

**Department of Computer Science**

**Gujarat University**

**5 Year Integrated**

**M. Sc.**

**(Computer Science)**

**Scheme & Syllabus**

**Effective From: September 2021**

**Integrated M.Sc. (Computer Science)**  
**Course Structure ( Semester –I & Semester-II)**  
**(With Effect from SEPTEMBER, 2021)**

Course Type		Subject Names & Credits	Total Credits
<b>Semester-I</b>	Core Courses	<ul style="list-style-type: none"> <li>• MSCCC111-Mathematical Foundation (4)</li> <li>• MSCCC112-Fundamentals of Computer Organization (4)</li> <li>• MSCCC113- Fundamentals of Programming (4)</li> <li>• MSCCC114- Fundamentals of Internet and Client-Side Scripting (4)</li> <li>• MSCCC115-Fundamentals of Programming – Practical (2)</li> <li>• MSCCC116-Fundamentals of Internet and Client-Side Scripting – Practical (2)</li> </ul>	<b>20</b>
	Ability Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSAE111-Environmental Studies-I (2)</li> </ul>	<b>2</b>
	Skill Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSSE111-Software Lab (4)</li> </ul>	<b>2</b>
	Discipline Specific Elective Courses		—
	Generic Elective Courses		—
	<b>Semester-I (Total Credits)</b>		<b>24</b>
<b>Semester-II</b>	Core Courses	<ul style="list-style-type: none"> <li>• MSCCC121-Linear Algebra (4)</li> <li>• MSCCC122-Advanced Programming (4)</li> <li>• MSCCC123-Database Management Systems-I (4)</li> <li>• MSCCC124-Networking Essentials (4)</li> <li>• MSCCC125-Advanced Programming – Practical (2)</li> <li>• MSCCC126-Database Management Systems-I -Practical (2)</li> </ul>	<b>20</b>
	Ability Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSAE121-Environmental Studies-II (2)</li> </ul>	<b>2</b>
	Skill Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSSE121-Front End Web Development (4)</li> </ul>	<b>2</b>
	Discipline Specific Elective Courses		—
	Generic Elective Courses		—
	<b>Semester-II (Total Credits)</b>		<b>24</b>

**SCHEME FOR INTEGRATED M. Sc. (COMPUTER SCIENCE)****SEMESTER - I of M.Sc. (Computer Science)**

Applicable from September 2021 onwards

Course		Hours per week							Credits	
No.	Name	Theory	Practical	Internal	Total	Lectures	Others (Tutorials)	Practical	Total	
MCSCC111	Mathematical Foundation	70	--	30	100	3	1	--	4	4
MCSCC112	Fundamentals of Computer Organization	70	--	30	100	3	1	--	4	4
MCSCC113	Fundamentals of Programming	70	--	30	100	4	--	--	4	4
MCSCC114	Fundamentals of Internet and Client-Side Scripting	70	--	30	100	4	--	--	4	4
MCSCC115	Fundamentals of Programming – Practical	--	35	15	50	--	--	4	4	2
MCSCC116	Fundamentals of Internet and Client-Side Scripting - Practical	--	35	15	50	--	--	4	4	2
MCSSE111	Software Lab	--	35	15	50	--	--	8	8	2
MCSAE111	Environmental Studies-I	35	--	15	50	2	--	--	2	2
<b>Total</b>		<b>315</b>	<b>105</b>	<b>180</b>	<b>600</b>	<b>16</b>	<b>2</b>	<b>16</b>	<b>34</b>	<b>24</b>

Theory/Tutorial Credits → 1 Hour = 1 Credit,

Practical Credits → 2 Hours = 1 Credit

**SCHEME FOR INTEGRATED M. Sc. (COMPUTER SCIENCE)**  
**SEMESTER - II of M.Sc. (Computer Science)**  
**Applicable from September 2021 onwards**

Course		Hours per week								Credits
No.	Name	Theory	Practical	Internal	Total	Lectures	Others (Tutorials)	Practical	Total	
MCSCC121	Linear Algebra	70	--	30	100	3	1	--	4	4
MCSCC122	Advanced Programming	70	--	30	100	3	1	--	4	4
MCSCC123	Database Management Systems-I	70	--	30	100	4	--	--	4	4
MCSCC124	Networking Essentials	70	--	30	100	4	--	--	4	4
MCSCC125	Advanced Programming – Practical	--	35	15	50	--	--	4	4	2
MCSCC126	Database Management Systems-I -Practical	--	35	15	50	--	--	4	4	2
MCSSE121	Front End Web Development	--	35	15	50	--	--	8	8	2
MCSAE121	Environmental Studies – II	35	--	15	50	2	--	--	2	2
<b>Total</b>		<b>315</b>	<b>105</b>	<b>180</b>	<b>600</b>	<b>16</b>	<b>2</b>	<b>16</b>	<b>34</b>	<b>24</b>
<b>Total</b>	<b>Semester 1+2</b>	<b>630</b>	<b>210</b>	<b>360</b>	<b>1200</b>	<b>32</b>	<b>4</b>	<b>32</b>	<b>68</b>	<b>48</b>

Theory/Tutorial Credits → 1 Hour = 1 Credit,

Practical Credits → 2 Hours = 1 Credit

## **Course Name: Mathematical Foundation**

### **Course Code: MCSCC111**

#### **Objectives:**

The aim of this course is to enable students to

- Introduce the concepts of sets, relations, co-ordinate geometry, calculus and data representation
- Apply these concepts to real life problems and machine learning problems

#### **Prerequisites:**

Basic knowledge of Mathematical fundamentals

#### **Contents:**

##### **1. Set theory**

Basic concepts, terminology and notations, order of a set, inclusion and equality of sets, operations on set, Venn diagram, basic set identities, properties of set operations, De-Morgan's law, power set, ordered pairs, Cartesian product, n-tuples, relation, binary relation, examples, graphical representation of relations

##### **2. Co-ordinate Geometry (2-dimensional)**

Co-ordinates of a point, distance between two points, straight line, general equation of a straight line, slope and intercept of a line, plotting of the line, section of a line, parallel and perpendicular lines, angle between two lines, Area of a triangle

##### **3. Functions**

Functions of single variable, definition and their graphs, types of functions (one-one, many-one, onto), identity function, constant, modulus, greatest integer, floor, ceiling, step functions, composition of functions, recursively defined function, inverse function, special functions like polynomials, trigonometric, exponential, logarithm, hyperbolic functions; limit and continuity of a function at a point

##### **4. Single variable Calculus - I**

Definition of derivative and its graphical meaning, rules of differentiation, chain rule, higher order derivatives, Optimization of functions of: Local Maxima and minima of functions, saddle point, necessary and sufficient conditions, global maxima, convex function, other applications of differentiation

##### **5. Single variable Calculus - II**

Definition of integration, and its geometric interpretation, indefinite and definite integral, rules of integration, integration by substitution and integration by parts, fundamental theorem of integral calculus, applications of integration

**References:**

1. J.P. Trembly, R. Manohar, "Discrete Mathematical Structures with applications to Computer Science", McGraw Hill Education
2. Erwin Kreyszig, "Advanced engineering Mathematics", 10<sup>th</sup> edition, John Wiley and sons
3. David C. Lay, "Linear Algebra and its applications", 3<sup>rd</sup> edition, Pearson
4. Dr. Chandrika Prasad, "Advanced Mathematics for engineers", Pothishala Private Ltd.

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Develop problem solving skills using mathematics techniques such as geometry, calculus and functions Solve problems using computers through C programming language
- Interpret, analyze and represent real life data into mathematical models
- Gain knowledge of Usage of mathematical models in various computer science domains such as artificial intelligence, network security, tend analysis and many more

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## **Course Name: Fundamentals of Computer Organization**

### **Course Code: MCSCC112**

#### **Objectives:**

The aim of this course is to enable students to

- Understand the elements of Computer Organization and Architecture
- Gain the basic knowledge necessary to understand the hardware operations of digital computers

#### **Prerequisites:**

None

#### **Contents:**

##### **1. Basics of a Digital Computer**

History of Computing, Development of BOMBE, Atanasoff-Berry Computer, Components of Digital Computers, Types of Computing Devices, Moore's Law, Huang's Law

##### **2. Number Systems**

Decimal System, Bistable Device, Binary, Octal and Hexadecimal numbers, Number Base conversions, Binary Addition, Subtraction, Multiplication, Division, Complements - Use of complements to represent Negative Numbers, Binary Number Complements, Complements in other Number Systems, Binary codes -Weighted and Non-weighted codes -BCD Code, Excess Three (XS-3) Code, Gray Code, Binary to Gray&Gray to Binary - Error detecting and correcting codes - Parity and Hamming code

##### **3. Boolean Algebra and Logic Gates**

Fundamental Concepts of Boolean Algebra, Logical Multiplication, AND & OR gates, Complementation & Inverters, Evaluation of Logical Expressions, Basic Laws of Boolean Algebra, Proof by Perfect induction, Simplification of Expressions, De Morgan's Theorems, Basic duality of Boolean Algebra, Derivation of a Boolean Expression, Interconnecting gates, Sum of Products and Product of Sums, Derivation of Product-of-Sums expressions, Derivation of Three input variable expressions, NAND & NOR gates, Map Method for Simplifying Expressions - K-map ( Four Variables), Cubes & covering, Don't Cares, Design Using NAND Gates, Design Using NOR Gates, NAND to AND & NOR to OR gate Networks

##### **4. Logic Design**

Flip-Flops, Transfer Circuit, Clocks, Flip-Flop Designs, Gated Flip-Flop, Master Slave Flip-Flop, Shift Register, Binary Counter, BCD Counter, Counter Design

##### **5. The Arithmetic-Logic Unit**

Construction of the ALU, Integer Representation, Binary Half-Adder, Full-Adder, Parallel

Binary Adder, Positive & Negative Numbers, Addition in the 1'S Complement System, Addition in the 2'S Complement System, Addition and subtraction in a parallel Arithmetic Element, Binary Coded Decimal Adder, Shift Operations, Binary Multiplication, Binary Division

#### **6. Digital Components**

Integrated Circuits, Decoders - NAND gate Decoder, Decoder Expansion, Encoders, Multiplexers, Memory Units - Random-Access Memory, Read-Only Memory, Types of ROMs

#### **7. Central Processing Units & Memory Organization**

Stack Organization (Intro.), Instruction Formats, Addressing modes, Memory Hierarchy, Main Memory - RAM, ROM, Bootstrap Loader, Auxiliary Memory - Magnetic Disk, Magnetic Tape, SSD Storage, M.2 Storage, Flash Drive, Overview of Cache Memory, Introduction to Virtual Memory

#### **8. Input-Output Organization & Peripheral Devices**

Peripheral Devices, Asynchronous Data Transfer, Handshaking, Modes of Transfer - Programmed I/O, Interrupt-initiated I/O, Direct Memory Access (DMA), Direct Memory Access (DMA), Keyboard, Mouse, Display Unit, Printer (Types), Scanner, OCR-OMR-MICR, Multimedia Projector

### **References:**

1. Thomas C. Bartee , "Digital Computer Fundamentals", Tata McGraw Hill, 6th Edition
2. M. Morris Mano, "Computer System Architecture", PHI/Pearson Education, 3rd Edition
3. V. Rajaraman& N. Adabala, "Fundamentals of Computers", , 6th Edition, PHI
4. A. Anand Kumar, "Fundamentals of Digital circuits",PHI/Pearson education

### **Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Apply the knowledge of computer organization and architecture for effective programming
- Gain the knowledge of the actual working and organization of digital computer system
- Troubleshoot the computers

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## **Course Name: Fundamentals of Programming**

### **Course Code: MCSCC113**

#### **Objectives:**

The aim of this course is to enable students to

- Understand the rudiments of programming to the students
- Get familiar with problem solving techniques and algorithm development using computers
- Solve problem using modular programming
- Understand structured programming using C, a high-level programming language

#### **Prerequisites:**

None

#### **Contents:**

##### **1. Introduction to programming & Basics of C**

Concepts of Algorithm and Flowcharts, Process of compilation, Generation of languages, Basic features of C Language like Identifier, Keywords, Variable, data types, Operators and Expression. Basic screen and keyboard I/O

##### **2. Control Statements**

Simple statements, Test Conditions, Conditional execution and selection, Iteration and Repetitive Executions, Nesting of control structures, , break and continue , goto statement

##### **3. Arrays**

Introduction to contiguous data types. One dimensional array, Multidimensional arrays, Array as strings, multidimensional character arrays, Operations on strings. Sorting, Searching, Merging

##### **4. Functions**

Concept of modular programming, Using functions, Scope of data, Recursive functions, Command line arguments

##### **5. Other features of C**

Bitwise operators and its usage, C Preprocessor Statements

**References:**

1. Pradip Dey & Manas Ghosh, "Programming in C", Oxford Press
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", Thomson Education
3. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill
4. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Education
5. Venugopal& Prasad , "Mastering C", Tata McGraw Hill
6. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill
7. YashwantKanitkar, "Let us C", BPB Publication

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Perform good problem solving and algorithm development skill
- Solve problems using computers through C programming language

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## **Course Name: Fundamentals of Internet and Client-Side Scripting**

### **Course Code: MCSCC114**

#### **Objectives:**

The aim of this course is to enable students to

- Understand the rudiments of Internet as a global resource
- Gain knowledge on Internet related activities
- Understand the basic activities related to Internet and the basic knowledge for design of the web page / site
- Create static websites

#### **Prerequisites:**

None

#### **Contents:**

##### **1. Introduction to Internet**

Introduction, Evolution and history of Internet, Growth of Internet, Owners of Internet, Internet Services, How does the internet work, Anatomy of Internet, Internet Addressing, Internet Vs Intranet, Impact of Internet, Governance of Internet

##### **2. Internet Technology & Protocol**

Past and present Digital Network, Basic Communication, Local Area Network, Introduction to ISO-OSI Reference model and TCP/IP protocol suite, Wire Area Network Technologies , U.S. Department of Defense Networking Research, Arpanet Backbone, Open communications, Growth of Internet

##### **3. Internet Connectivity**

Wide Area Networks, Data transmission, Network protocols, Building a Global Network, Internet Terminologies, Types of Networks, different types of connections, Levels of Internet connectivity, Internet service provider, Internet account by ISP, Internet access through Broadband and Wireless, Understanding clients and servers, Getting connected, Wireless Routers.

##### **4. Email, WWW and Web Browser**

Introduction to Email, Functionality and Significance, Mailboxes and Email addresses, Personal computers and Email providers, fees and Access, Email delay and retry attempts, Mailing lists, Undisclosed recipients, World Wide Web Introduction, Browsers and Web Servers, URLs and their meanings, Evolution of web, Basic elements of www, web browsers, search engines, search criteria.

**5. Internet Tools and Multimedia**

Hypermedia, Page with multimedia items, Different categories of multimedia elements, Animation, Fetching multiple items in browser, Current trends on Internet, Interactivity tools, multimedia and animation , Voice and Video Communication(Voip)

**6. Web Publishing**

Web publishing, Standard Generalize Markup Language (SGML), Core OpenGL (CGL), web page design, Social Networking and Personal Publishing, Growth in Internet Publishing.

**References:**

1. Douglas E. Comer, "The Internet Book", 5<sup>th</sup> Edition, CRC Press.
2. Douglas E. Comer, "Computer Networks and Internets", Pearson
3. Laura Le May, "Mastering HTML, CSS & JavaScript Web Publishing", BPB Publications

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Effectively use the Internet for both information retrieval and data transfer
- Understand the client server relationships between Web servers and Web browsers
- Understand the domain name concept and services, Internet addressing and URLs
- Setup Internet network platforms
- Plan and manage the back-end infrastructure of a small-to medium-size Web site

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## **Course Name: Fundamentals of Programming - Practical**

### **Course Code: MCSCC115**

#### **Objectives:**

The aim of this course is to enable students to

- Introduce the rudiments of programming to the students
- Enable student to solve problem using modular programming
- Make use of the programming principles to develop programs

#### **Prerequisites:**

None

#### **Contents:**

1. Introduction to Programming Environment - Editor, Compiler, Debugging and error detection technique
2. Writing programs to implement comments, constants, variables, data types and operators
3. Writing programs to implement control statements like conditional and looping statements
4. Writing programs to implement one dimensional array and two dimensional array
5. Writing programs to implement string and mathematical functions
6. Writing programs to implement user defined functions

#### **References:**

1. Pradip Dey & Manas Ghosh, "Programming in C", Oxford Press
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", Thomson Education
3. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill
4. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Education
5. Venugopal & Prasad, "Mastering C", Tata McGraw Hill
6. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill
7. YashwantKanitkar, "Let us C", BPB Publication
8. Byron Gottfried, "Schaum's Outline of Programming with C", Shaum Series

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Use programming environment to create , compile, debug and execute C programs
- Acquire logical thinking, Implement the algorithms and analyze their complexity, Identify the correct and efficient ways of solving problems.

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## **Course Name: Fundamentals of Internet and Client-Side Scripting – Practical**

### **Course Code: MCSCC116**

#### **Objectives:**

The aim of this course is to enable students to

- Create static websites
- Learn the usage of CSS for web development
- Learn the usage of Java Script for web development

#### **Prerequisites:**

Basic knowledge of working with Computer

#### **Contents:**

##### **1. HTML**

Introduction to HTML, HTML Page structure, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags, Elements of HTML: Working with Text, Working with Lists, Tables and Frames, Working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

##### **2. Cascading Style Sheets (CSS)**

Introduction to CSS, Concept of CSS, Creating Style Sheet, Style sheets with HTML , Types of CSS, CSS Properties & Value, CSS Styling (Background, Text Format, Controlling Fonts, Color), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties), CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Attribute selector)

##### **3. JavaScript**

Introduction to JavaScript, variable, operators, expression, data types, array, branching statement, iterative statement, built in objects (document, data, string, window, math) and their functions, user defined functions, Objects, DOM Architecture, Events

#### **References:**

1. Laura Le May, "Mastering HTML, CSS & JavaScript Web Publishing", BPB Publications
2. Julie C. Meloni, "Mastering HTML, CSS & JavaScript", BPB Publications
3. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML, PHP", BPB Publications
4. Official Documentation: <https://developer.mozilla.org/en-US/docs/Learn>

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Develop working expertise of static web development using the concepts of HTML, CSS and JavaScript
- Design a simple web page/web sites using Hypertext Markup Language (HTML)
- Implement CSS to design creative website(s)
- Implement Java Script for dynamic website design

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**Course Name: Software Lab**

**Course Code: MCSSE111**

**Objectives:**

The aim of this course is to enable students to

- Understand the fundamentals of the functioning of a computer
- Get an Insight of Basic and widely used operating systems like DOS and Windows
- Gain understanding of the various software packages available for use such as Microsoft Office suite of programs for effective representation and analysis of data

**Prerequisites:**

None

**Contents:**

**1. Disk Operating System (DOS)**

What is DOS ?, configuring DOS, working at command prompt, commands and programming, data organization in DOS, managing directories, DOSKEY, copying and moving files, file management, formatting and unformatting disks, disk management, DOS Editor, batch programs and macros

**2. Windows Operating System**

Introduction to Windows basic, Using the Windows interface effectively, working with files and folders, viewing and managing files and folders, configuring, customizing and optimizing Windows, using Control Panel, customizing the taskbar, start menu, desktop, keyboard settings and mouse settings, creating and customizing shortcuts, configuring the Recycle Bin, file and data management, using and customizing Windows Explorer, using Windows interface to create, installing and uninstalling applications and devices, print and store a file, , Set up password protected file sharing, managing system resources, disk defragmenter, understanding and using digital certificates

**3. Overview of latest web technologies**

Introduction to Web and Email, Introduction to Google Workspace products like Gmail, Forms, Drive, Meet, Calendar, Google Docs suite for content creation and google classroom as workspace for education. Introduction to e-Learning resources.

**4. Microsoft Office**

Introduction to MS-Office suite of programs, file management, using common office tools

- I. MS-Word : Laying out text, laying out the page, speeding text entry, quick text changes, using scroll bar, using Go To command, viewing files, techniques for entering text and graphics, finding and replacing text and other things, using textboxes, border, shading and color, creating numbered and bulleted lists, adding “text effects”, creating and removing columns, working with tables, macros, using mail merge, managing footnotes and endnotes, using headers and footers, page numbering, inserting captions, forging cross-references, paragraph and character styles, creating and applying styles, constructing Word templates, using hyperlinks, table of contents and indexes, using spell check, grammar and thesaurus, object linking and embedding, Protecting document: encryption, adding digital signatures, restricting final access
- II. MS-Excel : Types of data, entering, editing and erasing data, resizing rows and columns, hiding and unhiding rows and columns, formatting, auto formatting, conditional formatting, cell styles, adding comments, working with ranges, working with formulas and functions, fixing formulas, evaluating formulas, entering functions, nesting functions, recording, storing and using macros, understanding data series and categories, using the chart wizard, adjusting data on charts, formatting charts, mixing different types of charts in the same chart, filtering data with auto filter and advanced filter, sorting data, working with lists, Pivot Tables and Pivot Charts, using PivotTable wizard, creating one-variable and two-variable data tables, what-if analysis using Goal Seek and Scenario, Forecast Sheet, working with Add-ins, protecting and unprotecting a worksheet and a workbook
- III. MS-PowerPoint : Creating a presentation with AutoContent wizard, with a template and from scratch, inserting, deleting, rearranging and copying slides, using numbers and bullets, customizing and sprucing up presentations by adding images, slide transitions, animation schemes, including graphs, charts, tables, columns, sound and video, creating and modifying WordArt objects, managing headers and footers, using Action buttons, using Masters like the Slide Master, Handout Master and Notes Master, creating slide shows, rearranging and hiding slides, adding comments, moving between slides, setting up the slide show, custom slide show, using recording narration, creating self-running presentations, using Pack and Go wizard, printing slides, speaker notes, handouts - an outline
- IV. MS-Access : Introduction to database, tables, records, fields, forms, queries, modules and reports, creating a database with the Database wizard and from scratch, creating tables, defining data types and its properties, validation rule, type of text boxes(e.g list, combo), refining and

customizing a table, understanding and creating relationships and indexes, entering data in datasheet view or through form, using form views, controlling form appearance using Auto Format, binding a form to data, working with controls, exporting of data to other programs and databases, sorting, filtering and querying data, using select queries, action queries, customizing queries, creating forms and its layouts, creating and printing reports. Creating the Switchboard

### References:

1. Peter Norton's, "Complete Guide to DOS 6.22", Sixth Edition, Techmedia
2. John Monyjok Maluth, "Windows 7 For Beginners: The Beginner's Guide to Microsoft Windows 7 (ICT Basics)", Kindle Edition, Discipleship Press
3. Woody Leonhard, "Windows 7 All-in-One For Dummies", 1st Edition, Wiley publishing Inc.
4. Matthew Buxton, "Windows 7 Superguide", 2nd edition, ACEL Systems
5. Joe Habraken, "Microsoft Office 2019 Inside Out", 1st Edition, Pearson Education Inc.
6. Beth Melton, Mark Dodge, Echo Swinford, Andrew Couch, Eric Legault, Ben M. Shorr, Ciprian Adrian Rusen, "Microsoft Office Professional 2013 Step by Step", O'Reilly Media, Inc.
7. Douglas E. Comer, "The Internet book: everything you need to know about computer networking and how the Internet works", 5<sup>th</sup> edition, CRC Press
8. Mary Lemons, "Microsoft Access 2016", Wiley publishing Inc.

### Accomplishments of the student after completing the Course:

At the end of the course, students will be able to

- Work in both Command Line Interface (DOS) and Graphical User Interface (Windows) environment with ease
- In a position to create one's own document, perform analysis using a spreadsheet, prepare exotic presentations, and also be able to work with databases
- In a position to search for information on the Internet, read and send emails and communicate effectively over the Web

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**Course Name: Environmental Studies - I**

**Course Code: MCSAE111**

**Objectives:**

The objective of the course is to enable students to

- Understand key concepts of environmental studies
- Understand ecosystems and natural resources
- Conserve biodiversity and control pollution
- Understand environmental policies and practices

**Prerequisites:**

None

**Contents:**

**1. Introduction**

The Multidisciplinary Nature of Environmental Studies, Components of the Environment, Scope and Importance of Environmental Studies, Concept of Sustainability and Sustainable Development

**2. Ecosystems and Natural Resources**

Overview of Ecosystems, Structure and Function of Ecosystems, Energy Flow in Ecosystem, Food Chain, Food Web and Ecological Succession, Case Studies of Ecosystems, Degradation of Ecosystems, Renewable and Non-Renewable Resources, Deforestation, Role of an Individual in the Conservation of Natural Resources

**3. Biodiversity and Conservation**

Levels of Biological Diversity, Biogeographic Zones of India, India as a Mega-diversity Nation, Threats to Biodiversity, Ecosystem and Biodiversity Services

**4. Environmental Pollution**

Introduction to Environmental Pollution, Air Pollution, Water Pollution, Soil Pollution, Chemical Pollution, Noise Pollution, Nuclear Hazards and Human Health Risks, Solid Waste Management, Waste to Energy Methodologies, Case Studies on Pollution, Role of an Individual in the Prevention of Pollution, Field Work

**References:**

1. Bharucha Erach, *“Textbook of Environmental Studies for Undergraduate Courses”*, Universities Press
2. Hawkins R.E., *“Encyclopedia of Indian Natural History”*, Bombay Natural History Society, Bombay
3. Agarwal K.C., *“Environmental Biology”*, Nidi Publ. Ltd., Bikaner
4. Jadhav, H &Bhosale, *“Environmental Protection and Laws”*, Himalaya Pub. House, Delhi
5. Miller T.G. Jr., *“Environmental Science”*, Wadsworth Publishing Co.
6. Basu, M. and Xavier, S., *“Fundamentals of Environmental Studies”*, Cambridge University Press
7. Enger, E. and Smith, B., *“Environmental Science: A Study of Interrelationships”*, McGraw-Hill Higher Education
8. Wanger K.D., *“Environmental Management”*, W.B. Saunders Co., Philadelphia

**Accomplishments of the student after completing the course:**

At the end of the course, students will be able to

- Appreciate the policies and practices to preserve environment
- Preserve the ecosystem and biodiversity
- Help the society in controlling pollution
- Use the natural resources wisely

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**Course Name: Linear Algebra****Course Code: MCSCC121****Objectives:**

The aim of this course is to enable students to

- Learn the Concepts of Matrices, Vectors, data representation and Linear Algebra
- Interpret, analyze and represent real life data into mathematical models
- Develop the identification and problem solving skills using techniques of linear algebra in different domains of applications like data science, machine learning, graphs and networks, optimization problems, image processing, computer vision
- Demonstrate the understanding of underlying principles and solve unseen problems needing applications of the methods taught

**Prerequisites:**

Basic knowledge of Mathematical fundamentals

**Contents:****1. Functions of several variables**

Limit and continuity, partial differentiation, higher order partial derivatives, total derivative, partial differentiation of composite functions, chain rule differentiation of implicit functions, homogeneous functions, Euler's theorem on homogeneous function of two variables, Jacobian.

**2. Fundamentals of Vectors**

Definition of vector, scalars, addition and subtraction of vectors, scalar multiplication, inner product (dot product) of vectors, Norms, direction, orthogonal vectors, projection of vectors, cosine similarity, normal and orthonormal vectors, Gram-Schmidt Procedure, Orthogonal Decomposition

**3. Vector Spaces**

Spaces and Subspaces, Null Space, row space and column space, linear transformations, linear independence, basis vectors, linear combination, dimension, linear span, change of basis, invariant subspace

**4. Introduction to Matrices**

Definition, addition of two matrices, transpose, scalar multiplication, matrix multiplication, properties of matrix addition and multiplication, square matrix, null and identity matrix, determinant of a square matrix and its properties, invertible matrix and inverse, Rank, trace, popular types of matrices like symmetric, diagonal, orthogonal matrix, orthonormal matrix

**5. Eigen Values and Eigen Vectors**

Characteristic Equation of a matrix, Properties of Eigen values and Eigenvectors, Diagonalization of symmetric matrices, Orthogonal Diagonalization, Singular Value Decomposition, Principal Component Analysis

**6. Algebraic systems**

Divisibility, prime numbers, greatest common divisor, congruences, modular arithmetic, algebraic structure, groups, cyclic groups, algebraic systems with two binary operations: rings, Integral domain, Field, Finite fields, algebraic operations on polynomials, Galois fields  $GF(2^n)$

**References:**

1. Erwin Kreyszig, "*Advanced engineering Mathematics*", 10<sup>th</sup> Edition, ISV, John Wiley and sons, INC
2. Gilbert Strang, "*Linear Algebra and its applications*", 4<sup>th</sup> Edition, Cengage Learning
3. David C. Lay, "*Linear Algebra and Its Application*", 3<sup>rd</sup> Edition, Pearson
4. Discrete mathematical structures with applications to computer science / J.P. Trembly, R. Manohar
5. Discrete Mathematics and its applications, Kenneth H. Rosen, Pearson Education
6. Dr. Chandrika Prasad, "*Advanced Mathematics for engineers*", Pothishala Private Ltd.
7. V. Rajaraman, "*Computer Oriented Numerical Methods*", Prentice Hall India Learning Private Limited

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Find roots of an equation using numerical methods
- Carry out matrix operations, solve systems of linear equations using multiple methods, demonstrate understanding and knowledge of vector space, subspace, basis, span, linear independence, determine eigenvalues, eigenvectors and solve dimensionality reduction problems

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**Course Name: Advanced Programming**

**Course Code: MCSCC122**

**Objectives:**

The aim of this course is to enable students to

- Learn how to structure data efficiently
- Understand the concept of pointer and its applications in programming
- Learn how to allocate and free memory dynamically, and to control dynamic arrays of any type of data in general and structures in particular
- Store and manage data in files
- Understand and create and manipulate linked lists

**Prerequisites:**

Fundamentals of Programming

**Contents:**

**1. Pointers**

Need of pointer, Types and uses of pointer, pointer arithmetic, Array and Pointers, Pointers and strings, Pointer to Pointer, Pointers and functions, other aspect of Pointers. Use of pointers, Advantages of using pointers

**2. User Defined Data Types**

Structures, Declaring structures and structure variables, Accessing the members of a structure, Initialization of structures , Copying and comparing structures, Typedef and its use in structure Declarations, Nesting of structures, Arrays of structures, Initializing arrays of structures, Arrays within the structure , Structures and pointers, Structures and functions, Union and its usage, Declaring a union and its members, Accessing and initializing the members of a union , Structure versus Union , Enumeration types, Bitfields

**3. Files**

Types of files, using files in c, Working with text, Working with binary files ,Direct file input and output, Sequential versus random file access , files of records, Working with files of records, Random access to files of records, Other file management functions - Deleting a file, Renaming a file , Command line arguments

**4. Dynamic Memory Allocation**

Introduction to dynamic memory allocation, Allocating memory dynamically, resizing and releasing dynamically allocated memory

**5. Linked List**

Creating linked structures, Singly link list, Operations on singly link list. Applications of singly linked list

**References:**

1. Pradip Dey & Manas Ghosh, "Programming in C", Oxford
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", Thomson Education
3. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill
4. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Education
5. Venugopal & Prasad, "Mastering C", Tata McGraw Hill
6. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill
7. Yashwant Kanitkar, "Let us C", BPB Publication
8. Byron Gottfried, "Schaum's Outline of Programming with C", Schaum Series

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Develop structured, modular and memory efficient programs in 'C' with an eye on executional efficiency using structured data types, functions, pointers and data files.
- To represent real time objects and manipulate them using memory optimization dynamically

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## **Course Name: Database Management Systems-I**

### **Course Code: MCSCC123**

#### **Objectives:**

The aim of this course is to enable students to

- Understand the basics of Data Storage and Database structure
- Design ER Diagrams
- Design Data Models
- Perform SQL queries on Databases
- Enforce constraints on Data Models

#### **Prerequisites:**

Basic knowledge of working with Computer

#### **Contents:**

##### **1. Introduction**

*Basic Concepts:* data, database, database systems, database management system, Purpose and advantages of Database management system (over file systems), data models: Introduction, Three level architecture, Overall architecture of DBMS, Various components of a DBMS

##### **2. Data Modelling/Conceptual Design**

Entity sets, attributes and keys, Types of entities, Relationships (ER) and Types of relationships, Database modelling using entity and relationships, Enhanced entity-relationship diagrams

##### **3. Relational Data Model**

Relational structure - tables (relations), rows (tuples), domains, columns (attributes), keys: super key, candidate keys, primary key, entity integrity constraints, referential integrity constraints

##### **4. Data Dictionary**

Introduction to data dictionary, Usage of data dictionary

##### **5. Database Design**

Relational structure - tables (relations), rows (tuples), domains, columns (attributes), keys: super key, candidate keys, primary key, entity integrity constraints, referential integrity constraints, Database design process, Anomalies in a database, Functional Dependencies(Lossless decomposition, Dependency preservice, Closure set of FD,

Canonical cover, Lossless Joins ), Finding Candidate keys using Armstrong rules, *Stages of Normalization*: 1NF ,2NF ,3NF, BCNF ( with general definition also) and Multi-valued Dependency : 4NF & 5NF( Project Join NF)

Translation of E-R schemes (logical design) to relational schemes (physical design): A case study

#### 6. Relational Algebra

Basic operators (Select, project, union, set, difference, Cartesian product and rename)

Additional operators (Set interaction, Natural Join, Division and Assignment operator), Insert, Update, Delete operators

#### References:

1. S. Sudarshan, H.F. Korth, A. Silberschatz, "Database System Concepts", McGraw Hill
2. Ramakrishnan, Gehrke, "Database Management Systems", 3<sup>rd</sup> Edition, McGraw Hill
3. Peter Rob, Carlos Coronel, "Database Systems: Design, Implementation and Management", 7<sup>th</sup> Edition, Thomson Course technology
4. S.K.Singh, "Database Systems: Concepts, Design and Applications", Pearson Education

#### Accomplishments of the student after completing the Course:

At the end of the course, students will be able to

- Serve as an effective user or a DBMS Professional
- Effectively squeeze the "real world" data into the relational data model of the database system and would be able to retrieve the data afterwards

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**Course Name: Networking Essentials**

**Course Code: MCSCC124**

**Objectives:**

The aim of this course is to enable students to

- Study different communication methods for computer network
- Configure Computer Networks
- Troubleshoot different Computer Networks

**Prerequisites:**

Basic Knowledge of working with Computer

**Contents:**

**1. Introduction to Computer Networks**

Introduction, Network Topologies, OSI Model, Ethernet LAN, Home Networking, Assembling Office LAN, Testing & Troubleshooting a LAN

**2. Physical Layer Cabling**

Introduction, Structured Cabling, Unshielded Twisted Pair, Terminating CAT 6/5E/5 UTP Cables, Cable testing and Certification, 10 Gigabit Ethernet, Troubleshooting Cabling Systems, Overview of Optical Fibres, Nature of Light, Fibre Attenuation and Dispersion, Optical Components, Optical Networking, Safety

**3. Wireless Networking**

Introduction, The 802.11 Wireless LAN Standard, 802.11 Wireless Networking, Bluetooth, WiMAX and RFID, Securing Wireless LANs, Configuring a Point to Point Wireless LAN

**4. Inter-Connecting the LANs**

Introduction, The Network Bridge, The Network Switch, The Router, Interconnecting LANs with the Router, Configuring the Network Interface

**5. Protocol Stack**

Introduction, The TCP/IP Layers, IP and TCP Protocol Overview, IPv4 Addressing, Subnet Masks, CIDR Blocks, IPv6 Addressing, Application Layer Protocols like HTTP, DNS, E-mail protocols, FTP, DHCP, SSH, Telnet

**References:**

1. J. S. Beasley and P. Nilkaew, "Networking essentials", Pearson Education, 2012
2. G. E. Clarke, "CompTIA Network+ Certification Study Guide", McGraw-Hill, 2012
3. T. Lammle, "CompTIA Network+ Study Guide Authorized Courseware: Exam N10-005", John Wiley & Sons, 2012
4. K. Stewart, A. Adams, A. Reid, and J. Lorenz, "Designing and Supporting Computer Networks, CCNA Discovery Learning Guide", Cisco Press, 2008
5. G. Tomsho, "Guide to networking essentials", Cengage Learning, 2012
6. D. Lowe, "Networking All-in-one for Dummies", John Wiley & Sons, 2016
7. T. McMillan, "Cisco networking essentials", John Wiley & Sons, 2015

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Decide the appropriate network infrastructure
- Perform the duties of network technician
- Understand the protocol suite well and get well versed to various networking devices.

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**Course Name: Advanced Programming - Practical**

**Course Code: MCSCC125**

**Objectives:**

The aim of this course is to enable students to

- Learn how to structure data efficiently
- Understand the concept of pointer and its applications in programming.
- Learn how to allocate and free memory dynamically, and to control dynamic arrays of any type of data in general and structures in particular.
- Store and manage data in files
- Understand and create and manipulate linked lists

**Prerequisites:**

Fundamentals of Programming

**Contents:**

1. Writing programs to implement pointers, array of pointer and pointer to string
2. Writing programs to implement pointers to user-defined functions
3. Writing programs to implement call by value and call by reference
4. Writing programs to implement user defined data type like structures and union
5. Writing programs to implement reading, writing and other operation on files
6. Writing programs to implement link list and its applications

**References:**

1. Pradip Dey & Manas Ghosh, "Programming in C", Oxford Press
2. Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", Thomson Education
3. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill
4. Ashok N Kamthane, "Programming with ANSI and Turbo C", Pearson Education
5. Venugopal & Prasad, "Mastering C", Tata McGraw Hill
6. Herbert Schildt, "C: The Complete Reference", Tata McGraw Hill
7. Yashwant Kanitkar, "Let us C", BPB Publication
8. Byron Gottfried, "Schaum's Outline of Programming with C", Shaum Series

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Develop structured, modular and memory efficient programs in C programming language.
- Implement real time applications using the power of C language features.

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## **Course Name: Database Management Systems – I (Practical)**

### **Course Code: MCSCC126**

#### **Objectives:**

The aim of this course is to enable students to

- Develop expertise of DDL and DML commands with their application on solving real time problems
- Apply filters using where clause and nested queries, integrity constraints at table level and column level and to use built-in functions including numeric, character and date functions
- Fetch data from multiple tables using different types of JOIN operations

#### **Prerequisites:**

Basic knowledge of working with Computer

#### **Contents:**

##### **1. Query languages**

Structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, Basic DDL/DML queries, views and subqueries

##### **2. Advanced SQL queries**

Advanced SQL queries based on Constraints, Sequences, Indexes, and Union, Intersect and Minus clauses

##### **3. Working with Subquery**

Joining tables in SQL for fetching desired records

##### **4. Functions and Operators**

Using Built-in functions, Operators

#### **References:**

1. Ivan Bayross & Sharnam Shah, “MySQL 5 for Professionals”, Shroff Publishers
2. S. Sudarshan, H.F. Korth, A. Silbershatz, “Database System Concepts”, McGraw Hill
3. Ramakrishnan, Gehrke, “Database Management Systems”, 3<sup>rd</sup> Edition, McGraw Hill
4. Peter Rob, Carlos Coronel, “Database Systems: Design, Implementation and Management”, 7<sup>th</sup> Edition, Thomson Course technology
5. S.K.Singh, “Database Systems: Concepts, Design and Applications”, Pearson Education
6. MySQL Official Documentation <https://dev.mysql.com/doc/refman/5.7/en/tutorial.html>

**Accomplishments of the student after completing the Course:**

At the end of the course, students will be able to

- Serve as an effective user or a DBMS Professional
- Effectively squeeze the "real world" data into the relational data model of the database system and would be able to retrieve the data afterwards

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## **Course Name: Front End Web Development**

### **Course Code: MCSSE121**

#### **Objectives:**

The aim of this course is to enable students to

- Learn the concepts of Web Application development
- Create web page using HTML, CSS, Java Script and JQuery

#### **Prerequisites:**

Fundamentals of Internet and Web Technology, Knowledge of HTML

#### **Contents:**

##### **1. Advanced HTML**

Using new HTML5 structure elements, Styling HTML with CSS, When to Use the new HTML5 Structural elements, Text, Structuring main content areas, Adding blogpost and comments, Working with HTML5 outlines, Understand WAI-ARIA (W3C Web Accessibility Initiative's Accessible Rich Internet Applications suite), Global attributes, Removed Attributes

##### **2. Advanced Forms**

Input type, new attributes, <progress><meter> elements, backward compatibility with legacy browser, styling new form fields and error messages, overriding browser default , using Java script for DIY validation, avoiding validation, Video and Audio, Native multimedia, Codecs, Rolling custom controls, Multimedia Accessibility, Synchronizing media tracks

##### **3. Version Control System, FTP Program**

To manage files on servers, collaborate on a project with a team, share code and assets and avoid editing conflicts using Git version control system. Introduce GitHub and GitLab hosting service. Understand to manage files on servers using some FTP programs like Cyberduck, Fetch, Filezilla

##### **4. Canvas**

Canvas basics, Drawing path, Using transformers: pixels in disguise, Capturing images, Pushing pixels, Animating your canvas paintings

##### **5. Data Storage**

Storage options: Web Storage, Web SQL Database, IndexedDB

##### **6. Advanced CSS and JavaScript**

CSS: Selectors, Box Model, Backgrounds and borders, Image values and replaced content,

Text Effects, 2D/3D transformations, Animations, Multiple Column Layout, User Interface, Flexgrid

*JavaScript*: Primitive Data Types, Arrays, Loops and conditions, Functions, Objects, Browser Environment

*JQuery*: Introduction to JQuery, Traversing the DOM, Working with the DOM, Listening to DOM Events, Styling

### References:

1. Bruce Lawson and Remy Sharp, "Introducing HTML5", New Riders
2. [https://developer.mozilla.org/en-US/docs/Learn/Front-end\\_web\\_developer](https://developer.mozilla.org/en-US/docs/Learn/Front-end_web_developer)
3. Stoyan Stefanov and Kumar Chetan Sharma, "Object-Oriented Java Script"
4. Adam Boduch, Jonathan Shaffer and Karl Swedberg, "Learning JQuery", Packt
5. Ivan Bayross, "Web Enabled Commercial Application Development Using HTML, Java Script, DHTML and PHP"

### Accomplishments of the student after completing the Course:

At the end of the course, students will be able to

- Develop static web application using HTML 5 and CSS3
- Develop web application using DHTML
- Use JQuery in client side scripting language
- Use Github for Version Controlling

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**Course Name: Environmental Studies - 2**

**Course Code: MCSAE121**

**Objectives:**

The objective of the course is to enable students to

- Understand environmental policies and practices
- Understand the role of communities in environmental management
- Use computing effectively by applying concepts of green computing
- Develop ethical values towards the environment conservation

**Prerequisites:**

None

**Contents:**

**1. Environmental Policies and Practices**

Defining Policy, Climate Change, Global Warming, Ozone Layer Depletion, Acid Rain, Impacts on Human Communities and Agriculture, Environmental Law, Nature Reserves, Resource Sustainability, Principles Guiding Environmental Law, Public Perception and Participation

**2. Human Communities and the Environment**

Human Population and Growth, Carbon Footprint, Resettlement and Rehabilitation of Project-Affected Persons, Disaster Management, Environmental Movements, Environmental Ethics, Environmental Communication and Public Awareness, Visit to Local Area to Document Environmental Assets

**3. Environmental Ethics**

Ethical Use of Natural Resources, Three Views about Nature, Attitudes towards Nature, Environmental Equity, Environmental Justice, Environmental Racism, Religious Teachings about Environment, Collective Actions

**4. Green Computing**

Overview of Green Computing, Green Computing Efforts, Going Paperless, Power Measurement and Power Reduction, Electronic Waste, Recycling of Electronic Waste, Green Supply Chain, Certifications for Green Computing

### References:

1. Bharucha Erach, "Textbook of Environmental Studies for Undergraduate Courses", Universities Press
2. "Green Computing", Website: <https://mu.ac.in/wp-content/uploads/2021/03/Green-Computing.pdf>
3. Hawkins R.E., "Encyclopedia of Indian Natural History", Bombay Natural History Society, Bombay
4. Kaushik A., "Environmental Studies", New Age International Publication, New Delhi
5. Jadhav, H & Bhosale, "Environmental Protection and Laws", Himalaya Pub. House, Delhi
6. Rajgopalan R. "Environmental Studies", Oxford University Press, India
7. Basu, M. and Xavier, S., "Fundamentals of Environmental Studies", Cambridge University Press
8. Enger, E. and Smith, B., "Environmental Science: A Study of Interrelationships", McGraw-Hill Higher Education
9. Wanger K.D., "Environmental Management", W.B. Saunders Co., Philadelphia

### Accomplishments of the student after completing the course:

At the end of the course, students will be able to

- Identify procedures to reduce carbon footprint in computing
- Help the society in controlling pollution
- Apply environmental procedures and adhere to policies in daily life
- Build communities for conservation of environment

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**5 Year Integrated MSc (Computer Science)  
Semester-III  
Scheme & Course Structure  
With Effect from July, 2022**

**Course Structure with Credits**

	Course Type	Subject Names & Credits	Total Credits
<b>Semester-III</b>	Coue Courses	<ul style="list-style-type: none"> <li>• MCSCC211-Statistical Foundation (4)</li> <li>• MCSCC212-Object Oriented Concepts and Programming (4)</li> <li>• MCSCC213-Database Management Systems – II (4)</li> <li>• MCSCC214-Object Oriented Concepts and Programming - Practical (2)</li> <li>• MCSCC215-Database Management Systems – II - Practical (2)</li> </ul>	16
	Ability Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSAE211- General English (2)</li> </ul>	2
	Skill Enhancement Courses	<ul style="list-style-type: none"> <li>• MCSSE211-Project-1 (4)</li> </ul>	4
	Discipline Specific Elective Courses		—
	Generic Elective Courses	<ul style="list-style-type: none"> <li>• MCSGE211 - Open-Source Software</li> </ul>	2
	Semester-I (Total Credits)		24

## TEACHING &amp; EXAMINATION SCHEME FOR 5 YEAR INTEGRATED M. Sc. (COMPUTER SCIENCE) COURSE

	Course		Hours per week							Credits	
	No.	Name	Theory	Practical	Internal	Total	Lectures	Others	Practical		Total
<b>Semester-III</b>	MCSCC211	Statistical Foundation	70	***	30	100	3	1	***	4	4
	MCSCC212	Object Oriented Concepts and Programming	70	***	30	100	4	***	***	4	4
	MCSCC213	Database Management Systems – II	70	***	30	100	4	***	***	4	4
	MCSCC214	Object Oriented Concepts and Programming - Practical	***	35	15	50	***	***	4	4	2
	MCSCC215	Database Management Systems – II – Practical	***	35	15	50	***	***	4	4	2
	MCSAE116	General English	35	***	15	50	2	***	***	2	2
	MCSSE211	Project – I	***	70	30	100	***	2	4	6	4
	MCSGE211	Open-Source Software	35	***	15	50	2	***	***	2	2
		<b>Total</b>	<b>280</b>	<b>140</b>	<b>180</b>	<b>600</b>	<b>15</b>	<b>3</b>	<b>12</b>	<b>30</b>	<b>24</b>

**Practical - 2 hrs = 1 credit**

**Course Name: Statistical Foundation****Course Code: MCSCC211****Objectives:**

The aim of this course is to enable students to

- Obtain an intuitive and working understanding of probability and methods for the problems of analysis and prediction
- Gain experience in the implementation of methods for data analysis and prediction using a computer
- Get an appreciation of the concept of error in these methods and the need to analyze and predict it

**Prerequisites:**

Basic knowledge of Mathematics

**Contents:****1. Descriptive Statistics**

Introduction to statistics, Data, Scales of measurements, Sample vs. population, Introduction to frequency distribution, Measures of central tendency: Mean, median, mode, weighted mean, Measures of dispersion: absolute and relative measures of range, quartile deviation, standard deviation, basic mathematical properties and applications of the measures, Measures based on shape of distribution: Skewness and Kurtosis (basic concepts only, introduction using curve, possible values of these measures, relationship (distance) between mean, median, mode, Measures of association between two variables (Correlation: for paired observations only): Covariance, Types of correlation: (+ve, -ve, 0), (Linear, non-linear), Karl Pearson's correlation coefficient, its mathematical properties, regression line

**2. Introduction to Probability**

Basic probability concepts (Experiment, sample space, events, exclusive events, exhaustive events, independent events, dependent events), methods for assigning probability (Classical method, relative frequency method, subjective method, axiomatic method), events and their probability, addition rule, multiplication rule, conditional probability Posterior Probability, Bayes's theorem, Conditional Independence

**3. Probability Distributions**

Random variable, Discrete and continuous random variable, expected value and variance of random variable, Probability distribution: Joint probability distribution, Marginal Probability distribution, Conditional Probability distribution, Standard Distributions: Bernoulli distribution, Binomial distribution, Continuous probability distribution, Normal distribution

**4. Statistical Inference**

Sampling methods, Sampling distribution, central limit theorem (statement only), Hypothesis testing: Null & alternative hypothesis, Type I & II errors, one and two tailed test, rejection rule using p-value and critical value approach, Analysis of variance (1-way, two-way), Chi-square test for goodness of fit and independence

**References:**

1. Sheldon Ross , *“Numerical A First Course in Probability”*, 9<sup>th</sup> Edition, Pearson
2. Rohatgi & Saleh, *“An Introduction to Probability and Statistics”*, 2<sup>nd</sup> Edition, Wiley
3. Richard I Levin & David S Rubin, *“Statistics for Management”*, Pearson
4. J. Susan Milton & Jesse C Arnold, *“ Introduction to Probability and Statistics”*, McGraw Hill Publication

**Accomplishments of the student after completing the course:**

After completion of this course, students will be able to

- Apply probability and statistical concepts for analysis and prediction from data and able to infer the result
- Appreciate the role of statistics in the area of research

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**Course Name: Object Oriented Concepts and Programming****Course Code: MSCCC212****Objectives:**

The aim of this course is to enable students

- To differentiate between procedural and object-oriented programming
- To learn C++ as a language and various features to implement Object oriented concepts
- To learn Object Oriented principles and their application using C++

**Prerequisites:**

Knowledge of Fundamentals of Programming and Advanced Programming

**Contents:****1. Introduction to Object Oriented Programming**

Identifiers and constants (Literals), Keywords, Data Types, The Operators, New Casting Operators, The Conditional structures and Looping Constructs, The Difference between procedural language and object-oriented language, The Difference between struct and class in C++, The difference between Union and Class, Static Data members of a class, Pointer to objects and pointer to members of class, The local classes, Assigning Objects, namespace

**2. Functions**

Introduction, Inline function, Default Arguments to the function, Functions with object as parameters, Call by reference and return by reference, Prototyping and Overloading, Friend functions, Const and Volatile functions, Static functions, Private and Public functions, Function Pointers, Adding C functions to the C++ program

**3. Constructors and Destructors**

Introduction to constructors, The explicit constructors, Parameterized constructors, Having multiple constructors, Constructors with default arguments, Dynamic Initialization, Constructor with dynamic allocation, Copy constructors, The member initialization list, Destructors

**4. Operator Overloading & Template**

Introduction, Unary Operators, Binary Operators, Using Friends as operator functions, Overloading other Operators, Function Templates, Overloading a template function, Class Templates, Classes with multiple generic data types, Static data members, User defined conversion

**5. Inheritance**

The need, Defining derived class using single base class, Types of Inheritance, Derivation using public, private and protected access modifiers, The implementation of inheritance

in the C++ object model, The multiple-inheritance, Abstract classes, Composite objects (container objects)

#### 6. Runtime polymorphism by virtual functions

Compile Time and Runtime Polymorphism, Pointers to Objects, this pointer, Compatibility of Derived and base class pointers, Virtual functions, Static invocation of virtual function, Default arguments to virtual functions, Virtual destructors, Pure virtual functions

#### 7. Input/Output in C++

Need for streams, Advantages of using C++ I/O over C I/O, The C++ Predefined streams, Formatting IO, Formatting using ios members, Manipulators, Creating our own Manipulator, Text and binary streams, Opening and closing files, Dealing with text files Dealing with binary files, Providing Random Access using seek, IO Modes, Handling Errors

#### 8. The Standard Template Library

The STL (Standard Template Library) Introduction, Generic Programming, Generic Software Components, Generic Algorithms, Iterators, Containers, Algorithms

### References:

1. Bhushan Trivedi, *“Programming with ANSI C++”*, Oxford University Press
2. Sartaj Sahni, *“Data Structures, Algorithms and Applications in C++”*, Universities Press
3. E. Balagurusamy, *“Object-Oriented Programming with C++”*, McGraw Hill
4. Marshall Cline, *“C++ FAQs”*, Pearson Education
5. Stanley Lippmann, *“C++ Primer”*, Pearson Education
6. Scott Mayer, *“Effective C++”*, Addison-Wesley
7. Herbert Schildt, *“Complete Reference C++”*, McGraw Hill
8. ePgPathshala, *“Subject: Information Technology – P=01. Object Oriented Concepts and Programming using C++”*,  
<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iLkSuZZ5a+koxhsE1m+YjQ==>

### Accomplishments of the student after completing the Course:

After completion of this course, students will be able to

- Understand and appreciate the Object-Oriented approach of programming
- Get aware of the working and architectural model of C++
- Solve problems given to him/her using C++ with keeping balance between efficiency and flexibility

**Course Name: Database Management Systems-II****Course Code: MCSCC213****Objectives:**

The aim of this course is to enable students

- To implement the query optimization and transaction management for effective database design

**Prerequisites:**

Knowledge of fundamentals of Database design

**Contents:****1. Query Processing and Optimization**

Overview, Query interpretation, Equivalence of expressions, Join strategies for parallel processing, Algorithm for executing query operations, Heuristics of Query Optimization cost estimation of queries, Basic query optimization strategies: Selection operation, Sorting, Join operation

**2. Transaction Processing and Concurrency control**

Transaction concepts: Transaction execution and Problems, Transaction execution and control with SQL, Transaction properties, Transaction log, Concurrency control , Locking methods for concurrency control, Timestamp methods for concurrency control, Optimistic methods for concurrency control ( Read phase, validation phase, Write phase), Deadlock handling - detection and resolution

**3. Database backup and Recovery**

Need of Database backup, Database backup techniques, Types of Database failures, Types of Database recovery (Forward recovery, Backward recovery, Media recovery), Recovery techniques (Deferred Update, Immediate update, Shadow Paging, Checkpoints), Buffer management

**4. Implementing Security in Databases**

Introduction, Discretionary access control, Mandatory Access Control, Data Encryption

**5. Introduction to Other Databases**

Overview of parallel databases, Overview of Distributed databases, Overview of Object oriented databases

**References:**

1. S. Sudarshan , H.F. Korth, A. Silbershatz, "*Database System Concepts*", McGraw Hill

2. Ramakrishnan, Gehrke, *“Database Management Systems”*, 3<sup>rd</sup> edition, McGraw Hill
3. Elmasri Navathe, *“Fundamentals of Database Systems”*, 3<sup>rd</sup> edition, Addison Wesley
4. Peter Rob, Carlos Coronel, *“Database Systems: Design , Implementation and Management”*, 7<sup>th</sup> edition, Thomson Course technology

**Accomplishments of the student after completing the Course:**

After completion of this course, students will be able to

- Gain the Knowledge of handing multiple transactions effectively
- Implement query optimization features practically

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**Course Name: Object Oriented Concepts and Programming -Practical****Course Code: MSCCC214****Objectives:**

The main objective of this course is to enable students to

- Learn how to define various user defined datatypes
- Understand the concept of class and object and its applications in programming
- Learn how to reuse the code and working with generic datatypes
- Store and manage data in files

**Prerequisites:**

Knowledge of Fundamentals of Programming and Advanced Programming

**Contents:**

- 1. Basic Concepts of Object Oriented Concepts**  
Writing programs to implement class, object and constructor and destructor
- 2. Functions**  
Writing programs to implement different types of functions in C++
- 3. Inheritance and Polymorphism**  
Writing programs to implement different types of inheritances in C++
- 4. Polymorphism**  
Writing programs to implement different types of Polymorphism in C++
- 5. Templates**  
Writing programs to implement generic data type
- 6. Files**  
Writing programs to write and read data to files and other operations on files

**Reference Book(s):**

1. Bhushan Trivedi, "*Programming with ANSI C++*", Oxford University Press
2. E. Balagurusamy, "*Object-Oriented Programming with C++*", McGraw Hill
3. Marshall Cline, "*C++ FAQs*", Pearson Education
4. Stanley Lippmann, "*C++ Primer*", Pearson Education
5. Bjarne Stroustrup, "*The C++ Programming Language*", Pearson Education
6. Scott Mayer, "*Effective C++*", Addison-Wesley
7. Herbert Schildt, "*Complete Reference C++*", McGraw Hill

8. ePgPathshala, “*Subject: Information Technology – P=01. Object Oriented Concepts and Programming using C++*”,  
<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iLkSuZZ5a+koxhsE1m+YjQ==>

**Accomplishments of the student after completing the course:**

After completion of the course students will be able to

- Develop structured, modular, memory efficient and object-oriented programs in ‘C++’ with an eye on executional efficiency using functions, template, operator overloading, inheritance, Polymorphism and data files

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**Course Name: Database Management Systems – II (Practical)****Course Code: MCSCC215****Objectives:**

The aim of this course is to enable students to

- Develop expertise in writing query in a much optimized way, using indexes
- Implement Stored objects like procedures, functions, Triggers
- Use Cursors and exceptions in different stored objects
- To familiarize with the structure of PL/SQL programs and learn basic concepts
- To develop programs based on PL/SQL control structures
- To apply transaction management using set of Savepoint-rollback-commit statements

**Prerequisites:**

Basics of SQL

**Contents:****1. Advanced SQL Queries**

Joins and Subqueries – Fetching data from multiple table Creation of Indexes, View Query Cost, Writing optimized queries. Implementation of query optimization features learnt in theory

**2. Transaction Management Using Commit, Rollback, Savepoint****3. Basic PL/SQL Programs**

*Stored Procedures:* Introduction, Changing default delimiter, Creating, altering, removing procedures, parameterised procedures, Conditions, Loops, listing procedures.

*Functions:* Introduction, Creating, altering, removing functions, parameterised functions, return value, listing functions.

Invoking functions/procedures from command line client

**4. Exceptions**

Handling exceptions, Raising errors (Signal , Resignal)

**5. Cursors**

Implicit and Explicit Cursors : Row wise processing, traversing and fetching the result set

**6. Triggers**

Introduction, Types of triggers, utility of triggers, Before and After Triggers: Implementation of Before-Insert, After-Insert, Before-Update, After-Update and Before-Delete, After delete trigger, Listing the triggers in the system

**References:**

1. Ivan Bayross, “SQL, PL/SQL – The programming Language MySQL”
2. MySQL Official Documentation:  
<https://dev.mysql.com/doc/refman/8.0/en/stored-objects.html>

**Accomplishments of the student after completing the course:**

After completion of this course, students will be able to

- Gain the Knowledge of handing multiple transactions effectively
- Design the Stored procedures
- Utilize the triggers/cursors to control and retrieve data efficiently

**Course Name: General English****Course Code: MCSAE211****Objectives:**

The aim of this course is

- To introduce various forms of vocabulary for oral and written communications
- To introduce different parts-of-speech
- To acquaint students to various rules of grammar
- To inculcate reading and writing skills for English language

**Prerequisites: NIL****Contents:****1. Basic Grammar**

The Sentence Structure: Phrases, Sentence Patterns, Clause Types, Syntax, Parts of Speech. Nouns: Classification of Nouns. Adjectives: Types, Comparison of Adjectives, Correct use of Adjectives, Adjectives used as Nouns, Position Adjectives, Adjective Phrases. Articles: Definite Article, Indefinite Article. Pronouns: Types of Pronouns. Verbs: Finite and Non-finite Verbs, Strong and Weak Verbs, Aspect, Mood and Modality, Subject-Verb Agreement. Tense: Present Tense, Past Tense, Future Forms, Active and Passive Voice, Reported Speech. Auxiliaries: Primary and Modal Auxiliary Verbs, Anomalous Finites. Adverbs: Position of Adverbs, Verbs Compounded with Adverbs, Adverb Clause. Prepositions: Use of Prepositions, Phrase Prepositions, Prepositions for Nouns and Adjectives. Conjunction & Interjections: Types, Subordinating Conjunctions

**2. Sentence Pattern**

Analysis of Simple Sentences, Compound Complex Sentences and its Analysis, Synthesis of Sentences, Transformation of Sentences, Direct and Indirect Speech, Punctuation, Capitals

**3. Enriching Vocabulary**

Word Formation: Types of word formation processes: compounding, clipping, blending, derivation, creative respelling, coining and borrowing, prefixes and suffixes, acronyms, antonyms, standard abbreviations. Verb Patterns: Verb Structures, Phrases & Phrasal Verbs. Idioms

**4. Reading & Writing Skills**

Use of phrases and clauses in sentences, importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Nature and Style of Writing, Writing Practices (Comprehension, Letter Writing, Email Etiquettes, Report Writing, Memo Writing), American and British English, Indian English

## References:

1. Raymond Murphy, "Essential English Grammar", Cambridge University Press
2. Michael Swan, "Practical English Usage", Oxford University Press
3. Sachin Labade, et.al, "Communication Skills in English", Orient BlackSwan India
4. Hemamalini M., "Technical English", Wiley India
5. F.T. Wood, "Remedial English Grammar", Maxmillan
6. "Oxford Language Reference", Oxford University Press, India
7. William Zinsser, "On Writing Well", Harper Resource Book

## Accomplishments of the student after completing the Course:

After completion of this course, students will be able to

- Organize the sentences with proper English Grammar
- Effectively use English Language for Communications
- Improve their reading and listening skills

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**Course Name: Project-I****Course Code: MCSSE211****Objectives:**

The aim of this course is

- To introduce structured development of software systems
- To acquaint students to various techniques of requirements determination
- To introduce the concepts of analysis and design for software systems
- To model the system with various software diagrams
- To develop a system using software engineering concepts
- To prepare document/report of the system

**Prerequisites:**

Knowledge of Programming

**Contents:****1. Introduction to System Analysis & Design**

Concepts of System Analysis & Design, Components of a System, Users of a System, System Development Life Cycle, Role of System Analyst, Various approaches to develop a system

**2. Structured Systems Development Approach**

Requirements Gathering, surveying existing systems, Performing Feasibility Study before building a system, Formulating SRS, Designing Data Flow Diagrams, Entity-Relationship Diagrams, Designing Data Dictionary, designing effective Input, Output and Reports, Documenting the system.

**Guidelines for Project Development:**

1. During the semester, students will be required to develop a software system (on smaller scale) that contains input screens and reports. The system must include processing of data. It is preferable that the system uses database management system and supports CRUD operations on databases.
2. Projects can be created by a single student or in a group of 2-3 students.
3. The definition of project is to be submitted within 15 days of the starting of the semester.
4. The project should be free from plagiarism.
5. A student/group is required to report to their project guides on regular basis.
6. A student/group is required to present the project during internal exams.
7. It is advisable that the project must include different forms and reports.
8. It is necessary to prepare system diagrams, data dictionary as per the convention.
9. Project documentation should be prepared for the semester end examination.

10. In the semester end examination, executable project should be presented to the examiners along with the documentation(report).
11. Students must carry the source code of the project during final examination along with the Power Point presentation and project report.

**References:**

1. Kendall & Kendall. “System Analysis and Design ”, Prentice Hall India (PHI)
2. James Sen, “ Analysis and Design of Information System”, PHI
3. Arthur Langer, “ Analysis and Design of Information Systems “, Springer
4. Jeff Johnson, “ Designing with the Mind in Mind “, Morgan Kaufmann
5. Dennis, Wixom, Roth “System Analysis and Design”, Wiley India
6. Joseph Valacich, Joey F. George, “Modern Systems Analysis and Design”, Pearson
7. Priti Srinivas Sajja., “Essence of System Analysis and Design”, Springer

**Accomplishments of the student after completing the Course:**

After completion of this course, students will be able to

- Analyse and Design a system based on user requirements
  - To develop a software system using software engineering concepts
  - To prepare a document for the system
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**Course Name: Open-Source Software****Course Code: MCSGE211****Objectives:**

The aim of this course is to enable students

- To understand what an open-source project is
- To acquaint students to various licenses related to open-source software
- To use common open-source software
- To build open-source software

**Prerequisites:**

Knowledge of Programming

**Contents:****1. Overview of Open Source**

Introduction to Open-Source Software, Open-Source Vs. Free Software, Open-Source Initiative, Open-Source Standards and Philosophies, Licenses related to open-source software, Copyleft and Copyright, Case studies of Open-Source Software

**2. Introduction to Linux Operating System**

History of Linux, Overview of Linux distributions, Installation & Package Management, Repositories, Linux Manual, File Systems, File System Permissions, File System Management, Environment Variables, Editors, Basic commands of Linux, Filters in Linux

**3. Open-Source Software Installation**

Setting up Linux Development Environment, Development tools like “gcc, make, gdb”, Compiling and installing using tar ball, Installation using package manager, Installation using repositories, Installation using GUI, Updating a software, Overview of Github, Using Github to search and download software, Contributing to existing open-source projects,

**4. Shell Programming**

Types of Shell, Basic Shell scripts, Shell variables, Positional Parameters, Branching control structures, Loop-control structures, Continue and break statements, Arithmetic calculations in Shell Programs, Debugging Scripts, Standard I/O, Redirection Pipes and Filters

**References:**

1. Richard M. Stallman , “*Free Software*”, Free Society selected Essays
2. Andrew M.St.Laurent , “*Open Source and Free Software*”, Licensing (O’Reilly)
3. Deyanand ambawade & Deven Shah , “*Linux Lab Hands On Linux(Paperback)*”
4. Venkateshmurthy M.G. “*Introduction to Unix & Shell Programming*”, Pearson Education
5. Sumitabha Das, “*Unix Concepts and Applications*”, Tata McGraw-Hill
6. Randal Michael, “*Mastering Unix Shell Scripting*”, Wiley Publication

**Accomplishments of the student after completing the course:**

After completion of this course, students will be able to

- Use open-source software in day-to-day life
- Perform basic functionalities in Linux Operating Systems
- Develop shell scripts to automate minor tasks
- Contribute to existing open-source projects world-wide

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