implementation. • Quality Assurance. • System Maintenance • Case studies: College Admi.0ssion system, Inventory Management System, Library Management System	**12**

Text Book / Reference book:

1. System analysis and design – Anjali Bhatnagar, Vision Publication, First Edition 2008
2. System analysis and design – Elias M. Awad
3. Software Engineering –Kumudini Manwar, Manisha Kumbhar, Vision Publication,3rd Edition 2012
4. Software Engineering – Dr. Ashok Kumar, Anil Kumar Vayu Education of India, First 2009
5. Software Engineering – Roger S Pressman, McGraw Hill, 6th Edition

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: SEC-I: Skill Enhancement Course – III Course Title: HTML & CSS (Web Technology)

Credits: 02 Teaching Scheme: Practical 04 Lect. / Week Total Marks: 50

Course Outcomes:

Students who complete this course should be able to:

1. Understand basic as well as advanced concepts of HTML
2. Understand basics of CSS to design a page.
3. Design and develop website using HTML and CSS

Unit	Contents
1	**INTRODUCTION TO HTML** • Introduction, Elements of HTML • Advantages and Disadvantages of HTML • Basic structure of HTML, HTML Tags – Tags and attributes • Basic HTML tags, HTML headings and paragraphs • Text formatting tags - <b>, <i>, <u>, , , <small>, <ins>, <del>, <sub>, <sup>
2	**ADVANCED HTML** • Creating links in HTML, Images in HTML, Tables in HTML • Lists in HTML, Frames in HTML • Forms in HTML - Form tag, Input tag, Select tag.
3	**INTRODUCTION TO CSS** • Introduction to CSS, Features of CSS, Basics of CSS • Understanding the syntax of CSS, Types of Style Sheets – Inline Style, Internal or Embedded Style, External or Linked Styles.
4	**FORMATTING USING CSS** • Formatting Text and Fonts • Formatting colors and Backgrounds • CSS Borders, Margins and paddings • CSS Selectors – Group, Id, Class.

Text Books/ Reference Books

1. Teach Yourself Web Technologies – Ivan Bayross, BPB Publications
2. Web Technology – Ramesh Bangia
3. HTML 4 Unleashed - Second Edition - Rick Dranell
4. HTML & CSS: The Complete Reference - Fifth Edition – Thomas A. Powell
5. HTML 5 & CSS 3 - Seventh Edition – Castro Elizabeth and Bruce Hyslop
6. HTML Black Book – Steven Holzner

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: SEC-I: Skill Enhancement Course – IV Course Title: Java Script

Credits: 02 Teaching Scheme: Practical: 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course students should be able to:

1. Understand basics of Java Script
2. Design a web page to interact with user.
3. Handle different events like mouse, key, focus for user interaction.
4. Design web form using JQuery

Unit	Contents
1	**Introduction To JavaScript** • Introduction to JavaScript, Data types, operators and expressions, variables, Arrays, <script> tag and attribute. • Control structures: if-else, switch case, while loop, for loop, for-in Loop control-break, continue &label.
2	**Interacting With User:** • User defined Function, String function, creating alert, prompt & confirm dialog box,Getting confirmations from users, Handling errors, form validation
3	**Handling Events** • Responding to mouse - onclick, ondblclick, onmousedown, onmouseenter, onmousemover, onmouseout • Focus events: onblur, onfocus • Keboard: onkeydown , onkeypress ,onkeyup
4	**Using JQuery** • JavaScript libraries, use of jQuery library in page, selecting elements on a pagewith jQuery, bind events using jQuery. • Modifying styles on the Page. • Modifying Content on the Page.

Text Book/Reference Book:

1. Mastering HTML, CSS & JavaScript BPB Publication
2. Web Technology – Ramesh Bangia
3. Java script for beginners, Mahesh Bhave & Sunil Patekar, Shroff publishers & distributer PVT,LTD

Laboratory Assignments List

Practical: Lab Course based on DSC-301: RDBMS with MySQL

1. Write a SQL statement to create a table with appropriate fields and apply following integrity constraint on appropriate fields
    a. Primary Key
    b. Foreign key
    c. Unique key
    d. Null
    e. Check
    f. Default
2. Write a SQL statement to alter above table to add a new column and add new constraint to that column.
3. Write a SQL statement to drop a table.
4. Write a SQL statement to Create a table and do the following using different SQL commands.
    a. Insert 10 appropriate records
    b. Update a record
    c. Delete a record
5. Write a SQL select statement to perform different SQL Operators.
6. Write a SQL select statement with different SQL clauses.
7. Write a SQL select statement with different SQL functions.
8. Write a SQL select statement using subqueries and joins.

Practical: Lab Course based on DSC-401: Data Structure through C++

1. Write a C++ program to implement recursive i) Linear search ii) Binary search
2. Write a C++ program to implement sorting methods (Using Array)
    i) Bubble sort ii) Selection sort iii) Quick sort iv) Insertion sort
3. Write a C++ program to implement the following using an array.
    a) Stack ADT b) Queue ADT
4. Write a C++ program to implement list ADT to perform following operations:
    - Insert an element into a list.
    - Delete an element from list
    - Search for a key element in list
    - count number of nodes in list
5. Write C++ program to implement the following using a singly linked list.
    a) Stack ADT b) Queue ADT
6. Write C++ program for implementing sorting methods (Using Linked List)
    i) Bubble sort ii) Selection sort iii) Quick sort iv) Insertion sort

Practical: Lab Course based on DSC-302: Object Oriented Programming using C++

1. Write a C++ programs based on branching and looping statements.
2. Write a C++ programs based on implementation of class having data member, member function inside the class.
3. Write a C++ programs based on implementation of class having data member, member function outside the class.
4. Write a C++ programs based on nesting of member function.
5. Write a C++ programs based on array of object.
6. Write a C++ programs based on passing object as Parameter.
7. Write a C++ programs based on returning object.
8. Write a C++ programs based on static data members and static member function.
9. Write a C++ programs based on programs based on usage of constructor with its types.
10. Write a C++ programs based on destructor.
11. Write a C++ programs based on usage of Inline and friend function.
12. Write a C++ programs based on implementation of Single Inheritance.
13. Write a C++ programs based on usage of constructors in derived class.
14. Write a C++ programs based on implementation of multilevel Inheritance.
15. Write a C++ programs based on implementation of multiple Inheritance.
16. Write a C++ programs based on implementation of hierarchical Inheritance.
17. Write a C++ programs based on implementation of hybrid Inheritance.
18. Write a C++ programs based on implementation of function overloading.
19. Write a C++ programs based on implementation of unary, binary operator overloading.
20. Write a C++ programs based on implementation overloading operators using friend function.
21. Write a C++ programs based on implementation of run time polymorphism i.e., virtual function.
22. Write a C++ programs based on implementation of Abstract Class.

Practical: Lab Course based on SEC-III: Web Technology (HTML)

1. Design a web page using heading and text formatting tags in HTML.
2. Design a web page using image and link tags in HTML.
3. Design a web page using frame tag in HTML.
4. Create your class timetable using table tag and its attributes in HTML.
5. Create a form for student admission/student feedback by using form tag and its attributes in HTML.
6. Design web page/s of your College/Department with an attractive background, text color, images and fonts by using CSS properties.
7. Design web page/s of your city by using inline, internal and external CSS.
8. Design web page/s for display of online products by using CSS and CSS selectors.

Practical: Lab Course based on SEC-IV: JavaScript

1. Develop JavaScript to implement functions.
2. Develop JavaScript to implement Strings.
3. Write a JavaScript program to check whether a given number is perfect, abundant or deficient. Use alert box to display the output.
4. Design a form that accepts two integers. Provide 4 buttons for Add, Subtract, Multiply, Divide. Add JavaScript program to add, subtract, multiply and divide the given numbers when these buttons are clicked. Use output element to display the results.
5. Create college home web page using Form Elements.
6. Write a JavaScript program to validate USER LOGIN page using JQuery.
7. Blink text using jQuery.
8. Set the background color red of the following elements using jQuery.
9. Create a Login and registration form using HTML/CSS & JQuery.
10. Design a college website using HTML, CSS and Javascript.

Computer Science: Work-Load

Semester – III			
Paper No.	**Title of the Paper**	**Total Marks**	**Lectures Per week**
V	RDBMS With MySQL	50 (Theory)	4
VI	Object Oriented Programming using C++	50 (Theory**)**	4
Semester IV			
VII	Data structure using C++	50 (Theory)	4
VIII	System Analysis & Design	50 (Theory)	4
Practical Exam (Annual)			
LAB No.	**Title of the Paper**	**Total marks**	**Lectures per week**
LAB -5	Practical Based on DSC-301, 401 & 302	100	4
LAB -8	Practical Based on SEC-III & SEC-IV	100	4
*Note: 8 Lectures per week per 20 student's batch.			

- Total Teaching periods for paper -V, VI are 8 (eight) per week.
  4 (four) periods per paper per week, for semester III
- Total Teaching periods for paper - VII, VIII are 8 (eight) per week.
  4 (four) periods per paper per week, for semester IV
- Total teaching periods for practical course in computer science -III & IV, 8 hours per week per 20 student's batch.

Scheme of Examination

- The theory examination shall be conducted at the end of each semester.
- The theory paper shall carry 50 marks. [40 marks (University) and 10 marks (Internal).]
- There shall be no theory exam on SEC –III & SEC –IV.
- The practical examination shall be conducted annually.
- The practical paper shall carry 200 marks.
  100 marks for LAB -5 (External Assessment) and 100 marks for LAB-8 (Internal Assessment)

Nature of Theory Question Paper

- As per regular B.Sc. Programme

Examination Scheme for Practical

- The practical paper shall carry 100 marks.
- There shall be five questions carrying 25 marks each. Student has to attempt three questions.
- There are two sections: Section – I based on DSC-302, DSC-401 and Section – II based on
- DSC-301 (*Student must solve at least one question from each section*)
- Section – I carries three questions and Section – II carries 2 questions.
- 10 marks for journal and 15 marks for viva.
- The duration of practical examination will be four hours.

B.Sc. Computer Science Entire Part II Semester III and IV
Syllabus to be implemented from June 2023 onwards**.**
Course: Electronics

1. **TITLE:** Electronics
2. **YEAR OF IMPLEMENTATION:** Revised Syllabus will be implemented from June 2023 onwards.
3. **DURATION:** B.Sc. in Computer Science Entire Part- II The duration of course shall be one year and Two semesters.
4. **PATTERN:** Pattern of examination will be semester.
5. **STRUCTURE OF COURSE:**

Electronics (**Semester III)**			
Code	**Paper**	**Name of Paper**	**Marks**
GEC-303	Paper -V	Computer Organization	**50** (Univ 40 + 10 Internal)
GEC-304	Paper -VI	Computer Instrumentation	**50** (Univ 40 + 10 Internal)
Electronics (Semester IV)			
GEC-403	Paper- VII	Microcontroller Architecture & Programming	**50** (Univ 40 + 10 Internal)
GEC-404	Paper- VIII	Principles of Electronics Communication	**50** (Univ 40 + 10 Internal)
Practical Examination (Annual)			
LAB-6	Practical Examination Based on Theory Papers V, VI, VII & VIII		**100**

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: GEC -303: Electronics Paper-V Course Title: Computer Organization

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand code converters, digital comparators and counter design.
- Understand design of memory system with its expansion and mapping techniques.
- Understand various data transfer techniques in digital computer and the I/O interfaces.
- Understand the basics of register, stack, organization and study of ALU with instruction format.

Unit	Content	Hours Allocated
1	**DIGITAL SYSTEM DESIGN** Introduction to digital circuit design, Circuit design using logic gates: Binary to Gray converter, Gray to Binary converter, Concept of Digital comparator. Concept of excitation table, Design of 2-bit synchronous up counter, 3-bit random sequence generator.	**12**
2	**MEMORY ORGANISATION** Introduction, Characteristics of memory systems, Vertical & horizontal Memory expansion (Increasing the capacity, increasing word size), Memory hierarchy, Cache memory, Memory mapping techniques, Virtual Memory, Memory management concepts (Paging and segmentation), Introduction to USB storage device.	**12**
3	**I/O ORGANISATION** Need of interface, I/O mapped I/O, Memory mapped I/O, Input output Interface, Asynchronous data transfer. Modes of transfer, Priority Interrupts, DMA Controller, Input output Processor, Serial communication: Synchronous, asynchronous and their data transmission formats, General block diagram of UART.	**12**
4	**CPU ORGANISATION** Introduction, General register organization, Stack Organization, Instruction formats, (Zero, one, two, three address), Arithmetic and Logic Unit (One bit and multiple bit), Bit processor, Concept of RISC & CISC, Concept of pipeline.	**12**

Reference Books:

1. Fundamental of Digital electronics: R.P. Jain,
2. Digital design: M. Morris Mano, Prentice-Hall of India
3. Computer Organization -J.P. Hays TMH
4. Computer System Architecture: Morris Mano, Prentice-Hall of India
5. Digital system Design: Nirali /Techmax
6. Digital Electronics - Anandkumar
7. The Intel Microprocessors: Barry B. Brey- Pearson Education Asia

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: GEC -304: Electronics Paper-VI Course Title: Computer Instrumentation

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Describe the working principle, selection criteria and applications of various transducers used in instrumentation systems
- Gain knowledge about different type of signal conditioning circuits, data converters.
- Understand various types of Actuators and Data Acquisition systems.
- Understand construction, working principle of different types of digital instruments and display devices.

Unit	Content	Hours Allocated
1	**TRANSDUCERS AND SENSORS** Definition of Transducers and Sensors, Classification of transducers, Characteristics of Transducers, Specifications of Transducers (Accuracy, Range, Linearity, Sensitivity, Resolution, Reproduciability) examples of different transducers. ***Temperature:*** Thermocouple, RTD, LM35, thermister, Thermister ***Pressure/Force:*** Strain-Gauge, Piezo-Electric, LVDT, Capacitive, ***Optical:*** LDR, Photovoltaic Cell, **Proximity:** Hall effect sensor, ultrasonic sensor, PIR (passive infrared sensor) etc.	**12**
2	**SIGNAL CONDITIONING AND DATA CONVERTORS** Introduction, Signal conditioning of passive sensors using Whetstones bridge, Pre amplifiers, Filters: Concept, Active, Passive Filters (LP, HP, Band Pass and Reject - only frequency response) ADC: (SAR, Flash), Specifications (Linearity, Resolution, Conversion time, Accuracy) DAC: Binary weighted, DAC (R-2R), Specifications (Linearity, Resolution, Accuracy) Instrumentation Amplifier using three OP. AMP.	**12**
3	**ACTUATORS AND DATA ACQUISITION SYSTEMS** Definition & Principle, Electrical Actuators: Relays, Motors: AC, DC, Servo, Stepper, Generalized Data Acquisition System, signal conditioning for DAS, Types of DAS, Multiplexing, Sample and Hold Circuit, Computer based DAS, Data Logger.	**12**
4	**DIGITAL INSRUMENTS AND DISPLAY DEVICES** Digital Multimeter, Digital Frequency Meter, Universal Counter, Digital Tachometer, Digital Phase Meter, Concept of DSO, LCD technique, Concepts of LCD, LED, OLED Displays. (Comparative study)	**12**

Reference Books

1. Electronic Instrumentation -Kalsi TMH
2. Transducers & Instrumentation -Murthy PHI (Unit 1)
3. Instrumentation Measurements & Analysis-Nakra & Chaudhry TMH
4. Instrumentation Devices & Systems -Rangan, Sarma, Mani TMH

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: GEC -403: Electronics Paper-VII Course Title: Microcontroller Architecture and Programming

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand the architecture of 8051 microcontroller and its comparative family.
- Understand the detailed Instruction set of 8051 with addressing modes.
- Understand Facilities in 8051viz. Timer, Counter, Delay calculations and Serial Communication with its operating modes.
- Understand 8051 and Real-world interfacing using I/O peripherals.

Unit	Content	Hours Allocated
1	**INTRODUCTION TO MICROCONTROLLER** Comparison of Microcontroller & Microprocessor, Survey of 4-Bit, 8-Bit, 16-Bit And32-Bit Microcontrollers and their application areas, Study of 8051 and its Family (Comparative study of 89C51, 8031, 8032, 8052, 8751, Phillips (RD2) 89C51VRD2). Architecture of 8051: Block Diagram of 8051 and Study of Internal Blocks, Reset and Clock, Registers, Flags and Internal Memory, SFR, I/O Ports.	**12**
2	**8051 INSTRUCTION SET** Study of 8051 Instruction Set and Addressing Modes, Data transfer, Arithmetic, Logical, JUMP, Loops & CALL instructions, Bit manipulation Instructions.	**12**
3	**FACILITIES IN 8051** **Timer and Counter:** Timer and Counters, Timer modes, Programming the timers in Mode 1 using assembly and C. Time delay generation. **Serial Port:** Serial port of 8051, RS-232 standard and IC MAX–232, Baud rate in 8051, programming for transmitting character through serial port using assembly and C.	**12**
4	**INTERFACING METHODES** Interfacing with 8051: LED, Relay, Opto-coupler, Thumb wheel switch and seven segment display. Stepper Motor, DC motor (PWM), LCD (16 X 2), with respective programming in assembly language OR embedded C for all.	**12**

Reference Books

1. 8051 Microcontrollers 2nd Edition -Mazidi Pearson
2. 8051 Microcontroller -Ayala K.J.
3. 8051 Microcontroller -Deshmukh Ajay TMH

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: GEC -404: Electronics Paper-VIII Course Title: Principles of Electronics Communication

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand the functioning of basic communication system.
- Understand the concept of basic analog modulation techniques.
- Understand digital modulation and demodulation techniques.
- Understand wireless communication systems and mobile communication concept.

Unit	Content	Hours Allocated
1	**INTRODUCTION TO ELECTRONIC COMMUNICATION** Importance of Communication, Elements of Communication system, Electromagnetic spectrum, Types of communication, Parallel communication, Serial communication, Concepts of communication system: Signal bandwidth, channel bandwidth, data rate, baud rate, Nyquist theorem, Signal to noise ratio and channel capacity, Types of Noise.	**12**
2	**ANALOG MODULATION** Introduction to concepts of modulation and demodulation. *Modulation techniques:* ***Analog***: Amplitude, Frequency, Phase modulation only concept with waveforms Compare AM & FM, Equation of Amplitude modulated wave (derivation not expected) Modulation Index, Frequency spectrum, and Power distribution. (Derivation not expected)	**12**
3	**DIGITAL MODULATION AND MULTIPLEXING TECHNIQUES** Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM), Delta modulation Block diagram and working of each. Concept of ASK, FSK, BPSK, Block diagram of MODEM using FSK. Study of multiplexing: Space division multiplexing, Time division multiplexing, Frequency Division Multiplexing, and Code division multiplexing.	**12**
4	**WIRELESS COMMUNICATION SYSTEMS** Need of wireless communication systems. Introduction to mobile communication, Cellular concept, Working of GSM, Hand over, Introduction to GPRS. Introduction to RFID, Zig bee, Bluetooth and Wi-Fi. (Comparison based on Range, Data rate, Frequency, Power).	**12**

Recommended Books:

1. Communication Electronics: Principles and Applications. L.E.Frenzel 3rd Edn.
2. Modern Electronic Communication. G.M. Miller 7th Edition.
3. Mobile Communication Jochen Schiller 2nd Edition.
4. Wireless Communications: Principles and Practice. Rappaport
5. Wireless Communications and Networks. William Stallings

LAB: 6 ELECTRONICS PRACTICAL III (Group A)

Sr. No.	Title of practical
1	Built& study Gray to binary and Binary to Gray converter
2	Built& study 2 –bit serial Up down counter (7473)
3	Built& study 4-bit Ring & Johnson counter using D/JK Flip-Flop ICs
4	Built& study Decimal to BCD as Priority Encoder using 74147
5	Built & study Digital single Bit Comparator.
6	Built& study 4-bit asynchronous counter using Flip-Flop ICs
7	Built& study- 4-bit Shift Register (SISO) using D/JK Flip-Flop ICs
8	Study DAC (R-2R Ladder)
9	Study ADC (3-bit Flash) IC or Discrete
10	Study Analog Multiplexers (8:1/4:1)
11	Study Instrumentation amplifier using Op. Amp.
12	Built and test LDR based light control system
13	Built & study of op.amp. as integrator and differentiator
14	Study of ON/OFF Temperature controller (LM34/LM35/AD590)

LAB: 6 ELECTRONICS PRACTICAL IV (Group B)

Sr. No.	Title of practical
1	Interfacing of Relay and LED with 8051
2	Interfacing of THUMB WHEEL SHITCH / 7-SEGMENT DISPLAY with 8051
3	Time delay generation using timers (Mode 1 OR 2) of 8051(use simulator or kit)
4	Interfacing of Stepper motor with 8051
5	Interfacing of DC motor (PWM) with 8051
6	Arithmetic and Logical operations using 8051 C (Use 8051 Simulator)
7	Interfacing of DAC with 8051 to generate Triangular & Square / Staircase wave
8	Study of Amplitude Modulator and Demodulator.
9	Study of Frequency Modulator
10	Study of F S K modulator.
11	Study of Pulse Amplitude Modulation.
12	Study of A S K Modulator.
13	Study of Pulse Width Modulation
14	Study of B P S K Modulator

* Note: At least any 12 Experiments from each group

SECOND YEAR B.Sc. Computer Science (Entire)

ELECTRONICS

Total **Work–Load**

Semester III

Paper No.	Title of the Paper	Total Marks	Lectures Per week
V	Computer Organization	50	4
VI	Computer Instrumentation	50	4

Semester IV

Paper No.	Title of the Paper	Total Marks	Lectures Per week
VII	Microcontroller Architecture & Programming	50	4
VIII	Principles of Electronics Communication	50	4

Practical (Annual)

Title of the Paper	Total marks	Lectures per week
Practical Paper	100	4

Examination scheme for practical

S.Y. B.Sc. Computer Science (Entire) Electronics: Practical Course

- Total Experiments to be performed 28.
- 24 experiments compulsory: At least 12 Practical's from each of the A and B groups.
- *Practical Examination* –
    - Annual examination: 100 Marks in two session of 3 Hours as usual practice**.**
    - Session - I: 45 marks (Practical work 45 marks)
    - Session - II: 45 marks (Practical work 45 marks)
    - Journal Work: 10 Marks

B.Sc. Computer Science Entire Part II
Mathematics (Sem. III & IV)
Syllabus to be implemented from June 2023 onwards.

1) **TITLE:**
   Mathematics
2) **YEAR OF IMPLEMENTATION:**
   Revised Syllabus will be implemented from June 2023 onwards.
3) **DURATION:**
   B.Sc. in Computer Science Entire Part- II The duration of course shall be one year and Two semesters.
4) **PATTERN:**
   Pattern of examination will be semester.
5) **STRUCTURE OF COURSE:**

Mathematics (Semester III)

Code	Paper	Name of Paper	Marks
GEC-305	Paper-V	Linear Algebra	40 (Theory) + 10 (Internal): 50 Marks
GEC-306	Paper-VI	Numerical Methods	40 (Theory) + 10 (Internal): 50 Marks

Mathematics (Semester IV)

Code	Paper	Name of Paper	Marks
GEC-405	Paper-VII	Computational Geometry	40 (Theory) + 10 (Internal): 50 Marks
GEC-406	Paper-VIII	Operation Research	40 (Theory) + 10 (Internal): 50 Marks

Practical Examination (Annual)

Code	Paper	Name of Paper	Marks
LAB-7	---	Lab Course based on GEC- 305, 306 & 405, 406	100 Marks

EQUIVALENCE IN ACCORDANCE WITH TITLIES AND CONTENTS OF PAPERS

Sr. No.	Old Paper			New Paper		
	Code	**Paper No.**	**Title**	**Code**	**Paper No.**	**Title**
SEMESTER III						
1	GEC-305	V	Linear Algebra	GEC-305	V	Linear Algebra
2	GEC-306	VI	Numerical Methods	GEC-306	VI	Numerical Methods
SEMESTER IV						
3	GEC-405	VII	Computational Geometry	GEC-405	VII	Computational Geometry
4	GEC-406	VIII	Operation Research	GEC-406	VIII	Operation Research
Practical Examination ANNUAL PATTERN						
5	LAB-7	---	Lab Course based on GEC- 305, 306 & 405, 406	LAB-7	---	Lab Course based on GEC- 305, 306 & 405, 406

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: GEC -305: Mathematics Paper-V Course Title: Linear Algebra

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand the concept of linear transformation and its application to real life applications.
- Evaluate mathematical expressions to compute quantities that deal with linear systems and eigenvalue problems.
- Analyze mathematical statements and expressions.
- Reason mathematically. Understand the notion of vector space, subspace, basis.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Linear Equations and Matrices:** 1.1 Matrices 1.2 Matrix Transformation 1.3 Linear Systems 1.4 Results on system of linear equations and invertible matrices (StatementsOnly) 1.5 Solutions of System of Linear Equations 1.5.1 Gauss Elimination Method 1.5.2 Gauss-Jordon Method	12
2	**Vector Space:** 2.1 Vector Space 2.2 Sub Space 2.3 Linear Dependent and Independent 2.4 Basis and Dimension	12
3	**Inner Product Space** 3.1 Definition and Example 3.2 Properties 3.3 Orthonormal Basis in R 3.4 Gram-Schmidt Process	12
4	**Eigen values, Eigen vectors and diagonalization** 4.1 Eigen values and Eigen Vectors 4.2 Diagonalization 4.3 Cayley-Hamiltonian theorem (Statement Only) and Examples.	12

Note: All theorems in sections 1.4, 4.1, 4.2, 4.3 are without proof.

Recommended Book:

1. Elementary Linear Algebra with Applications, Howard Anton, Chris Rorres, John Wiley and sons., 7th Edition (1994).

REFERENCE BOOKS:

1. A textbook of Matrices, Shanti Narayan, P. K. Mittal, S. Chand.
2. Topics in Algebra, I. N. Herstein.
3. Linear Algebra, Schaum Series.

B. Sc. Computer Science (Entire) Part- II (Semester III)

Course Code: GEC -306: Mathematics Paper-VI Course Title: Numerical Methods

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand how to find the roots of transcendental equations.
- Understand learn numerical solution of differential equations.
- Understand how to find the roots of transcendental equations.
- Understand how to interpolate the given set of values.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Solution of Non – linear Equations:** 1.1 Introduction 1.2 Bisection method: Algorithm, graphical representation and examples. 1.3 Regula–Falsi method: Algorithm, graphical representation and examples. 1.4 Newton Raphson method: Algorithm, graphical representation and examples.	12
2	**Concepts of Numerical Interpolation** 2.1 Interpolation, Equally and Unequally spaced data. 2.2 Definition of Forward Difference (Δ), Backward Difference (∇) and Shift Operator (E). 2.3 Elementary results of Δ, ∇, E. 2.4 Fundamental theorem of difference calculus (with proof).	12
3	**Methods of Numerical Interpolation** 3.1 Newton – Gregory Forward interpolation formula (with proof) and Examples. 3.2 Newton – Gregory Backward interpolation formula (with proof) and Examples. 3.3 Lagrange's interpolation formula (with proof) and example	12
4	**Numerical Integration** 4.1 Introduction of numerical integration. 4.2 General Quadrature formula (with proof). 4.3 Trapezoidal rule (with proof) and examples. 4.4 Simpson's $1/3$ rule (with proof) and examples. 4.5 Simpson's $3/8$ rule (with proof) and examples. 4.6 Weddle's rule (with proof) and examples.	12

Recommended Book:

1. Introductory Methods of Numerical Analysis, S.S. Sastry, 3rd edition, Prentice Hall of India, 1999.
2. Finite differences and Numerical Analysis, H.C. Saxena, S. Chand and Company.

REFERENCE BOOKS:

1. Numerical Analysis, Balguruswamy.
2. Calculus of Finite Differences and Numerical Analysis, P. P. Gupta, G. S. Malik and S. Gupta, Krishna Prakashan Media (P) Ltd.
3. Computer oriented Numerical methods, A. B. Auti Tech-max publications.

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: GEC -405: Mathematics Paper-VII Course Title: Computational Geometry

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- Understand how to represent point, lines, transformations and matrices,
- Understand how to Various types of transformations.
- Solve multiple transformation and projection on three dimensional.
- Understand the concepts curve, its properties and B-spline curve.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Introduction to Two dimensional transformations** 1.1 Introduction 1.2 Representation of Point 1.3 Transformation and Matrices 1.4 Transformation of points 1.5 Transformation of straight lines 1.6 Midpoint transformation 1.7 Transformation of parallel lines 1.8 Transformation of intersecting lines 1.9 Transformation: Scaling, Shearing, Rotation, Reflection 1.10 Combined Transformation 1.11 Transformation of a unit plane 1.12 Solid body Transformation	12
2	**Two dimensional transformations and Homogeneous coordinates** 2.1 Transformation and homogeneous coordinates-Translation. 2.2 Rotation about an arbitrary point. 2.3 Reflection through an arbitrary line. 2.4 Overall Scaling. 2.5 Point at infinity.	12
3	**Three dimensional transformations** 3.1 Introduction. 3.2 Three dimensional–Scaling, Shearing, Rotation, Reflection, Translation. 3.3 Multiple transformations. 3.4 Rotation about – an axis parallel to coordinate axes, an arbitrary axis in space. 3.5 Reflection through – coordinate planes, planes parallel to coordinate planes, arbitrary planes.	
4	**Plane Curves** 4.1 Introduction. 4.2 Curve representation. 4.3 Parametric curves. 4.4 Parametric representation of a circle and generation of circle. 4.5 Parametric representation of an ellipse and generation of ellipse. 4.6 Parametric representation of a parabola and generation of parabolic segment.	12

Recommended Book:

1. Mathematical elements for computer graphics, F. David and J. Alan Adams (McGraw Hill International Edition)

REFERENCE BOOKS:

1. Computer graphics, Schaum series.
2. Computer Graphics handbook,Geometry and Mathematics, M.E.Mortenson, Industrial Press Inc.

B. Sc. Computer Science (Entire) Part- II (Semester IV)

Course Code: GEC -406: Mathematics Paper-VIII Course Title: Operation Research

Total Contact Hours: 48 hrs. (60 lectures of 48 min)

Credits: 02 Teaching Scheme: Theory – 04 Lect. / Week Total Marks: 50

Course Outcomes: After completion of this course, student should be to

- To learn about characteristics, scope of operation Research.
- Understand the Assignment problem.
- Understand the Transportation problem Initial Solution and Optimization.
- To know the fundamental of game theory.

UNIT	CONTENTS	HOURS ALLOTTED
1	**Introduction to operation Research** 1.1 Basics of operation research 1.2 Different definitions of operation research 1.3 Characteristics, scope, limitations of operation research	12
2	**Assignment problem** 2.1 Introduction to Assignment problem 2.2 Hungarian method and examples 2.3 Maximization in Assignment problems and examples 2.4 Unbalanced Assignment problem and examples 2.5 Assignment problems with restrictions and examples	12
3	**Transportation problem Initial Solution and Optimization** 3.1 Basics of Transportation problem 3.2 Basic Definitions 3.3 Initial Solution 3.3.1 North – West corner method and examples 3.3.2 Matrix minima method and examples 3.3.3 Vogel's approximation method and examples 3.4 MODI method and examples 3.5 Maximization in transportation problem and examples 3.6 Unbalanced transportation problem and examples	12
4	**Theory of Games** 4.1 Basics definitions 4.2 Saddle point and examples 4.3 Algebraic method for $\mathbf{2 \times 2}$ size game and examples 4.4 Arithmetic method for $\mathbf{2 \times 2}$ size game and examples 4.5 Principal of dominance, Dominance method and examples 4.6 Sub-game method for $\mathbf{2 \times n \& m \times 2}$ size game and examples 4.7 Graphical method for $\mathbf{2 \times n \& m \times 2}$ size game and examples	12

Recommended Book:

1. Operations Research, S. D. Sharma

REFERENCE BOOKS:

1. Principles of Operations Research, H. M. Wagner,Prentice Hall of India.
2. Operations Research, Gupta and Hira.
3. Operations Research, J K Sharma (second edition)

Practical Annual: Mathematics Lab-7

LAB-7– Lab Course based on Linear Algebra and Numerical methods

Practical Number	Title Of Practical
1	Gauss Elimination method, Gauss-Jordan method
2	Gram Schmidt process
3	Eigen values and Eigen vectors, Diagonalizable
4	Verification of Cayley-Hamilton theorem and Inverse of a matrix using Cayley-Hamilton Theorem
5	Bisection method, Regula-Falsi method and Newton Raphson method
6	Newton Forward and Backward interpolation, Lagrange's interpolation
7	Trapezoidal, Simpson's $^1/_3$ and Simpson's $^3/_8$ rule
8	Computer Program for 1) Bisection Method 2) Regula-Falsi Method 3) Newton-Raphson Method 4) Trapezoidal rule 5) Simpson $^1/_3$rule 6) Simpson $^3/_8$ rule 7) Weddle Rule

Computational Geometry and Operational Research

Practical Number	Title Of Practical
9	Plane Linear transformation Scaling, Shearing, Reflection and Rotation about origin, Rotation about arbitrary point, Reflection through arbitrary line Combined transformation matrix
10	Space linear transformation Scaling, Shearing and Rotation about Co – ordinate axis Reflection through Co – ordinate planes, Translation Multiple transformations, Rotation about a line parallel to Co – ordinate axis, Rotation through planes which are parallel to Co – ordinate planes
11	Plane Curves Generation of points on circle and ellipse (Examples only) Generation of points on parabolic segment (Examples only)
12	Initial solution of transportation problem North – West Corner method, Matrix minima method and Vogel's approximation method
13	MODI method
14	Maximization in transportation problem, Unbalanced transportation problem
15	Assignment Problem-Minimization type (Example only)
16	Maximization in assignment problem, Unbalanced assignment problem

B.Sc. Computer Science (Entire) - II (MATHEMATICS)

Workload

Theory

SEMESTER – III

Paper No.	Title of the Paper	Total Marks	Periods Per Week
V	Linear Algebra	50	4
VI	Numerical Methods	50	4

SEMESTER – IV

VII	Computational Geometry	50	4
VIII	Operational Research	50	4

Practical (Annual Pattern)

Title of the Paper	Total Marks	Periods Per Week per batch
Linear Algebra	50	4

*Note :4 hours per week per batch of 20 students.

Work Load:

1. Total teaching periods for paper -V, VI are 8(eight) per week. 4(four) periods per paper per week for semester III.
2. Total teaching periods for paper - VII, VIII are 8(eight) per week. 4(four)periods per paper per week for semester IV.
3. Total teaching periods for practical course in mathematics 4(four) periods per week per batch of 20 students.

Scheme of Examination:

Theory

- The theory examination shall be conducted at the end of each semester.
- The theory paper shall carry 40 marks and internal evaluation shall carry 10 marks.
- The practical examination shall be conducted at the end of each year.
- The practical paper shall carry 100 marks.
- The evaluation of the performance of the student in theory shall be on the basis of examination.

Nature of theory question paper

- As per regular B.Sc. Programme.

Practical

- The practical paper shall carry 100 marks.
- There shall be five questions carrying 25 marks each.
- Student has to attempt three questions.
- Questions no.1 is compulsory
- Student has to choose Any two questions from questions no.2 to questions no.5
- 10 marks for certified journal and 15 marks for viva.
- The duration of practical examination will be four hours.

Nature Of Practical Question Paper

Question Number	Title	Marks
1	a) Program writing (Bisection/ Regula-Falsi/ Newton-Raphson) b) Execution and output writing Or a) Program writing (Trapezoidal/ Simpson's $^1/_3$/ Simpson's $^3/_8$, Weddle's) b) Execution and output writing	15 10 15 10
2	a) Eigen Values Eigen Vectors/ Diagonalizable Matrix b) Gauss Elimination/ Gauss-Jordon or a) Bisection b) Trapezoidal/ Simpson's $^1/_3$/ Simpson's $^3/_8$	15 10 15 10
3	a) Gram Schmidt process b) Cayley-Hamilton Theorem or a) Newton's Forward/ Newton's Backward/ Lagrange's Interpolation b) Regula-Falsi/ Newton-Raphson	15 10 15 10
4	a) Plane Linear Transformation (Scaling/ Shearing/ Rotation/ Reflection/ Translation) b) Space Linear Transformation or a) Initial solution of transportation problem b) Assignment Problem (Minimization)	15 10 15 10
5	a) Plane Linear Transformation (Rotation about arbitrary point, Reflection through arbitrary line) b) Plane Curve or a) MODI/ Maximization in Transportation Problem/ Unbalanced Transportation Problem b) Maximization in Assignment Problem/ Unbalanced Assignment Problem	15 10 15 10