Integrated M. Sc. Programmes in Computer Science

Programme 1

Integrated M.Sc. Programme in Computer Science Artificial Intelligence and Machine learning

Programme 2

Integrated MSc Programme in Computer Science Data Science

Preamble

The syllabus and curriculum of Integrated M.Sc. Programme in Computer Science offered by the University is so designed to make a set of highly talented and skilled computer professionals enough to meet the requirements of software industry, research and development as well as in academic arena of Computer Science. The five year programme spread across 10 semesters inculcates the knowledge in Mathematics and Statistics essential for a computer professional in addition to computer programming skills.

The Integrated M.Sc. Programmes are designed as an alternative to the M.Sc. programmes after the B.Sc. degree . A candidate joining the programme have to take serious efforts during the period to acquire the essential skills. The integrated programmes enables the aspirant to complete the Post Graduate programme in a single stretch.

On successful completion of the programme, the candidate will be able to meet all expectations of the industry or can pursue research work leading to further laurels. The integrated programme syllabus consists of the fundamental papers of Computer Science as well as the latest additions on topics like Machine learning, Artificial Intelligence, Big Data and Internet of Things.

The syllabus of these Integrated Programmes give more stress on practical knowledge than conventional courses in Computer Science. The final semester is compulsorily meant for a project work / internship of six months duration, helping the candidate to be an IT professional. As part of Internship, the candidate can study any of the technology or package of industrial demand, which may not be covered in their syllabus.

Programme Objective

The Integrated M.Sc. Programme in Computer Science in Mahatma Gandhi University is meant to be introduced from Academic year 2020-21. The Primary objectives of the Programme are

a. To attract young aspirants to the field of Computer Science to join the newly introduced pattern of Integrated PG programmes , Complete UG with PG as a single package .

b. The programme can be a milestone for further research and development as well as a successful career in software industry.
c. Aspirants can acquire entrepreneurial skills in software development enabling the successful launching of start-ups or self-employment in IT related platforms.
d. To generate skilled professionals as per the demands of industry.

Eligibility Criteria for admission to integrated M.Sc. Programmes

1. Integrated M.Sc. Programme in Computer Science (Artificial Intelligence and Machine Learning)
2. Integrated M.Sc. Programme in Computer Science (Data Science)

For both these programmes, the eligibility for admission is recommended as Candidate shall be required to have passed the Plus Two in Kerala Syllabus or any other equivalent examination in Science stream with Physics, Chemistry and Mathematics/Computer Science as compulsory subjects.

OR

Candidate shall be required to have passed the Plus Two in CBSE / ICSE examination or any other equivalent examination in Science stream with Mathematics/Computer Science/Informatics Practices/ Information Technology as one of the optional subjects.

The Programme overview

The Integrated M.Sc. programme in Computer Science includes English as the first language, a second language from the list of languages approved by the University, Mathematics and Electronics/Statistics as complementary subjects in first four semesters in addition to core courses in Computer Science in various semesters.

Complementary papers “Graph Theory and Operations Research” and “ Linear Algebra” are common for both Integrated courses in the first two semesters. For Integrated M.Sc in Computer Science (Artificial Intelligence and Machine Learning) Electronics will be available as the complementary paper in the third and fourth semesters whereas Statistics will be available for the Integrated M.Sc in Computer Science (Data Science) during these semesters. The final

semester is purely designed for project work / internship in reputed organizations, outside the campus.

Course Structure and Scheme

Integrated MSc Computer Science Artificial Intelligence and Machine Learning

Semester	Sl. No.	Course Code	Title	Hrs/ Week	Theory Hrs/Weeks	Lab Hrs/Weeks	Lab/ Theory	Type of Course	Credits	Total Hours
I	1	IEN1CC01	English 1- Communication Skills in English	5	5		*Theory*	*Common Course*	4	90
	2	ICSC1CR2	Programming in C	4	4		*Theory*	*CoreCourse*	3	72
	3	ICSC1CR3	Introduction to Computer	3	3		*Theory*	*CoreCourse*	3	54
	4	ICSC1CR4	Database Management Systems	3	3		*Theory*	*CoreCourse*	3	54
	5	ICSC1CM5	Mathematics – I-Graph Theory and Operations Research	4	4		*Theory*	*Complemetary*	4	72
	6	ICSC1CP6	Software Lab I	6		6	*Lab*	*Core Practical*	4	108
			TOTAL	25	19	6			21	450
II	1	IML/IHN2CC01	Second Language	5	5		*Theory*	*Common Course*	4	90
	2	ICSC2CR2	Object Oriented Programming Using C++	3	3		*Theory*	*CoreCourse*	3	54
	3	ICSC2CR3	Data Structures using C++	3	3		*Theory*	*CoreCourse*	3	54
	4	ICSC2CR4	Operating Systems	4	4		*Theory*	*CoreCourse*	4	72
	5	ICSC2CM5	Mathematics – II-Linear Algebra	4	4		*Theory*	*Complemetary*	4	72
	6	ICSC2CP6	Software Lab II	6		6	*Lab*	*Core Practical*	4	108
			TOTAL	25	19	6			22	450
III	1	ICSA3CR1	Advanced Computation Techniques	4	4		*Theory*	*CoreCourse*	4	72
	2	ICSC3CR2	Programming in Python	3	3		*Theory*	*CoreCourse*	3	54
	3	ICSC3CR3	R Programming and Mathematics for Artificial Intelligence	4	4		*Theory*	*CoreCourse*	3	72
		ICSC3CR4	Computer Organization and Architecture	4	4		*Theory*	*CoreCourse*	4	72
	5	ICSA3CM5	Digital Electronics	4	4		*Theory*	*Complemetary*	4	72
	6	ICSA3CP6	Software Lab III : Python and R Programming	6		6	*Lab*	*Core Practical*	2	108
			TOTAL	25	19	6			20	450

Integrated MSc Computer Science Artificial Intelligence and Machine Learning

Semester	Sl. No.	Course Code	Title	Hrs/ Week	Theory Hrs/Weeks	Lab Hrs/Weeks	Lab/ Theory	Type of Course	Credits	Total Hours
IV	1	IEN4CC01	English II-English Language Skills for Academic Purposes	5	5		*Theory*	*Common Course*	4	90
	2	ICSA4CM2	Microprocessors	4	4		*Theory*	*Complemetary*	3	72
	3	ICSC4CR3	Data Mining	4	4		*Theory*	*Core Course*	4	72
	4	ICSC4CR4	Software Engineering	4	4		*Theory*	*Core Course*	3	72
	5	ICSC4CR5	Basics of Artificial Intelligence	4	4		*Theory*	*Core Course*	3	72
	6	ICSA4CMP6	Complemetary Lab: Digital Electronics Lab	2		2	*Lab*	*Complementary Practical*	2	36
	7	ICSA4CP7	Software lab IV	2		2	*Lab*	*Core Practical*	1	36
TOTAL				25	21	4			20	450
V	1	ICSC5CR1	Principles of Machine learning	3	3		*Theory*	*Core Course*	4	54
	2	ICSC5CR2	Web application Development Using PHP	4	4		*Theory*	*Core Course*	3	72
	3	ICSC5CR3	Programming in Iava	4	4		*Theory*	*Core Course*	3	72
	4	ICSC5CR4	IT and Environment	3	3		*Theory*	*Core Course*	4	54
	5	ICSA5PR5	Project Minor - Phase I	3		3		*Core Project Minor*		54
	6	ICSA5CP6	Software Lab V : Java and PHP	8		8	*Lab*	*Core Practical*	3	144
TOTAL				25	14	11			17	450
VI	1	ICSC6CR1	Linux and Shell Programming	3	3		*Theory*	*Core Course*	3	54
	2	ICSC6CR2	Computer Networks	4	4		*Theory*	*Core Course*	4	72
	3	ICSA6CR3	Advanced Machine Learning Techniques	4	4		*Theory*	*Core Course*	4	72
	4	ICSC6EA1/2/3	Elective 1 [Bunch A]	3	3		*Theory*	*Core Elective*	3	54
	5	ICSA6PR4	Project Minor Phase II	7		7	*Lab*	*Core Project Minor*	4	126
	6	ICSA6CP5	Software Lab VI : Machine Learning Techniques	4		4	*Lab*	*Core Practical*	2	72
TOTAL				25	14	11			20	450

Integrated MSc Computer Science Artificial Intelligence and Machine Learning

Semester	Sl. No.	Course Code	Title	Hrs/ Week	Theory Hrs/Weeks	Lab Hrs/Weeks	Lab/ Theory	Type of Course	Credits	Total Hours
VII	1	ICSC7CR1	Computational Mathematics	4	4		*Theory*	*Core Course*	4	72
	2	ICSA7CR2	Applied Statistics for Data Analytics	4	4		*Theory*	*Core Course*	4	72
	3	ICSA7CR3	Advanced Python Programming	4	4		*Theory*	*Core Course*	4	72
	4	ICSA7CR4	Data Science and Analytics	4	4		*Theory*	*Core Course*	3	72
	5	ICSA7CP5	Software Lab VII : Advanced Python Programming	5		5	*Lab*	*Core Practical*	3	90
	6	ICSA7CP6	Software Lab VIII : Statistical Programming and Data Analytics using R	4		4	*Lab*	*Core Practical*	2	72
			TOTAL	**25**					**20**	**450**
VIII	1	ICSA8EB1/2	Elective 2 [Bunch B]	4	4		*Theory*	*Core Elective*	4	72
	2	ICSC8CR1	Advanced Deep Learning Techniques	4	4		*Theory*	*Core Course*	4	72
	3	ICSA8CR2	Digital Image Processing	4	4		*Theory*	*Core Course*	4	72
	4	ICSA8EC1/2	Elective 3 [Bunch C]	4	4		*Theory*	*Core Elective*	4	72
	5	ICSA8CP3	Software Lab IX : DIP using Python	5		5	*Lab*	*Core Practical*	2	90
	6	ICSA8CP4	Software Lab X : Deep Learning Lab using R /Python	4		4	*Lab*	*Core Practical*	2	72
			TOTAL	**25**					**20**	**450**
IX	1	ICSA9ED1/2	Elective 4 [Bunch D]	4	4		*Theory*	*Core Elective*	4	72
	2	ICSA9CR1	Advanced Concepts in AI	4	4		*Theory*	*Core Course*	3	72
	3	ICSA9CR2	Natural Language Processing	4	4		*Theory*	*Core Course*	4	72
	4	ICSC9EE1/2	Elective 5 [Bunch E]	4	4		*Theory*	*Core Elective*	4	72
	5	ICSA9CP3	Software Lab XI: NLP Lab using R /Python	4		4	*Lab*	*Core Practical*	2	72
	6	ICSA9PR4	Case study and Minor project	5		5	*Lab*	*Core Project Minor*	3	90
			TOTAL	**25**	**16**	**9**			**20**	**450**
X	1	ICSAXPR1	Major Project	**25**		**25**	*Lab*	*Core Project Major*	**16**	**450**
	2	ICSAXVV2	Comprehensive Viva Voce				*Lab*	*Core Viva Voce*	**4**	
			TOTAL	**25**		**25**			**20**	**450**

Electives *Integrated MSc Computer Science Artificial Intelligence and Machine Learning*	
	Bunch A
ICSC6EA1	Cloud Computing
ICSC6EA2	Full stack programming Techniques
ICSC6EA3	Predictive Analytics
	Bunch B
ICSA8EB1	Soft Computing Techniques
ICSA8EB2	Mobile Application Development
	Bunch C
ICSA8EC1	*Computer Vision*
ICSA8EC2	*Augmented and Virtual Reality*
	Bunch D
ICSA9ED1	Robotics,
ICSA9ED2	IoT Analytics
	Bunch E
ICSC9EE1	Block Chain Technology
ICSC9EE2	Big Data Analytics

Integrated MSc Computer Science- Data Science

Semester	Sl. No.	Code	Title	Hrs/Week	Theory Hours per Week	Lab Hours per Week	Lab/Theory Exam	Course Type	CREDITS	TOTAL HOURS
I	1	IEN1CC01	English I – Communication skills in English	5	5		*Theory*	*Common Course*	4	90
	2	ICSC1CR2	Programming in C	4	4		*Theory*	*Core Course*	3	72
	3	ICSC1CR3	Introduction to Computer	3	3		*Theory*	*Core Course*	3	54
	4	ICSC1CR4	Database Management Systems	3	3		*Theory*	*Core Course*	3	54
	5	ICSC1CM5	Mathematics – I – Graph Theory and Operations Research	4	4		*Theory*	*Complementary*	4	72
	6	ICSC1CP6	Software Lab I	6		6	*Lab*	*Core Practical*	4	108
TOTAL				25	19	6			21	450
II	1	IML/IHN 2CC01	Second Language	5	5		*Theory*	*Common Course*	4	90
	2	ICSC2CR2	Object Oriented Programming Using C++	3	3		*Theory*	*Core Course*	3	54
	3	ICSC2CR3	Data Structures using C++	3	3		*Theory*	*Core Course*	3	54
	4	ICSC2CR4	Operating Systems	4	4		*Theory*	*Core Course*	4	72
	5	ICSC2CM5	Mathematics – II – Linear Algebra	4	4		*Theory*	*Complementary*	4	72
	6	ICSC2CP6	Software Lab II	6		6	*Lab*	*Core Practical*	4	108
TOTAL				25	19	6			22	450
III	1	ICSD3CR1	Introduction to data Science	4	4		*Theory*	*Core Course*	4	72
	2	ICSC3CR2	Programming in Python	3	3		*Theory*	*Core Course*	3	54
	3	ICSC3CR3	R Programming and Mathematics for Artificial Intelligence	4	4		*Theory*	*Core Course*	3	72
		ICSC3CR4	Computer Organization and Architecture	4	4		*Theory*	*Core Course*	4	72
	5	ICSD3CM5	Probability and Statistics	4	4		*Theory*	*Complementary*	4	72
	6	ICSD3CP6	Software Lab III : Python and R Programming	6		6	*Lab*	*Core Practical*	2	108
TOTAL				25	19	6			20	450
IV	1	IEN4CC01	English II – English Language Skills for Academic Purposes	5	5		*Theory*	*Common Course*	4	90
	2	ICSD4CM2	Probability Distributions and Statistical Inference	4	4		*Theory*	*Complementary*	3	72
	3	ICSC4CR3	Data Mining	4	4		*Theory*	*Core Course*	4	72
	4	ICSC4CR4	Software Engineering	4	4		*Theory*	*Core Course*	3	72
	5	ICSC4CR5	Basics of Artificial Intelligence	4	4		*Theory*	*Core Course*	3	72
	6	ICSD4CMP6	Complemetary Lab: R Programming For Statistical Tools	2		2	*Lab*	*Complementary Practical*	2	36
	7	ICSD4CP7	Software lab IV	2		2	*Lab*	*Core Practical*	1	36
TOTAL				25	21	4			20	450

Integrated MSc Computer Science- Data Science

Semester	Sl. No.	Code	Title	Hrs/Week	Theory Hours per Week	Lab Hours per Week	Lab/Theory Exam	Course Type	CREDITS	TOTAL HOURS
V	1	ICSC5CR1	Principles of Machine learning	3	3		*Theory*	*Core Course*	4	54
	2	ICSC5CR2	Web application Development Using PHP	4	4		*Theory*	*Core Course*	3	72
	3	ICSC5CR3	Programming in Iava	4	4		*Theory*	*Core Course*	3	72
	4	ICSC5CR4	IT and Environment	3	3		*Theory*	*Core Course*	4	54
	5	ICSD5PR5	Project Minor - Phase I	3		3		Core Project Minor		54
	6	ICSD5CP6	Software Lab V : Java and PHP	8		8	*Lab*	*Core Practical*	3	144
TOTAL				25	14	11			17	450
VI	1	ICSC6CR1	Linux and Shell Programming	3	3		*Theory*	*Core Course*	3	54
	2	ICSC6CR2	Computer Networks	4	4		*Theory*	*Core Course*	4	72
	3	ICSD6CR3	Mobile Application Development using Kotlin	4	4		*Theory*	*Core Course*	4	72
	4	ICSC6EA1/2/3	Elective 1 [Bunch A]	3	3		*Theory*	*Core Elective*	3	54
	5	ICSD6PR4	Project Minor Phase II	7		7	*Lab*	Core Project Minor	4	126
	6	ICSD6CP5	Software Lab VI : Mobile Application Development using Kotlin	4		4	*Lab*	*Core Practical*	2	72
TOTAL				25	14	11			20	450
VII	1	ICSC7CR1	Computational Mathematics	4	4		*Theory*	*Core Course*	4	72
	2	ICSD7CR2	Applied Statistics for Data Science	4	4		*Theory*	*Core Course*	4	72
	3	ICSD7CR3	Advanced Python Programming for data Science	4	4		*Theory*	*Core Course*	4	72
	4	ICSD7CR4	Data Engineering in Data Science	4	4		*Theory*	*Core Course*	3	72
	5	ICSD7CP5	Software Lab VII : Python Programming Lab for data Science	5		5	*Lab*	*Core Practical*	3	90
	6	ICSD7CP6	Software Lab VIII : Data Engineering Lab	4		4	*Lab*	*Core Practical*	2	72
TOTAL				25	16	9			20	450
VIII	1	ICSD8EB1/2	Elective 2 [Bunch B]	4	4		*Theory*	*Core Elective*	4	72
	2	ICSC8CR1	Advanced Deep Learning Techniques	4	4		*Theory*	*Core Course*	4	72
	3	ICSD8CR2	Data Visualization	4	4		*Theory*	*Core Course*	4	72
	4	ICSD8EC1/2	Elective 3 [Bunch C]	4	4		*Theory*	*Core Elective*	4	72
	5	ICSD8CP3	Software Lab IX : Deep Learning Lab using R	4		4	*Lab*	*Core Practical*	2	72
	6	ICSD8CP4	Software Lab X : Data Visualization Lab using Tableau	5		5	*Lab*	*Core Practical*	2	90
TOTAL				25	16	9			20	450

Integrated MSc Computer Science- Data Science

Semester	Sl. No.	Code	Title	Hrs/Week	Theory Hours per Week	Lab Hours per Week	Lab/Theory Exam	Course Type	CREDITS	TOTAL HOURS
IX	1	ICSD9ED1/2	Elective 4 [Bunch D]	4	4		*Theory*	*Core Elective*	4	72
	2	ICSD9CR1	Text Analytics & Natural Language Processing	4	4		*Theory*	*Core Course*	3	72
	3	ICSD9CR2	Web Analytics	4	4		*Theory*	*Core Course*	4	72
	4	ICSC9EE1/2	Elective 5 [Bunch E]	4	4		*Theory*	*Core Elective*	4	72
	5	ICSD9CP3	Software Lab XI : NLP using R	4		4	*Lab*	*Core Practical*	2	72
	6	ICSD9PR4	Case study and Minor project	5		5	*Lab*	Core Project Minor	3	90
TOTAL				25	16	9			20	450
X	1	ICSDXPR1	Major Project	25		25	*Lab*	Core Project Major	16	450
	2	ICSDXVV2	Comprehensive Viva Voce				*Lab*	*Core Viva Voce*	4	
TOTAL				25		25			20	450

Electives *Integrated MSc Computer Science*- Data Science	
	Bunch A
ICSC6EA1	Cloud Computing
ICSC6EA2	Full stack programming Techniques
ICSC6EA3	Predictive Analytics
	Bunch B
ICSD8EB1	Advanced DBMS
ICSD8EB2	Business Intelligence & Analytics
	Bunch C
ICSD8EC1	Image and Video Analytics
ICSD8EC2	Genomic data science
	Bunch D
ICSD9ED1	Healthcare data Analytics
ICSD9ED2	Social media Analytics
	Bunch E
ICSC9EE1	Block Chain Technology
ICSC9EE2	Big Data Analytics

Semester I

Semester	Sl. No.	Code	Title	Hrs/Week	Lab/Theory Exam	Credits	Total hours
I	1	IEN1CC01	English I – Communication Skills in English	5	*Theory*	4	90
	2	ICSC1CR2	Programming in C	4	*Theory*	3	72
	3	ICSC1CR3	Introduction to Computer	3	*Theory*	3	54
	4	ICSC1CR4	Database Management Systems	3	*Theory*	3	54
	5	ICSC1CM5	Mathematics - I	4	*Theory*	4	72
	6	ICSC1CP6	Software Lab I	6	*Lab*	4	108
TOTAL				25		21	450

Syllabus of English paper: IEN1CC01 English I: As approved by BoS of English (UG).
Syllabus of complementary paper Mathematics: ICSC1CM5 Mathematics - I : As approved by BOS of Mathematics (UG) .

Course Code	Course Title	Total Credits
ICSC1CR2	Programming in C	3

Course Objectives

On completion of the course, the student will be able to write a complete C program, he/she will be able to use decision making statements and looping structures, should have a clear concept on one dimensional, two dimensional arrays, modular programming using user defined functions, clarity on concept of strings, structures and Unions. Should be able to use files for input and output, basic ideas on dynamic storage allocation and command line arguments

Module No.	Title & Contents	No. of Sessions
1	Algorithm and flow chart (structure, desirable qualities, simple examples (sequential, branching and iterative)). Basic concepts in machine language program and program execution, assembly language program and assembler, High level language program and translators (compilers and interpreters). Procedural programming paradigm - examples. Steps in developing a program - (problem analysis, algorithm design, coding, debugging, testing, documentation). Approaches - top down and bottom up approaches. C Language - structure of a C program - simple sequential program. Role of editor. Compilation, linking and execution under Windows and Linux. IDEs. Types of errors.	14

2	Keywords, constants, variables, data types and variable names, assignment statement. Operators and expressions (including increment, decrement and sizeof()), precedence and order of execution, mixed mode expressions and type conversions. Elementary ideas in function (C program as a collection of functions), main function. Formatted input and output. Simple sequential programs. Decision making: The goto statement, if, if-else, nesting of if, else if ladder and switch statement, conditional expression. Example programs based on decision making.	12
3	Control statements: The while loop, the do...while loop, the for loop, nesting of for loops, the break statement and continue statement. Example programs. Functions, basics, prototype, parameter passing, storage classes, recursion. Built-in functions. Example programs.	14
4	Arrays, arrays and functions. Strings, string operations and algorithms, string functions in C. Example programs using arrays and strings (including simple search and sort, matrix operations). Pointers - basic concepts, pointer arithmetic, pointers and arrays, pointers and strings, pointers and functions. Dynamic memory allocation, Simple programs using pointers.	16
5	Structures - basics, array of structures, pointers and structures, structure and function, self-referential structures, union. Programs using structures. The Pre-processor: File Inclusion, Macro Definition and Substitution, Macros with Arguments, Nesting of Macros, Conditional Compilation. (Simple illustrative examples) File Management: Defining and Opening a file, Closing Files, Input/Output Operations on Files, Predefined Streams, Error Handling during 1/0 Operations, Random Access to Files, Command Line Arguments. Simple examples of file creation.	16

Book of study

Programming in Ansi C: E Balagurusami 8th edition MC GRAW HILL INDIA publishers

Reference texts

1: Programming with C: Byron S Gottfried, schaumes outline series 4th edition

2: Programming in C: Ashok n Kamthane : Pearson education 3rd edition

3: Let us C: Yeshwant Kanetkar 16th edition BPB publishers

Course Code	**Course Title**	**Total Credits**
ICSC1CR3	**Introduction to Computer**	**3**
Course Objectives		
After successful completion of the course, the students will be able to Understand basic functions of computer hardware, software components including memory & operating systems • Understand the concept of networking and internet • Understand IT and its impact on society.		

Module No.	Title & Contents	No. of Sessions
1	Introduction: Functional units of a computer system, Different types of computers, Computer Software and Hardware, Types of Software (System software and Application software). Characteristics of Computers. Computer Languages (Machine, Assembly and Higher Level languages- 36L,4GL,5GL)	8
2	Interaction with Computers, Data Processing and Storage Information: Input devices, Output devices. Representation of Data, Processing of Data, the CPU, Memory , different types of RAM and ROM. Types of Storage devices(Magnetic storage devices, Optical storage devices, Solid state storage devices), SSD-types, performance, benefits ; Graphics Processing Unit (GPU)	12
3	Introduction to Operating Systems, Networking: Definition of an Operating System, Different types of PC Operating Systems, File Management (file access methods, file operations, file naming). Computer Network : Basic elements of communication system, Data transmission modes ,Data transmission speed, Data transmission media (twisted pair wire, coaxial cable, Microwave system, Communication satellite, Optical fibers), Modems, Categories of networks (PAN,CAN,LAN, WAN, MAN).	12
4	Internet : Definition, Working of Internet , Major features of Internet, Major services (WWW, Electronic mail, FTP, Chat, Instant messaging ,Telnet, Usenet News, Online services, Peer-to-peer services), TCP/IP, URL's, Web Browsers ,Major elements of Internet Search engines, Popular Search Engines, Uses of the Internet, WWAN, Academic service (INFLIBNET, NOTEL, NICNET ,BRNET)	12
5	Introduction to Cyber World : Cyber space, introducing cyber laws ,Scope of cyber laws(E-commerce ,online, contracts, IPRs(copyrights ,trademarks, and software patenting) ; cyber ethics, Cyber Addiction- types of internet addiction, causes of cyber addiction, effects of Internet addiction; Cyber Crimes- Introduction, categories of cyber crime, types of cyber crimes	10

Books of Study

1. Peter Norton's- Introduction to Computers, Sixth edition, Tata McGraw Hill
2. P.K Sinha & Priti Sinha - Computer Fundamentals, Fourth Edition , BPB Publications.
3. Barkha and U. Rama Mohan - Cyber Law Crimes, Asia Law House, New edition

Reference texts

1. V Rajaraman " Introduction to Information technology" Prentice-Hall of India.
2. Harley Hahn - The Internet Complete reference Tata Mc Graw-Hill edition
3. Dr. Farooq Ahamad- Cyber law in India(Law of Internet), New Era Law publication

Course Code	Course Title	Total Credits
ICSC1CR4	Database Management Systems	3

Course Objectives

On completion of the course, the student should have a clear concept on databases, data models, architecture and components od DBMS. The concept of entity, attributes , associations and relationships concept of tables and its properties, table creation and manipulation of tables and databases using SQL. DDL and DML facilities of SQL Syllabus:

Module No.	Title & Contents	No. of Sessions
1	Database Management System Concepts: Introduction, Significance of Databases, Advantages of database approach; Data Independence; Components of Database Systems, classification of Users, the Database Administrator (DBA) and his responsibilities; advantages and disadvantages of Database Management System.	9
2	Entity attributes and Data Models for a Database; Entities and their Attributes, different types of Entities and Attributes, Association and relationships and their different types E-R Diagrams. : Data Models, Hierarchical, Network and Relational data models. Benefits and Application of each Data models.	9
3	DBMS Architecture and Schema, Data Dictionary. Three Level Architecture of DBMS, The External Level or Subschema, The Conceptual Level or Conceptual Schema, The Internal Level or Physical Schema, Data Definition Language, Data Manipulation Language: Database Management System Structure, Database Manager, Database Administrator, Data Dictionary: Brief introduction to Distributed databases and Client /Server Architecture.	10
4	Unit 4. The Relational Approach to DBMS: The Concept of relations in Mathematics, Mathematical concept of sets, relations and functions, Relational OOOO approach to DBMS Attributes and Domains ; concept and properties of tables, cardinality and degree of relations, keys and different types of keys; strong entities and weak entities Entity integrity rule, the foreign key and rule of referential integrity. Representation of relational database schemas, integrity constraints and different types; Relational Algebra. Operators in Relational Algebra.	12

5	The Structured Query Language (SQL). The need for SQL. Brief introduction to query languages and its evolution Basic structure of SQL queries, Data Definition Commands : Data types in SQL, CREATE, ALTER DROP Commands Adding constraints in SQL, Basic operations in Data Manipulation Using SQL, INSERT, SELECT, DELETE, UPDATE, Substring comparison using LIKE operator ,BETWEEN operator, SQL set operations UNION , EXCEPT, INTERSECT: order By and Group By clauses, complex queries in SQL , Nested queries , EXISTS and UNIQUE functions, Renaming of attributes and Joining of tables, Aggregate functions, Creating and Managing Views.	14

Book of study

Raghu Ramakrishnan & Johannes Gehrke, "Data Base Management Systems", Mc Graw Hill International Edition

Reference texts

1. Fundamentals of Database systems 7th edition: Elmasri & Navathe : Pearson Education
2. An introduction to database systems C.J Date 8th edition. Pearson education
3. Abraham Silberschatz, Hentry F.Korth and S.Sudharssan,"Database System Concepts", 4th Edition, Tata McGraw Hill.

Course Code	**Course Title**	**Total Credits**
ICSC1CP6	**Software Lab I**	**4**
The candidate needs to submit a Lab Record, duly signed by the teacher in charge and Head of the Department, (minimum of 20 Programs, (10+10, C and SQL), failing which he/she will not be allowed to attend the external software lab examination. The Lab record should be hard binded with name of college and the emblem of the college depicted on the first page and should be properly indexed.		

Module No.	Title & Contents	No. of Sessions
1	**Syllabus for C programs** 1. Simple Programs to familiarize printf() and scanf() functions. 2. Programs Based on Decision making statements, break, goto, continue, switch. 3. Programmes using Loop controls statements. 4. Programs Based on One dimensional and two dimensional arrays (linear search, sort, matrix addition, multiplication, transpose etc..) 5. Programs on Strings and string handling functions. 6. Programs using the concept of Pointers, operations on pointers, Pointers to one dimensional array 7. Programs using the concept of functions, Call by value, Call by reference, Recursion. 8. Programs based on structure and union, array of structures, Pointer to structure, structure as argument to functions. 9. Simple programs using pointers and malloc ().	54
2	**Syllabus for SQL Programs** Problems involving the following topics to be included 1. Data definition commands - CREATE, ALTER, DROP, Adding Constraints Primary key, foreign key unique key, check, not null. 2. Basic SQL queries INSERT, SELECT, DELETE, UPDATE, Using multiple tables, ordering of rows using ORDER BY option, Set operations using UNION, EXCEPT, INTERSECT, Substring Comparison using LIKE operator, BETWEEN operator. 3. Complex Queries Nested Queries, EXISTS and UNIQUE/DISTINCT functions, NULL values, Renaming of attributes and Joining of tables, Aggregate functions and grouping. 4. Managing views, Simple stored procedures.	54

Course Code	Course Title	Total Credits
ICSC1CM5	**Mathematics I –Graph Theory and Operations Research**	**4**

Module No.	Title & Contents	No. of Sessions
1	**Graphs** Graphs and Graph Models, Graph Terminology and Special types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths. Text 1 Chapter 8 (Sections 8.1, 8.2, 8.3, 8.4 and 8.5 only)	18
2	**Trees** Introduction to Trees, Application of Trees, Tree Traversal, and Spanning Trees. Text 1 Chapter 9 (Sections 9.1, 9.2, 9.3 and 9.4 only)	18
3	**Linear programming problems** Mathematical formulation of a L.P.P., General linear programming problems, solution of a L.P.P, graphical method for solving a L.P.P. Simplex Method: Stack and surplus variables- reduction of any feasible solution to a basic feasible solution. Unbounded solution. Optimality conditions- artificial variable techniques- Big M method.	18
4	**Transportation & Assignment Problems** Transportation model- solution by simplex method- north west corner rule, lowest cost entry method,Vogel method, MODI method, degeneracy, assignment problems.	18

Text Books

1. Kenneth H Rosen ; Discrete Mathematics And Its Applications ; 6th Edition ; Tata Mc Graw-Hill Publishing Company Limited
2. Belly E Gillet – Introduction to Operations Research (A Computer Oriented Arithmetic Approach) (Tata Mc. GrawHill)

Semester II

Semester	Sl. No.	Code	Title	Hrs/Week	Lab/Theory Exam	credits	Total hours
II	1	IML/IHN 2CC01	Second Language	5	*Theory*	4	90
	2	ICSC2CR2	Object Oriented Programming Using C++	3	*Theory*	3	54
	3	ICSC2CR3	Data Structures using C++	3	*Theory*	3	54
	4	ICSC2CR4	Operating Systems	4	*Theory*	4	72
	5	ICSC2CM5	Mathematics - II	4	*Theory*	4	72
	6	ICSC2CP6	Software Lab II	6	*Lab*	4	108
TOTAL				25		22	450

Syllabus of Second Language IML2CC01/IHN2CC01 As Approved by the respective BOS

Syllabus of complementary paper ICSC2CM5 Mathematics As approved by BOS of Mathematics

Course Code	Course Title	Total Credits
ICSC2CR2	**Object Oriented Programming Using C++**	**3**

Course Objectives

On completion of the course, the student will be able to understand

Object oriented programming concepts and introduction of C++ Programming language.
Different control structures used in C++ and implementation of functions in C++.
Importance of class and objects concept in programming
Role of constructors and destructors and importance of Operator overloading
Different types of inheritance and implementation of polymorphism.

Module No.	Title & Contents	No. of Sessions
1	Principles of Object Oriented Programming, Beginning with C++ Object Oriented Technology, Disadvantages of conventional Programming, Programming Paradigms, Key concepts of Object Oriented Programming,	10

	Advantages of OOP. Parts of C++ program, Types of tokens, Data types in C++, Type modifiers, Type casting, Constants, Constant pointers, Operators in CH, Referencing and dereferencing operators, Scope access operator, Memory management operators.	
2	Control structures and functions in C++ Decision making statements, Loops in CH, Function in C++ - The main function, Parts of a function, Passing arguments, Return by reference, Default arguments, Inline function, Function overloading, Principles of function overloading.	12
3	Classes and Objects Structures in CH, Class in C++, Declaring Objects, public private protected Keywords, Defining member functions, Characteristics of member functions, Outside member function inline, Rule for inline functions, Data hiding, Memory allocation for objects, Static member variables and functions, Arrays of objects, Objects as function arguments, Friend functions, Friend classes, Local classes.	10
4	Constructers, Destructors and Operator overloading Constructors and destructors, Characteristics of constructors and destructors, Applications with constructors, Constructors with argument, Overloading Constructors, Constructors with Default arguments, Copy constructors, Destructors, Operator overloading, Over loading unary operators, Over loading binary operators, Overloading with friend function, Type conversion, Rules for overloading operators.	10
5	Inheritance, Pointers, Binding, Polymorphism and virtual functions Inheritance, Access specifiers and simple inheritance, Types of inheritance, Virtual base classes, Constructors Destructors and inheritance, Advantages and disadvantages of inheritance. Pointer, Pointer declaration, void pointers, wild pointers, Pointers to objects, this pointer, Pointers to derived classes and base classes, Binding in C++, Pointer to derived class Objects, Virtual functions, Rules for virtual functions, Pure virtual functions, Abstract classes, Working of virtual functions, Object slicing.	12

Book of Study:

Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India

Reference:

1. E. Balagurusamy - Object Oriented Programming with CH, Fifth edition, Tata McGraw Education Hill, 2011.

2. Ravichandran-Object Oriented Programming in C++, TMH, 3rd Edition

Course Code	Course Title	Total Credits
ICSC2CR3	Data Structures using C++	3

Course Objectives

Upon successful completion of this course, students should be able to:

- Describe fundamental concepts of data structures.
- Illustrate the representation of arrays in memory and operations on it
- Compare and Contrast different searching and sorting techniques.
- Design operations on linear data structures such as stacks and queues.
- Implement operations on various types of linked lists.

Module No.	Title & Contents	No. of Sessions
1	Introduction to Data Structures, Definition, Classification of data structures, Primitive and Nonprimitive, Operations on data structures. Static and dynamic memory allocation. Dynamic memory allocation and pointers, Memory allocation operators in C++. User defined data types in C++. Recursion, Recursive functions in C++.	10
2	Arrays, Linear array- Representation of array in memory, operations on linear array, Insertion, Deletion, Sorting and Searching. Two Dimensional Arrays - Representation of 2D array in memory, operations on 2D array. Multidimensional Arrays.	10
3	Search and Sort: Search, Basic search techniques, Search algorithms. Searching techniques, Sequential search, Binary search. Sort, general Background, Definition, different types, Bubble Sort, Selection sort, Merge sort.	10
4	Stack and Queue: Stack, Definition, Array representation of stack, Operations on stack. Infix, prefix and postfix notations, Conversion of an arithmetic expression from infix to postfix, Postfix evaluation, Applications of stack. Queue- Definition, Array representation of queue, Simple queue operations. Circular queues, Double ended queue, Priority queue.	12
5	Linked List: Linked list-definition, Components of linked list, Representation of linked list, Advantages and disadvantages of linked lists, Types of linked list. Singly linked list. Operations on singly linked list, Creation, Insertion, Deletion, Search and Display. Doubly linked lists, Operations on doubly linked lists, Creation, Insertion, Deletion, Search and display. Circular linked list, Operations on circular linked list, Creation, Insertion, Deletion, Search and Display.	12

Book of Study

G.S Baluja, Data Structures Through C++ (A Practical Approach), Danapat Rai & Co.

References: 1

1. Ellis Horowitz and Sartaj Sajni, Fundamentals of Data Structures, Galgotia publications

2, Seymour Lipschutz, Theory and Problems of Data Structures, Schaums outline series

Course Code	Course Title	Total Credits
ICSC2CR4	Operating Systems	4

Course Objectives

After completing the course, the student should be able to explain
- The fundamental concepts regarding an OS
- Concept of a process and management of processes
- Inter process synchronization methods and deadlock handling
- Various memory management techniques
- Concept of file and various file handling methods

Module No.	Title & Contents	No. of Sessions
1	Introduction OS Definition, Functions, Types of operating systems-Batch Operating System, Multi programming, Time sharing, Real time, distributed operating systems - Operating System Operations, Operating System Services, User Operating System Interface, System Calls, Types of System Calls.	14
2	Processor Management: Job and process concept, Operating system view of process, process state, state transition diagram, PCB (Process control block), System state and process lists, process switch, threads, Multi-threading operating system, operating system services for process management. Process Scheduling - Types of schedulers, scheduling and performance criteria, scheduling algorithms, multiple processor scheduling.	14
3	Inter process synchronization and communication Concurrent Processes, need for inter process synchronization, critical section problem, mutual exclusion, mutual exclusion algorithms, semaphore definition, primitives, implementation of semaphores, monitors Deadlocks – Definition, Deadlock characterization, Resource allocation graph, methods for handling deadlocks, deadlock prevention, deadlock avoidance, safe state, resource allocation graph algorithm, Banker's algorithm, deadlock detection, recovery from deadlock.	16
4	Memory Management Preliminaries, address binding, dynamic linking and loading, Overlays. logical versus physical address space, Swapping, Contiguous	16

	allocation - fragmentation, OO compaction, Paging-principles of page allocation, structure of page table, hardware support, multi level paging, Segmentation-principles of operation, hardware, implementation of segment table, protection and sharing, fragmentation, segmentation with paging. Virtual Memory-Demand paging, Page replacement algorithms page allocation policies – Thrashing, hierarchical address translation tables, MMUS.	
5	File Management: File structure, File types, File access, File attributes, File operations. Directories - Flat directory systems, hierarchical directory systems. File system implementation Allocation methods, contiguous allocation, linked allocation, indexed allocation.	12

Book of study

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 7th Edition

Reference texts:

1. Andrew S. Tanenbaum, — Modern Operating System, Prentice Hall India
2. Dhamdhere, system software and operating systems - Tata Mc Graw Hill
3. H M Deitel, An Introduction to Operating System - Adison Wesley
4. Tanenbaum, Modern Operating systems - Prentice Hall
5. William Stallings, Operating Systems - Pearson Education

Course Code	**Course Title**	**Total Credits**
ICSC2CP6	**Software Lab II**	**4**
The candidate needs to submit a Lab Record, duly signed by the teacher in charge and Head of the Department, (minimum of 20 Programs, (10+10, CPP and DS) failing which he/she will not be allowed to attend the external software lab examination. The Lab record should be hard binded with name of college and the emblem of the college depicted on the first page and should be properly indexed.		

Module No.	Title & Contents	No. of Sessions
1	Syllabus for CPP programs (minimum of 10 questions) 1. Programs based on default arguments, function overloading. 2. Programs based on array of objects, friend functions, passing objects as arguments to function. 3. Programs based on operator overloading (binary, unary) using member functions and friend functions. 4. Programs based on constructors, different types of constructors. 5. Programs based on inheritance, different types of inheritance, Polymorphism	
2	Syllabus for Data structures using CPP (minimum of 10 questions) Student needs to code and implement CPP programs for the following: Arrays - Insertion, Deletion, Polynomial addition using arrays Sort - Selection, Insertion, Quick Search - Linear search, Binary search Sparse matrix : - Sparse form representation, transpose and addition using the sparse form Stack :Implementation using arrays (linear stack), Infix to postfix conversion, Postfix evaluation Queue: - Implementation using arrays (linear queue), Implementation of circular queue Singly linked list - Implementation using dynamic memory allocation techniques, arrange the list based on the ascending or descending order of the information field, concatenate two linked lists, interchange any two nodes in a list, Implementation of circular list, Implementation of linked stacks and queues. Doubly linked list – Implementation of doubly linked list, Implementation of circular doubly linked list.	

Course Code	Course Title	Total Credits
ICSC2CM5	Mathematics II – Linear Algebra	4

Module No.	Title & Contents	No. of Sessions
1	**Introduction To Vector Spaces** Vector Spaces: Rn and Cn, lists, Fnand digression on Fields, Definition of Vector spaces, Subspaces, sums of Subspaces, Direct Sums, Span and Linear Independence, bases, dimension.	15
2	**Linear Maps** Definition of Linear Maps - Algebraic Operations on - Null spaces and Injectivity - Range and Surjectivity - Fundamental Theorems of Linear Maps - Representing a Linear Map by a Matrix - Invertible Linear Maps - Isomorphic Vector spaces - Linear Map as Matrix Multiplication - Operators - Products of Vector Spaces - Product of Direct Sum - Quotients of Vector spaces.	20
3	**Eigenvalues, Eigenvectors and Eigenspaces** Eigenvalues and Eigenvectors - Eigenvectors and Upper Triangular matrices - Eigenspaces and Diagonal Matrices.	20
4	Inner Products and Norms Inner Products, Norms, Orthonormal Bases, Self Adjoint and Normal Operators, Spectral theorem, Polar Decomposition and Singular Value Decomposition. (proof of all theorems are excluded for module 4)	17

Book of study

Sheldon Axler, Linear Algebra Done Right, Third Edition Springer, 2017.