KAVAYITRI BAHINABAI CHAUDHARI NORTH MAHARASHTRA UNIVERSITY, JALGAON

School of Computer Sciences

MASTER OF COMPUTER APPLICATIONS (MCA)

Syllabus

[*under CBCS and Academic Flexibility*]

Faculty of Science and Technology

With effect from 2019-20

Summary of Distribution of Credits under CBCS Scheme for M.C.A. at School of Computer Sciences

[at University Campus under Academic Flexibility w.e.f. 2019-20]

Sr. No	Type of course	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem IV
01	Core	**24**	**24**	**24**	**24**	**24**	**-**
02	Skill based	**04**	**04**	**-**	**-**	**-**	**-**
03	School Elective	**-**	**-**	**04**	**04**	**04**	**-**
04	Project	**-**	**-**	**-**	**-**	**-**	**12**
05	Audit	**02**	**02**	**02**	**02**	**-**	**-**
06	Total Credits	**30**	**30**	**30**	**30**	**28**	**12**

Subject Type	Core	Skill based	School Elective	Project	Audit	Total
Credits	**120**	**08**	**12**	**12**	**08**	**160**

Total Credits = 102

School of Computer Sciences
Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon
M. C. A. (w. e. f. A. Y. 2019 -2020)
Course credit scheme

Semester	(A) Core Courses			(B) Skill Based / Elective Course			(C) Audit Course (No weightage in CGPA)			Total Credits (A+B+C)
	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (Pract.)	Total Credits	
I	6	16 + 8	**24**	1	4 + 0	4	1	2	2	30
II	6	16 + 8	**24**	1	4 +0	4	1	2	2	30
III	6	16 + 8	**24**	1	4 + 0	4	1	2	2	30
IV	6	16 + 8	**24**	1	4 + 0	4	1	2	2	30
V	6	16 + 8	**24**	1	4 + 0	4	-	-	-	28
VI	1	12	**12**	-	-	-	-	-	-	12
Total Credits	**132**			**20**			**8**			**160**

(T, Theory; P, Practical)

Structure of Curriculum

		First Year				Second Year								Total Credit Value
		Semester I		Semester II		Semester III		Semester IV		Semester V		Semester VI		
		Credit	Course	Credit	Course	Credit	Course	Credit	Course	Credit	Course	Credit	Course	
(A)	**Prerequisite and Core Courses**													
	Theory	16	4	16	4	16	4	16	4	16	4	-	-	**80**
	Practical	8	2	8	2	8	2	8	2	8	2	-	-	**40**
	Project(Industrial Training)	-	-	-	-	-	-	-	-	-	-	12	1	**12**
(B)	**Skill Based / Subject Elective Courses**													
1	Theory /Practical	4	1	4	1	4	1	4	1	4	1	-	-	**20**
(C)	**Audit Course (No weightage in CGPA calculations)**													
1	Practicing Cleanliness	2	1	-	-	-	-					-	-	**2**
2	Personality & and Cultural Development Related Course	-	-	2	1	-	-	-	-	-	-	-	-	**2**
3	Technology Related + Value Added Course	-	-	-	-	2	1	-	-	-	-	-	-	**2**
4	Professional /Social + Value added course	-	-	-	-	-	-	2	1	-	-	-	-	
	Total Credit Value	**30**	**8**	**30**	**8**	**30**	**8**	**30**	**8**	**28**	**7**	**12**	**1**	**160**

List of Audit Courses (Select any ONE course of Choice from Semester II and Semester III)

Semester I (Compulsory)		Semester II (Choose One) Personality and Cultural Development		Semester III (Choose One) Technology + Value Added Course		Semester IV (Choose One) Professional /Social + Value added course	
	Course Title		**Course Title**		**Course Title**		**Course Title**
AC-101	Practicing Cleanliness	AC-201 (A)	Soft Skills	AC-301(A)	Computer Skills	AC-401(A)	Human Rights
		AC-201 (B)	Sport Activities	AC-301(B)	Cyber Security	AC-401(B)	Current Affairs
		AC-201 (C)	Yoga	AC-301(C)	Linux (Spoken Tutorial Course)	AC-401(C)	Java (Spoken Tutorial Course)
		AC-201 (D)	Music	AC-301(D)	Advance C++ (Spoken Tutorial Course)	AC-401(D)	PHP & MySQL (Spoken Tutorial Course)

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

School of Computer Sciences

Syllabus under CBCS for Master of Computer Applications (MCA)

Course Structure (w.e.f. 2019-20)

COURSE STRUCTURE WITH CREDIT

Semester-I

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th(L)	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
CA-101	Core	Computer Organization & Architecture	04	-	04	40	-	60	-	100	-	04
CA-102	Core	Database Management System (DBMS)	04	-	04	40	-	60	-	100	-	04
CA-103	Core	Mathematical Foundations of Computer Science-I	04	-	04	40	-	60	-	100	-	04
CA-104	Core	System Programming	04	-	04	40	-	60	-	100	-	04
CA-105	Skill Based	Object Oriented Programming using C++	04	-	04	40	-	60	-	100	-	04
CA LAB-I	Core	LAB on DBMS	-	04	04	-	40	-	60	-	100	04
CA LAB-II	Core	LAB on C++ Programming	-	04	04	-	40	-	60	-	100	04
AC-101	Audit Course	Practicing Cleanliness	-	02	02	-	100	-	-	-	100	02

Semester-II

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th(L)	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
CA-201	Core	Automata Theory and Computability	04	-	04	40	-	60	-	100	-	04
CA-202	Core	Data Structures and Algorithms	04	-	04	40	-	60	-	100	-	04
CA-203	Core	Operating systems	04	-	04	40	-	60	-	100	-	04
CA-204	Core	Computer Networks	04	-	04	40	-	60	-	100	-	04
CA-205	Skill Based	Python Programming	04	-	04	40	-	60	-	100	-	04
CA LAB-III	Core	LAB on Data Structures and Algorithms	-	04	04	-	40	-	60		100	04
CA LAB-IV	Core	LAB on Python programming	-	04	04	-	40	-	60		100	04
AC- 201 (A) /(B)/(C)/(D)	Elective Audit Course	Choose one out of four (AC-201 (A)/(B)/(C)/(D)) (Personality and Cultural Development Related)	-	02	02	-	100	-	-	-	100	02

List of Elective Audit Courses to be offered in Semester-II:

AC-201 (A): Soft Skills

AC-201 (B): Practicing Sports Activities

AC-201 (C): Practicing Yoga

AC-201 (D): Introduction to Indian Music

Note: Syllabus for Spoken Tutorial Courses AC-201 (C)/(D) is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India.

Semester-III

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th(L)	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
CA-301	Core	Web Designing	04	-	04	40	-	60	-	100	-	04
CA-302	Core	Design and Analysis of Algorithms	04	-	04	40	-	60	-	100	-	04
CA-303	Core	Mathematical Foundations of Computer Science-II	04	-	04	40	-	60	-	100	-	04
CA-304	Core	Artificial Intelligence	04	-	04	40	-	60	-	100	-	04
CA-305(A) / (B)	Elective	Choose one from CA-305(A) and CA-305(B)	04	-	04	40	-	60	-	100	-	04
CA LAB-V	Core	LAB on Design and Analysis of Algorithms	-	04	04	-	40	-	60	-	100	04
CA LAB-VI	Core	LAB on Web Designing (HTML/XML/CSS/Navigation)	-	04	04	-	40	-	60	-	100	04
AC-301 (A)/(B)/(C)/(D)	Elective Audit Course	Choose one out of four (AC-301 (A)/(B)/(C)/D)) (Technology + Value added course)	-	02	02	-	100	-	-	-	100	02

List of Elective Courses to be offered in Semester-III:

CA-305(A): Optimization Algorithms CA-305(B): Data Warehousing and Data Mining (DWDM)

List of Elective Audit Courses:

AC-301 (A) : Computer Skills AC-301 (B) : Cyber Security

AC-301 (C) : Linux (Spoken Tutorial Course) AC-301 (D): Advance C++ (Spoken Tutorial Course)

Note: Syllabus for Spoken Tutorial Courses AC-301 (C)/(D) is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India.

Semester-IV

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th(L)	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
CA-401	Core	High Performance Computing Paradigms and applications	04	-	04	40	-	60	-	100	-	04
CA-402	Core	Web Application Technology	04	-	04	40	-	60	-	100	-	04
CA-403	Core	Machine Learning	04	-	04	40	-	60	-	100	-	04
CA-404	Core	Computer Graphics and Digital Image processing	04	-	04	40	-	60	-	100	-	04
CA-405(A) /(B)	Elective	Choose one from CA-405A / CA-405B	04	-	04	40	-	60	-	100	-	04
CA LAB-VII	Core	LAB on Computer Graphics and Digital Image Processing	-	04	04	-	40	-	60		100	04
CA LAB-VIII	Core	LAB on High Performance Computing (HPC) and Web Application Technology	-	04	04	-	40	-	60		100	04
AC-401(A)/(B)/(C)/(D)	Elective Audit Course	Choose one out of four (AC-401(A)/(B)/(C)/(D)) (Professional and Social + Value added course)	-	02	02	-	100	-	-	-	100	02

List of Elective Courses to be offered in Semester-IV:

CA-405A: Accounting and Management Control

CA-405B: Data Analytics

List of Elective Audit Courses:

AC-401(A) : Human Rights

AC-401(B) : Current Affairs

AC-401(C) : Java (Spoken Tutorial Course)

AC-401(D) : PHP & MySQL (Spoken Tutorial Course)

Note: Syllabus for Spoken Tutorial Courses AC-401 (C)/(D) is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India.

Semester-V

Course Code	Course Type	Title of the Course	Contact Hours/Week			Distribution of Marks for Examination						Credits
						Internal		External		Total		
			Th(L)	Pr	Total	Th	Pr	Th	Pr	Th	Pr	
CA-501	Core	Compiler Construction	04	-	04	40	-	60	-	100	-	04
CA-502	Core	Software Engineering	04	-	04	40	-	60	-	100	-	04
CA-503	Core	Natural Language Processing	04	-	04	40	-	60	-	100	-	04
CA-504	Core	Mobile Application Development	04	-	04	40	-	60	-	100	-	04
CA-505 (A) / (B)	Elective	Choose one from CA-505 (A) or CA-505 (B)	04	-	04	40	-	60	-	100	-	04
CA LAB-IX	Core	LAB on Android Programming	-	04	04	-	40	-	60		100	04
CA LAB-X	Core	LAB on Drupal Framework/LAB on Ruby on Rails	-	04	04	-	40	-	60		100	04

List of Elective Courses to be offered in Semester-V:

CA-505 (A): CMS: Drupal Website Development Framework

CA-505 (B): Ruby on Rails

Semester-VI

Course Code	Course Type	Title of the Course	Contact Hours/Week	Distribution of Marks for Examination					Credits
				Internal		External	Total		
			Six Month Full Time Industrial Training	Th	Pr	Project Evaluation	Th	Pr	
CA-601	Project	Full time Industrial Training	Students contact to teachers through E-mail, AView Software and other ICT technologies throughout the Semester	-	-	Project Evaluation in the form of Demonstration, Project Report Writing, Confidential Report from the Industry, Viva Voce etc.	-	300	12

Program at a Glance

Name of the program (Degree)	:	Master in Computer Applications (MCA)
Faculty	:	Science and Technology
Duration of the Program	:	Three years (six semesters)
Medium of Instruction and Examination	:	English
Examination Pattern	:	60% (External Assessment) + 40% (Internal Assessment)
Passing Standard	:	Separate Passing for internal as well as external assessment (40%).
Evaluation mode	:	CGPA
Total Credits of the program	:	160 (120 core credits including 12 credits of project/dissertation, 12 skill enhancement credits, 12 subject elective credits and 08 audit credits)

Program Objectives for M.C.A. Program:

1. To impart the fundamental knowledge in computer paradigm and techniques
2. To cater knowledge involved in application building and maintenance.
3. To equip the students with the current technologies used in application design, development and testing.
4. To provide platform to build manpower that can solve real world problems.
5. To make students updated as per recent hardware and software trends.

Program Outcomes (PO) for M.C.A. Program:

Upon successful completion of the M.Sc. program, student will be able to:

PO No.	PO	Cognitive level
PO 1	Understand fundamentals of mathematics, science and knowledge of computer science for solving complex problems.	**2**
PO 2	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects.	**6**
PO 3	Apply basic and advanced skills in areas of student interest thereby increasing their level of expertise through the specialization approach.	**3**
PO 4	Solve real world problems by modeling it and developing applications	**6**
PO 5	Create and design innovative methodologies to solve complex problems for the betterment of the society	**6**

Semester- I

*Course Code:***CA-101** **Computer Organization & Architecture** *Clock Hours:***60**
Total Marks: **100**

Course Objectives:

1) To enable students to understand significance and various techniques of data (integer numbers, float numbers as well as characters) representation for computers.
2) To understand basic building blocks (digital logic circuit and components) of computers, functioning, and organization of processor in detail involving the 8085 microprocessor and its programming.
3) To study the functioning and organization of memory in detail along with how the computer interacts with the outer world using different I/O modes.

Unit-I **[10]** Max Marks:**15**

Number System and Representation of Information: Positional Number System, Conversions, Complements, Representation of Negative numbers, Fixed Point Representation, Floating Point Representation, Character Codes, Error detection Codes

Unit-II **[10]** Max Marks:**15**

Digital Logic Circuits and Components: Digital Computers, Boolean Algebra, Boolean Identities, Simplifications of Boolean Expressions, Logic gates, Combinational Circuits: Half-Adder, Full-Adder, Decoders, Encoders, Multiplexers, Sequential Circuits: Flip flops, Registers, Shift Registers, Binary Counters, Memory Unit.

Unit-III **[10]** Max Marks:**15**

Processor Organization: General Register Organization, ALU, Instruction codes, Instruction Formats, Stack Organization, Addressing modes, Control Unit, Interrupts

Unit-IV **[10]** Max Marks:**15**

8085 Microprocessor: Introduction, History, Internal Architecture, Instruction set, Assembly Language introduction, Simple programs.

Unit-V **[10]** Max Marks:**15**

Memory Organization: Types of Memory, Main memory, Auxiliary memory, Memory Hierarchy, Cache Memory and related mapping, replacement policies, Virtual

memory.

Unit-VI **[10]** Max Marks:**15**

I/O interface, Asynchronous data transfer, Modes of transfer, Interrupt controlled I/O Transfer, Direct memory access, I/O channels

References:

1. Linda Null and Jullia Lobur (2006). The essentials of Computer Organization and Architecture. Jones Bartlett Publication, ISBN: 978-0763737696
2. M. Morris Mano (2007). Computer System Architecture. Pearson Education India, ISBN: 978-8131700709
3. Ramesh S Goankar (1998). Microprocessor Architecture, Programming & Applications with the 8085. Prentice Hall Publishing (India) Pvt. Ltd.
4. V. Heuring, H. Jorden (2003). Computer Systems Design and Architecture, Pearson Education, Second Ed., 2009. ISBN: 978-0130484406
5. William Stallings (2010). Computer Organization and Architecture Designing for Performance, PHI Pvt. Ltd., ISBN-13: 978-0-13-607373-4.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA101C.1	Apply number system and representation of information in computer.	3
CA101C.2	Understand simple digital logic circuits & components, describe processor organization and functioning in detail, comprehend various 8085 instructions and categorize them as per addressing modes.	2
CA101C.3	Solve examples related to memory management and discuss I/O process and various modes of I/O.	6

Course Code: **CA-102** **Database Management System (DBMS)** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

The objectives of the course are:

1) Introduction to the basic concepts of database management systems, learning to design databases using ER modelling, and decomposing data based on functional dependencies
2) Understand Relational databases, SQL, Transaction management, Query processing, concurrency control and recovery system.
3) Describe and discuss selected advanced database topics such as distributed database and XML and Web data.

Unit-I **[05] Max Marks:08**

Introduction: Database system application and purpose, Characteristics of DBMS, Database

Users, 1-tier, 2-tier and 3-tier architecture of DBMS along with its advantages, Levels of Database Architecture, Data Models, Data-schemas and instances, Data Independence, Role and responsibilities of DBA.

Unit-II **[10]** Max Marks:**10**

Database Design and E-R Model: Overviews of Database Design, ER Modelling concepts, ER Diagrams, Reduction to Relational Schemas, Extended ER Features, Alternative notations for Modelling, Cardinality constraints, Atomic Domains and 1NF, Decomposition using Functional Dependencies (BCNF, 3NF and 4NF).

Unit-III **[12]** Max Marks:**20**

Relational Databases: Structure of Relational Databases, Database Schemas, Keys, Schema diagrams, Relational Query Languages, Relational Operation. Overview of SQL, SQL Data Definition, Basic Structure of SQL Queries, Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of Databases. Join Expressions, Views, Transactions, Integrity Constraints, SQL data types and Schemas, Authorization, Accessing SQL from Programming Languages, Overview of Dynamic SQL and SQL CLI. Functions and Procedures, Triggers. The relational Algebra fundamental and extended Operations. Tuple and Domain Relational Calculus.

Unit-IV **[10]** Max Marks:**22**

Transaction Management and Query Processing: Transaction Concept, Model, Storage Structure, Atomicity and Durability, Isolation, Levels of Isolation, Overview of Query Processing, Measuring Query Cost, Selection Operation, Sorting, Join Operation, Other Operations and Evaluation of Expression. Overview of Query Optimization, Transformation of Relational Expression, Choice of Evaluation Plan.

Unit-V **[10]** Max Marks:**15**

Concurrency Control and Recovery System: Lock based Protocol, Timestamp based Protocol, Validation based Protocol, Deadlock Handling, Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithms, Buffer Management, Early lock release and logical undo operations, Remote Backup Systems. Case study: ARIES

Unit-VI **[13]** Max Marks:**25**

Advanced Topics in Databases: Type your unit content here.(comma separated) Introduction to Object Databases: Shortcomings of Relational Data Model, The Conceptual Object Data Model, Objects in SQL:1999 and SQL:2003. Introduction to XML and Web Data: Semi-structured Data, Overview of XML, XML Data Definitions, XML Schema, XML Data Manipulation: XQuery, XPath Query Languages: XPath and SQL/XML. Distributed Databases: Overview, Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control, Cloud based Databases.

References:

1] Michael Kifer, Arthur Bernstein, P.M, Lewis and P.K. Panigrahi (2011), “Database Systems: An Application Oriented Approach”, Second Edition, Pearson Education, 2011,

ISBN: 9788131703748.
2] C. J .Date, A. Kannan and S. Swamynathan (2006), "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006, ISBN:978-81-7758-556-8
3] A. Silberschatz, H.F.Korth, and S.Sudarshan (2011), "Database System Concepts", TMH Publications, Sixth Edition,2011, ISBN:978-007-132522-6.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA102C.1	Apply the relational model, specify integrity constraints, and explain how to create a relational database using an ER diagram and normalization techniques.	3
CA102C.2	Apply SQL to create, query and manipulate relational databases.	6
CA102C.3	Determine partitioning and distribution of data across networked nodes of a DBMS and data optimization in a distributed environment.	3

Course Code: **CA-103** **Mathematical Foundations of Computer Science-I** *Clock Hours:* **60** *Total Marks:* **100**

***Course Objectives*:**

The purpose of the course is to:

1) Introduction to Logics and Proof, Sets and Relations
2) Study types and graphical representations of functions and basic of counting.
3) Understand Graphs and Trees

Unit-I **[10]** Max Marks:**15**

Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Proof Methods and Strategy.

Unit-II **[10]** Max Marks:**20**

Sets, Relations: Sets, Set Operations, Relations and their Properties, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

Unit-III **[10]** Max Marks:**15**

Functions, Function Types, Some Important Functions, Graphical Representation of Functions.

Unit-IV **[10]** Max Marks:**15**

Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations.

Unit-V **[10]** Max Marks:**20**

Graphs: Graphs and Graph Models, Graph terminology and Special Types of Graphs, Representing Graphs, nGraph Isomorphism, Connectivity, Euler and Hamilton Paths.

Unit-VI **[10]** Max Marks:**15**

Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

References:

1.Rosen Kenneth H. (2007). Discrete Mathematics and Its Applications, Tata McGraw-Hill Publishing Company Limited, New Delhi, ISBN 13: 978-0-07-064824-1, ISBN 10:0-07-064824-7

2. Liu C. L. (1985). Elements of Discrete Mathematics, Second Edition, Mc Graw Hill, ISBN 007043476X, ISBN 9780070434769

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA103C.1	Construct a logic sentence in terms of predicates, quantifiers, and logical connectives, Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction, Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion.	6
CA103C.2	Determine the domain and range of a discrete or non-discrete function, graph functions, identify one-to-one functions, perform the composition of functions, find and/or graph the inverse of a function, and apply the properties of functions to application problems. Solve counting problems by applying elementary counting techniques using the product, sum rules, permutations and combinations.	3
CA103C.3	Solve problems using tree and graph algorithms.	6

Course Code: **CA-104** **System Programming** *ClockHours:***60**

*Total Marks:***100**

Course Objectives:

1) Introduction to system programming; organization, processing and various activities related to language processors and data structures used by them
2) Understand in depth the working of different languages processors like: assemblers, Macro Preprocessors, compilers, linker and loaders.
3) To know tools like Editors, Debug Monitors used for Program Development.

Unit-I **[06]** Max Marks:**12**

Introduction to System Programming: Introduction, Programming Languages and Language Processors, Language Processing Activities, Program Execution, Multi-Pass Organization of Language Processors, Symbol Table Entry Formats.

Unit-II **[12]** Max Marks:**20**

Assemblers: Elements of Assembly Language Programming, Simple Assembly Scheme, Pass Structure of Assemblers, Design of a Two-Pass Assembler-Pass I of the Assembler Intermediate Code Forms, Intermediate Code for Imperative Statements, Processing of Declarations and Assembler Directives, Pass II of the Assembler.

Unit-III **[10]** Max Marks:**12**

Macros and Macro Preprocessor: Macro Definition and Call, Macro Expansion, Nested Macro Calls, Conditional Expansion, Expansion Time Loops, Semantic Expansion, Design of a Macro Preprocessor- Design Overview.

Unit-IV **[10]** Max Marks:**15**

Linkers and Loaders: Introduction, Relocation and Linking Concepts, Design of a Linker, Self-Relocating Programs, Linking of Overlay Structured Programs, Dynamic Linking, Loaders.

Unit-V **[06]** Max Marks:**10**

Scanning and Parsing: Programming Language Grammars, Scanning, Parsing – Top Down Parsing and Bottom Up Parsing.

Unit-VI **[10]** Max Marks:**20**

Compilers: Causes of a Large Semantic Gap, Binding and Binding Times, Static and Dynamic Memory Allocation, Compilation of Expressions – Intermediate Codes for Expressions, Postfix Notation, Triples and Quadruples, Function and Procedure Calls, Code Optimization- Optimizing Transformations, Local Optimization and Introduction to Global Optimization, Pure and Impure Interpreter.

Unit-VII **[06]** Max Marks:**11**

Software Tools: Software Tools for Program Development, Editors, Debug Monitors.

References:

1. Dhamdhere D M, (2011). System Programming. Tata McGraw Hill Education Private Limited, New Delhi. ISBN 10: 0071333118
2. Leland L. Beck, D. Manjula (2002). System Software: An Introduction to System Programming, 3rd Edition, Pearson Education, ISBN-10: 817758555X
3. John J. Donavan (2001). System Programming. Indian Edition, Mc Graw Hill Education, ISBN10:0074604821
4. Srimanta Pal, (2011). System Programming. Oxford Higher Education, ISBN-10: 0198070888

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA104C.1	Explain various the organization, processing and working of various kinds of language processors.	3
CA104C.2	Describe the working of different languages processors like: assemblers, Macro Preprocessors, compilers, linker and loaders.	2
CA104C.3	Understand software tools used in program development.	2

Course Code: **CA-105** **Object Oriented Programming using C++** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) To familiarize the Object-Oriented Programming (OOP) concepts, such as abstraction, encapsulation, instances, initializations, polymorphism, overloading, inheritance etc.
2) To write programs to solve problems using generic programming constructs such as templates and using standard template library.
3) To understand and know the importance of pointers and learn file handling and exception handling in real-world problems.

Unit-I **[10]** Max Marks:**12**

Fundamentals

Object-Oriented Programming (OOP): Need, Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object oriented programming language.

Object-Oriented Programming using C++ : C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members.

Functions: Function, function prototype, accessing function and utility function, Constructors and destructors, Copy Constructor, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function

Unit-II **[12]** Max Marks:**20**

Polymorphism and Inheritance

Operator Overloading: concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable.

Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Inheritance, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation, Classes Within Classes.

Polymorphism: concept, relationship among objects in inheritance hierarchy, abstract classes, polymorphism.

Unit-III **[12]** Max Marks:**18**

Virtual Functions: Pointers- indirection Operators, Memory Management: new and delete, Pointers to Objects, A Linked List Example, accessing Arrays using pointers, Function pointers, Pointers to Pointers, A Parsing Example, Debugging Pointers, Dynamic Pointers, smart pointers, shared pointers, Case Study : Design of Horse Race Simulation. Virtual Function Friend Functions, Static Functions, Assignment and Copy Initialization, this

Pointer, virtual function, dynamic binding, Virtual destructor.

Unit-IV **[10]** Max Marks:**18**

Templates: function templates, Function overloading, overloading Function templates, class templates, class template and Nontype parameters, template and inheritance, template and friends Generic Functions, Applying Generic Function, Generic Classes, The typename and export keywords, The Power of Templates.

Exception Handling: Fundamentals, other error handling techniques, simple exception handling Divide by Zero, rethrowing an exception, exception specifications, processing unexpected exceptions, stack unwinding, constructor, destructor and exception handling, exception and inheritance.

Unit-V **[08]** Max Marks:**16**

Files and Streams: Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output, Early vs. Late Binding.

Unit-VI **[08]** Max Marks:**16**

Standard Template Library (STL): Introduction to STL, Containers, algorithms and iterators, *Containers*: Sequence container and associative containers, container adapters,

Algorithms: basic searching and sorting algorithms, min-max algorithm, set operations, *Iterators*: input, output, forward, bidirectional and random access. Object Oriented Programming – a road map to future

References:

1. Robert Lafore, Object-Oriented Programming in C++, fourth edition, Sams Publishing, ISBN:0672323087.
2. Bjarne Stroustrup, The C++ Programming language, Third edition, Pearson Education ISBN 0-201-88954-4.
3. Deitel, C++ How to Program, 7th Edition, Pearson Education, ISBN-10: 0-13-611726-0 ISBN-13: 978-0-13-611726-1.
4. Herbert Schildt, C++ The complete reference, Fifth Edition, McGraw HillProfessional, , ISBN-10: 0071634800 ISBN-13: 978-0071634809.
5. Stanley B. Lippman, Josée Lajoie, Barbara E. Moo(2013), C++ Primer, Fifth Edition, Addison-Wesley, 2013, ISBN-13: 978-0-321-71411-4, ISBN-10: 0-321-71411-3

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA105C.1	Understand and use the basic programming constructs of C++ and manipulate various C++ datatypes, such as arrays, strings, and pointers.	2
CA105C.2	Manage memory appropriately using proper allocation/deallocation procedures.	6
CA105C.3	Write small-scale C++ programs using the above skills.	6

Course Code: **CA LAB-I** **LAB on DBMS** *Total Marks:* **100**

Course Objectives:

1) Provides foundation knowledge in database concepts, technology and practice to prepare students into expert database application developers.
2) Strong practice in SQL programming through a variety of database problems.
3) Develop database applications using front-end tools and back-end DBMS.

1. Creating database tables and using data types.
   - Create table
   - Modify table
   - Drop table
2. Practical Based on Data Manipulation.
   - Adding data with Insert
   - Modify data with Update
   - Deleting records with Delete
3. Practical Based on Implementing the Constraints.
   - NULL and NOT NULL
   - Primary Key Constraint
   - Foreign Key Constraint
   - Unique Constraint
   - Check Constraint
   - Default Constraint
4. Practical for Retrieving Data Using following clauses.
   - Simple select clause
   - Accessing specific data with Where
   - Ordered By
   - Distinct
   - Group By
5. Practical Based on Aggregate Functions.
   - AVG
   - COUNT
   - MAX
   - MIN
   - SUM
   - CUBE
6. Practical Based on implementing all String functions.
7. Practical Based on implementing Date and Time Functions.
8. Practical Based on implementing use of UNION, INTERSECTION, SET DIFFERENCE.
9. Implement Nested Queries & all types of JOIN operation.
10. Practical Based on performing different operations on a view.
11. Practical Based on implementing use of Procedures.
12. Practical Based on implementing use of Triggers

13. Practical Based on implementing Cursor.
14. Demonstrate Database connectivity with front end tools like – VB.NET, C#.NET, JAVA, D2K, etc.
15. Practical based on creating Data Reports.
16. Design entity relationship models for a business problem and develop a normalized database structure

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABIC.1	Design and implement a database schema for a given problem-domain.	6
CALABIC.2	Create and maintain tables using PL/SQL, Populate and query a database using SQL DML/DDL commands and programming PL/SQL including stored procedures, stored functions, cursors, triggers.	6
CALABIC.3	Application development using PL/SQL & front-end tools.	3

Course Code: **CA LAB-II** **LAB on C++ Programming** *Total Marks:* **100**

Course Objectives:

1) Apply object-oriented approaches to software problems in C++
2) Apply exception handling techniques to software problems in C++
3) Apply generic programming approaches using templates and efficiently use standard template library in software development

1. Write program to demonstrate encapsulation using of class.
2. Write program to demonstrate use of constructor, constructor overloading and destructor.
3. Write program to demonstrate use of array manipulations.
4. Write program to demonstrate use of string manipulations.
5. Write program to demonstrate use of function overloading.
6. Write program to demonstrate use of operator overloading.
7. Write program to demonstrate use of pointers.
8. Write program to demonstrate use of operator overloading.
9. Write program(s) to demonstrate use of all types of inheritance.
10. Write program to demonstrate use of virtual function.
11. Write program to demonstrate use of friend function.
12. Write program to demonstrate use of virtual class.
13. Write program to demonstrate use of function templates.
14. Write program to demonstrate use of class templates.
15. Write program to demonstrate use of static data member and static member function.
16. Write program to demonstrate use of exception handling.
17. Write program to demonstrate command line arguments.

18. Write program to demonstrate file handling.
19. Write program(s) to demonstrate use of STL.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABIIC.1	Develop logic of a program for solving real time problems and isolate and fix common errors in C++ programs	6
CALABIIC.2	Understand the object-oriented approach for the program development and make use of the OOP concepts (data abstraction, encapsulation, polymorphism, overloading, and inheritance) of C++ appropriately in problem solving.	2
CALABIIC.3	Create applications using the STL library.	6

AC-101: Practicing Cleanliness

(Compulsory; Campus-level Audit Course; Practical; 2 Credits)

Course Objectives:

- To make students aware of Clean India Mission and inculcate cleanliness practices among them.

  - Awareness program on
    - Swachh Bharat Abhiyan (Clean India Mission)
    - Clean Campus Mission
    - Role of youth in Clean India Mission
  - Cleaning activities inside and surroundings of Department buildings.
  - Tree plantation and further care of planted trees
  - Waste (Liquid/Solid/e-waste) Management, Japanese 5-S practices
  - Planning and execution of collection of Garbage from different sections of University campus
  - Role of youth in power saving, pollution control, control of global warming, preservation of ground water and many more issues of national importance.
  - Cleanest School/Department and Cleanest Hostel contests
  - Painting and Essay writing competitions

Course Outcome:

By the end of this course, students should be able to:

CO No.	CO	Cognitive level
AC101.1	Identify need at of cleanliness at home/office and other public places.	**2**
AC101.2	Plan and observe cleanliness programs at home and other places.	**4**
AC101.3	Practice Japanese 5-S practices in regular life.	**3**

Semester- II

Course Code: **CA-201** **Automata Theory and Computability** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) Build concepts of theoretical design of deterministic and non-deterministic finite automata and push down automata.
2) Acquire conceptual understanding of fundamentals of grammars and languages.
3) Develop understanding of different types of PDAs, Turing machines and applications.

Unit-I **[12]** Max Marks:**20**

Finite Automata:

Sets, relations, functions, graphs, trees, mathematical induction, Finite Automata(FA), definition, description, transition systems, acceptability of a string, NFA, DFA, equivalence of DFA and NFA, Melay & Moore model, minimization of automaton, Applications.

Unit-II **[04]** Max Marks:**12**

Formal Languages:

Formal languages, Chomsky classification of languages, languages, their relation and automaton.

Unit-III **[14]** Max Marks:**23**

Regular Expressions:

Regular expressions, FA and regular expressions, pumping lemma for regular sets, applications of pumping lemma, closure properties of regular sets, regular sets and regular grammars.

Unit-IV **[10]** Max Marks:**15**

Context Free Languages:

CFLs and derivation trees, ambiguity in Context-Free Grammars (CFGs), simplification of CFGs, Normal Forms for CFGs (CNF and GNF), pumping lemma for CFLs, decision algorithms for CFLs.

Unit-V **[08]** Max Marks:**15**

Push Down Automata:

Pushdown Automaton (PDA), informal description, basic definitions, acceptance by a PDA, PDA and CFLs.

Unit-VI **[08]** Max Marks:**15**

Turing Machine:

Turing Machine, Model, computable languages and function, representation of TMs, Language Acceptability by TMs, Design of TM, Halting Problem of TMs.

References:

1. Smita Rajpal. Theory of Automata and Formal Languages: GALGOTIA Publications

ISBN 1234027054.
2. J.E.Hopcraft, R. Motwani and J.D.Ullman. Introduction to Automata Theory languages & Computation: Pearson Education Asia ISBN 978-0321455369.
3. K.L.P.Mishra, N. Chandrashekharan. Theory of Computer Science: PHI ISBN 8120329686.
4. M.Sipser (1997). Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning I*SBN* 978-1133187790.
5. http://nptel.ac.in/

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA201C.1	Differentiate between deterministic and nondeterministic automata, design finite automata, equivalence of languages described by finite automata and regular expressions.	4
CA201C.2	Devise regular, context free grammars while recognizing the strings and tokens and design pushdown automata to recognize the language.	4
CA201C.3	Develop an understanding of computation through Turing Machine.	6

Course Code: **CA-202** **Data Structures and Algorithms** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) To impart the basic concepts of data structures and algorithms
2) To understand basic concepts about array, stacks, queues, linked lists, trees and graphs and advance topics like AVL Trees, BTrees, B* and B+ Trees
3) To understand concepts about searching, sorting and hashing techniques

Unit-I **[08]** Max Marks:**06**

Introduction to Data Structures and Algorithms: Algorithmic Notation: Format Conventions, Statement and Control Structures. Time and Space Analysis: Data types and Abstract data types, Types of Data structures; Primitive, Non primitive, Linear and Nonlinear Data structures

Unit-II **[08]** Max Marks:**15**

Array: Storage representation, operations and applications (Polynomial addition and subtraction) **Stack**: operations and applications (infix, postfix and prefix expression handling), **Queue**: operations and applications, Circular Queues: operations and applications, Concept of Double ended Queue and Priority Queue, Linked representation of stack and queue.

Unit-III **[10]** Max Marks:**12**

Linked Lists: Operations and Applications of Linear linked list (Polynomial addition and subtraction), Circular linked list and Doubly linked list.

Unit-IV **[11]** Max Marks:**21**

Trees: Binary Trees, Binary Tree: Representations, Operations (insert/delete), Traversal (inorder, preorder, postorder, level order), Threaded Binary Tree, Search Trees: AVL Tree, single and double rotations, B-Trees: insertion and deletion, Introduction to B+ and B* Trees

Unit-V **[11]** Max Marks:**18**

Graphs and Their Applications: Representation (Matrix/Adjacency) and Traversal (Depth First Search/Breadth First Search), Spanning Trees, Minimal Spanning Tree (Prim's and Kruskals's algorithm), Shortest Paths and All Pair Shortest Path, Dijkstra's, Floyd-Warshall Algorithms.

Unit-VI **[12]** Max Marks:**18**

Hash Table: Hash Function, Collision and its Resolution, Separate Chaining, Open Addressing (linear probing, quadratic probing, double hashing), Rehashing, Extendible Hashing **Searching:** Linear Search and Binary Search (array/binary tree). **Sorting**: General Background, Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Quicksort, Mergesort, Heapsort and Radix Sort.

References:

1. Tremblay, J. & Sorenson, P.G., (2001), An Introduction to Data Structures with Application, Mcgraw Hill India, ISBN: 978-0074624715, 0074624717
2. Langsam, Y., Augenstein, M.J. & Tenenbaum A.M., (2015), Data Structures using C and C++, 2nd Edition, Pearson Education ISBN: 978-9332549319, 9332549311
3. Balagurusamy, E., (2013), Data Structures using C, 1st Edition, Mcgraw Hill Education, ISBN: 978-1259029547, 1259029549
4. Weiss, M.A., (2002), Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson India, ISBN: 978-8177583588, 8177583581
5. Horowitz, E., Sartaj S. & Mehta, D. (2008), Fundamentals of Data Structures in C++, Universities Press ISBN: 978-8173716065, 8173716064
6. Lafore, R., (2003), Data Structures & Algorithms in Java, 2nd Edition, Pearson India, ISBN: 978-8131718124, 8131718123
7. Kruse, R., Tondo, C.L., Leung B., & Mogalla S, (2006), Data Structures and Program Design in C, Pearson India, ISBN: 978-8177584233.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA202C.1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.	2
CA202C.2	Understand data structures such as arrays, linked lists, stacks and queues, graphs, trees and hash tables.	2
CA202C.3	Solve problem involving graphs, trees and apply different sorting and searching algorithms.	3

Course Code: **CA-203** **Operating Systems** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) To get acquainted with the main components of an OS, and study concepts like system calls, processes management, threads, scheduling, synchronization, deadlocks, memory management, IO management.
2) To understand the working of an OS as a resource manager, file system manager, process manager, memory manager and I/O manager and methods used to implement the different parts of OS
3) To study the need for special purpose operating systems with the advent of new emerging technologies

Unit-I **[04]** Max Marks:0**8**
Introduction: review of computer organization, introduction to popular operating systems like UNIX, Windows, etc., OS structure, system calls, functions of OS, evolution of Oss.

Unit-II **[03]** Max Marks:0**6**
Computer organization interface: using interrupt handler to pass control between a running program and OS.

Unit-III **[08]** Max Marks:**12**
Concept of a process: states, operations with examples from UNIX (fork, exec), Process scheduling, interprocess communication (shared memory and message passing), UNIX signals.

Unit-IV **[04]** Max Marks:0**6**
Threads: multithreaded model, scheduler activations, examples of threaded programs.

Unit-V **[06]** Max Marks:**10**
Scheduling: multi-programming and time sharing, scheduling algorithms, multiprocessor scheduling, thread scheduling (examples using POSIX threads).

Unit-VI **[08]** Max Marks:**12**
Process synchronization: critical sections, classical two process and n-process solutions, hardware primitives for synchronization, semaphores, monitors, classical problems in synchronization (producer-consumer, readers-writer, dining philosophers, etc.).

Unit-VII **[06]** Max Marks:**10**
Deadlocks: modelling, characterization, prevention and avoidance, detection and recovery.

Unit-VIII **[07]** Max Marks:**12**
Memory management: with and without swapping, paging and segmentation, demand paging, virtual memory, page replacement algorithms, working set model, implementations from operating systems such as UNIX. Current Hardware support for paging: e.g., Pentium/ MIPS processor etc.

Unit-IX **[07]** Max Marks:**12**
Secondary storage and Input/Output: device controllers and device drivers, disks, scheduling algorithms, file systems, directory structure, device controllers and device drivers, disks, disk space management, disk scheduling, NFS, RAID, other devices. Operations on them, UNIX FS, UFS protection and security, NFS

Unit-X **[04]** Max Marks:**06**
Protection and security: Illustrations of security model of UNIX and other Oss. Examples of attacks.

Unit-XI **[03]** Max Marks:**06**

Epilogue: Pointers to advanced topics (distributed OS, multimedia OS, embedded OS, real-time OS, OS for multiprocessor machines).

All above topics shall be illustrated using UNIX as case-studies.

References:

1. 1 Abraham Silberschatz, Peter B. Galvin, Greg Gagne (2009), Operating System Concepts, 8th Ed., John Wiley ISBN 0-471-69466-5.
2. William Stallings (2014), Operating Systems: Internals and Design Principles. Pearson, 8th Ed. ISBN-13: 978-0-13-230998-1
3. AS Tanenbaum (2009), Modern Operating Systems, 3rd Ed., Pearson. ISBN: 0135013011
4. AS Tanenbaum, AS Woodhull (2006), Operating Systems Design and Implementation, 3rd Ed., Prentice Hall ISBN-10: 0131429388
5. M. J. Bach (1986), Design of the Unix Operating System, Prentice Hall of India ISBN0. -13-201757-1 025

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA203C.1	Analyse design aspects and data structures/policies/algorithms used for file subsystem, memory subsystem, process subsystem and i/o subsystem of Unix OS.	4
CA203C.2	Differentiate between threads and processes and compare different processor scheduling algorithms.	4
CA203C.3	Identify the need to create the advance and special purpose operating system.	2

1)

*Course Code:***CA-204** **Computer Networks** *ClockHours:***60**

*Total Marks:***100**

Course Objectives:

1) To introduce concepts and fundamentals of data communication and computer networks.
2) To explore the working of various layers of OSI Reference Mode in order to gain insight of how data transmission take place between nodes and what are the difficulties encountered during transmission
3) To study issues/protocols/algorithms related to communication channels, routing of packets, cryptography and network security.

Unit-I **[10]** Max Marks:**20**

Overview of Computer Network, OSI and TCP/IP Reference Models, Guided and Unguided Transmission Media, Analog and Digital Communication, Encoding and Modulation, Nyquist Theorem, Shannon's capacity, Switching techniques- TDM,FDM.

Unit-II **[15]** Max Marks:**25**

Framing, Error detection and Error correction- Vertical Redundancy Check (VRC) Longitudinal Redundancy Check (LRC), Hamming Distance, Hamming Code, Cyclic Redundancy Check(CRC), Stop and Wait Protocol, Sliding Window Protocol, Go-Back-n ARQ, Selective-Reject ARQ, HDLC.

Unit-III **[10]** Max Marks:**15**

Channel Allocation, ALOHA Systems, CSMA Protocols, Collision Free Protocols, Local Area Networks, Bridges, ATM

Unit-IV **[15]** Max Marks:**25**

Routing- Flooding, Shortest Path Routing, Distance Vector Routing, Link State Routing, Congestion Control-Leaky Bucket and Token Bucket algorithms, IP Protocol, IP Addressing, ARP, RARP, OSPF, BGP, TCP, UDP,DHCP.

Unit-V **[10]** Max Marks:**15**

Cryptography and Network Security- Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

References:

1.Andrew S. Tanenbaum ,(2009). Computer Networks 4th Edition , Pearson Prentice Hall.ISBN- 978-81-7758-165-2

2.Behrouz A. Forouzan, (2012).Data Communications and Networking. 5th Edition. Mc Graw – Hill, ISBN-10: 0073376221

3. William Stalling, (2013) Cryptography and Network Security 6 edition Pearson Education India, ISBN-10: 9332518777

4. Behrouz A Forouzan and Debdeep Mukhopadyay, (2010) Cryptography and Network Security, 2nd edition, McGraw Hill Education, ISBN-10: 007070208X

5. Atul Kahate, (2009),Cryptography and Network Security, 2nd Edition, McGraw Hill Education, ISBN-10: 0070151458

Auxiliary Resources:

a. http://nptel.ac.in/courses/106105081/1
b. http://www.nptelvideos.in/2012/11/computer-networks.html
c. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/lecture-9/

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA204C.1	Understand of the OSI Reference Model and have an upright knowledge of layers 1-3.	2
CA204C.2	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.	4

CA204C.3	Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications.	3

Course Code: **CA-205** **Python Programming** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) Introduce to python programming: data types, operators, conditional and logical statements, control structures, writing user defined functions and file handling
2) To introduce to OOP through python, regular expressions, exception handling and GUI constructs for web.
3) To study advance topics in python viz., lambda functions, functional programming tools, using and configuring modules etc.

Unit-I **[12]** Max Marks:**20**

The Python Programming Language, Python Data, Variables, Expressions and Statements, Values and Data Types, Type conversion Functions, Operators and Operands, Input, Order of Operations, Functions, Calling Functions, Passing Functions, Formal Arguments, Variable-length Arguments, Functional Programming, Boolean Expressions, Logical operators, Precedence of Operators, Conditional Execution, Unary Selection, Nested conditionals, Chained conditionals, Boolean Functions, Iteration, The for loop, The while Statement

Unit-II **[08]** Max Marks:**15**

Strings, A Collection Data Type, Operations on Strings, Index Operator: Working with the Characters of a String, String Methods, Length, The Slice Operator, String Comparison, Lists, List Values, List Length, Accessing Elements, List Membership, Concatenation and Repetition, List Slices, Lists are Mutable, List Deletion, Objects and References, Aliasing, Cloning Lists, Repetition and References, List Methods, Append versus Concatenate Lists and for loops, Using Lists as Parameters, Nested Lists, Strings and Lists, List Type Conversion Function, Tuples, Tuple operators and built-in functions, Tuples and Mutability, Tuple Assignment, Tuples as Return Values

Unit-III **[15]** Max Marks:**20**

Dictionaries, Dictionary Operations, Dictionary Methods, Dictionary Keys, Aliasing and Copying, Sparse Matrices, Working with Data Files, Finding a File on your Disk, Reading a File, Iterating over lines in a file, Writing Text Files, Object Oriented Programming, Classes, Instances, Class method Calls, Coding Class Tree, Attributes, Building and Method Invocation, Composition, Inheritance, Operator Overloading, Encapsulation and Information Hiding, Search Algorithms, Sorting Algorithms, Hash Tables

Unit-IV **[10]** Max Marks:**20**

Regular Expressions, Exceptions, Standard Exceptions, Exceptions Syntax, The try/except/else Statement, The try/finally Statement, Unified try/except/finally, The raise Statement, The assert Statement, with/as Context Managers String-Based Exceptions, Class-Based Exceptions, General raise Statement Forms, Nesting Exception Handlers, Exception Idioms, Exception Design Tips. Catch All Exceptions, Catch A Specific Exception, Catch

Multiple Specific Exceptions, Clean-up After Exceptions, GUI Programming using TKinter.

Unit-V **[15]** Max Marks:**25**

Advance Function Topics: Anonymous Function Lambda, Mapping Functions over Sequences: map, Functional Programming Tools: filter and reduce, List Comprehensions Revisited: Mappings. Modules: Python Program Architecture, Module Creation, Module usage, Module Namespaces, Reloading Modules, Module Packages. Data Hiding in Modules, Enabling Future Language Features, Mixed Usage Modes, Changing the Module Search Path, The import as Extension, Relative Import Syntax, Module Design Concepts

References:

1. John V Guttag (2013), Introduction to Computation and Programming Using Python, Prentice Hall of India, 2013, ISBN: 9780262525008
2. R. Nageswara Rao(2016), Core Python Programming, Dreamtech Press, 2016, ISBN-13: 9789351199427
3. Wesley J. Chun(2006), Core Python Programming – Second Edition, Prentice Hall, ISBN-13: 978-0132269933, ISBN-10: 0132269937
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser(2013), Data Structures and Algorithms in Pyhon", Wiley, 2013, ISBN : 978-1-118-54958-2, ISBN : 978-1-118-29027-9(HardCover)
5. Kenneth A. Lambert(2011), Fundamentals of Python – First Programs, CENGAGE Publication, 2011, ISBN 1111822700, ISBN 9781111822705
6. Luke Sneeringer(2015), Professional Python, Wiley Inc.,2015, ISBN: 1119070856
7. Mark Lutz (2007), Learning Python, 3rd Edition, O'Reilly Media, Inc., 2007, ISBN-13: 978-0-596-51398- 6, ISBN-10: 0-596-51398-4

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA205C.1	Use lists, tuples, dictionaries, strings and files efficiently for solving real world problems.	3
CA205C.2	Implement the concepts of object-oriented programming using python.	3
CA205C.3	Develop modules, packages and GUI based programming for web.	6

Course Code: **CA Lab-III** **LAB on Data Structures and Algorithms** *Total Marks:* **100**

Course Objectives:

1) Solve real-world problems by reasoning about data structure choices, choose appropriate implementations.
2) To make the students write various programs and ADTS for all data structures.
3) Students will learn to write, debug, and test large programs systematically.

Implementation of programs based on the following

- Arrays
- Multidimensional Arrays, Matrices
- Stacks, Polish Notation

- Queues
- Deques
- Linear Linked List, Circular Linked List, Doubly Linked List
- Polynomial Addition/Subtraction

Implementation of programs based on Trees

- Binary Search Tree
- In-order, Pre-order and Post-order Traversals
- Heap Tree
- Balanced Binary Tree (AVL)
- B-Trees

Implementation of programs based on Graphs

- Depth First Traversal
- Breadth First Traversal
- Obtaining Shortest Path (Dijkstra and Floyd-Warshall)
- Minimum spanning tree (Kruskal and Prim)

Implementation of programs for Hash Table, Searching and Sorting techniques

- Hash Table
- Linear and Binary Search (using array)
- Bubble sort
- Selection sort
- Insertion sort
- Radix sort
- Quick sort
- Merge sort
- Heap sort

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABIIIC.1	Develop solutions for a range of problems using procedure oriented / object-oriented programming.	6
CALABIIIC.2	Choose the appropriate data structure and algorithm design method for a specified application.	3
CALABIIIC.3	Apply practical knowledge on the applications of data structures.	3

Course Code: **CA Lab-IV** **Lab on Python Programming** *Total Marks:* **100**

Course Objectives:

1) To acquire programming skills in core Python.
2) To develop the skill of designing Graphical user Interfaces in Python
3) To develop the ability to write file handling, exception handling and modular programming applications in Python.

1. Develop programs to understand the control structures of python
2. Develop programs to learn different types of structures (list, dictionary, tuples) in python
3. Develop programs to learn concept of functions scoping, recursion and list mutability.
4. Develop programs to understand object oriented programming using python.

5. Develop programs for data structure algorithms using python – searching, sorting and hash tables.
6. Develop programs to learn regular expressions using python.
7. Develop programs to learn GUI programming using Tkinter.
8. Demonstrate the concept of exception handling using try/except/else Statement, Unified try/except/finally, try/finally Statement, raise Statement, assert Statement, catch multiple specific exceptions
9. Demonstrate the concept of String-Based Exceptions, Class-Based Exceptions and Nesting Exception handlers.
10. Demonstrate implementation of the Anonymous Function Lambda.
11. Demonstrate implementation Mapping Functions over Sequences.
12. Demonstrate implementation functional programming tools such as filter and reduce
13. Demonstrate the Module Creation, Module usage, Module Namespaces, Reloading Modules, Module Packages, Data Hiding in Modules.
14. Demonstrate Mixed Usage Modes of modules, Changing the Module Search Path, The import as Extension, Relative Import Syntax, Module Design Concepts

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABIVC.1	Demonstrate use and working of various data types, control structures, files, exceptional handling etc.	2
CALABIVC.2	Create, configure and make use of modules.	6
CALABIVC.3	Develop console based and GUI applications (both procedural/object oriented) to solve different problems using python programming.	6

AC-201(A): Soft Skills

(Personality and Cultural Development Related Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives:

- To inculcate different soft skills among students.

Unit 1 Introduction to soft skills

Formal definition, Elements of soft skills, Soft vs. Hard skills, Emotional quotient, Goal setting, life skills, Need for soft skills, Communication skills, Etiquettes& Mannerism.

Unit 2 Self-Assessment

Goal setting, SWOT analysis, attitude, moral values, self-confidence, etiquettes, non-verbal skills, achievements, positive attitude, positive thinking and self-esteem.

Activity: The teacher should prepare a questionnaire which evaluate students in all the above areas and make them aware about these aspects.

Unit 3 Communication Skills

Types of communication: Verbal, Non-verbal, body language, gestures, postures, gait, dressing sense, facial expressions, peculiarity of speaker (habits).

Rhetoric speech: Prepared speech (topics are given in advance, students get 10 minutes

to prepare the speech and 5 minutes to deliver, Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic), Storytelling (Each student narrates a fictional or real-life story for 5 minutes each), Oral review (Each student orally presents a review on a story or a book read by them)

Drafting skills: Letter, Report & Resume writing, business letters, reading & listening skills

Activity: The teacher should teach the students how to write the letter, report and build resume. The teacher should give proper format and layouts. Each student will write one formal letter, one report and a resume.

Unit 4 Formal Group Discussion, Personal Interview & Presentation skills **4 hrs.**

Topic comprehension, Content organization, Group speaking etiquettes, driving the discussion & skills.

Preparation for personal interview: dress code, greeting the panel, crisp self-introduction, neatness, etiquettes, language tone, handling embarrassing & tricky questions, graceful closing.

Activity: Each batch is divided into two groups of 12 to 14 students each. Two rounds of a GD for each group should be conducted and teacher should give them feedback. Mock interview are to be conducted.

Unit 5 Aptitude and analytical skills **8 hrs.**

Quantitative aptitude, Numerical reasoning, verbal reasoning, diagrammatic test, situational tests, logical thinking.

Analytical skills: Definition, Types, problem solving

Unit 6 Life skills **4 hrs.**

Time management, critical thinking, sound and practical decision making by dealing with conflicts, stress management, leadership qualities

Activity: The teacher can conduct a case study activity to train students for decision making skills. The teacher should conduct a session on stress management and guide students on how to manage stress. The teacher may conduct a stress relieving activity in the class. He/she may counsel students individually to know their problems and guide them on dealing with them effectively.

Suggested readings:

1. Basics of Communication In English: Francis Sounderaj, MacMillan India Ltd.
2. English for Business Communication: Simon Sweeney, Cambridge University Press
3. An Introduction to Professional English and Soft Skills: Das, Cambridge University Press
4. Quantitative Aptitude: R.S. Agrawal

Course Outcome:

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

CO No.	CO	Cognitive level
AC201A.1	Identify their lacunas about some soft skills and try to overcome the same.	2
AC201A.2	Practice learned soft skills in real life and do their jobs more effectively.	3

AC-201(B): Practicing Sports Activities

(Personality and Cultural Development Related Audit course; Practical; 2 Credits)

(Optional: Campus-level)

Course Objectives:

- To motivate students towards sports and provide them required training.

SR NO	NAME OF THE SPORT/GAME (Select ONE of the Following)	SYLLABUS OF THE COURSE	TIMING (02 Hours in a Week)	SEMESTER
1	Volleyball	• General Fitness • Basic Fitness • Specific Fitness • History of the Game • Basic Skill of the Game • Major Skill of the Game • Technique & Tactics of the Game • Game Practice	Morning : 07 to 09 AM OR Evening : 05 to 07 PM	Total 30 Hours in Each Semester
2	Athletics			
3	Badminton			
4	Cricket			
5	Basketball			
6	Handball			
7	Kabaddi			
8	Kho-Kho			
9	Table-Tennis			
10	Swimming			

Course Outcome:

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

CO No.	CO	Cognitive level
AC201B.1	Identify one or more sports of their choice and develop more interest to participate at University/National level sport events.	2
AC201B.2	Practice the learned sports activities regularly in real life.	3

AC-201(C): Practicing Yoga

(Personality and Cultural Development Related Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives:

- To motivate students towards yoga and provide them required training.

- Yog: Meaning, Definition & Introduction, Objectives
- Primary Introduction of Ashtanga Yoga
- Preparation of Yogabhyas
- Omkar Sadhana, Prayer, Guru Vandana
- Sukshma Vyayamas
- Suryanamaskar (12 Postures)
- Asanas :
  - Sitting (Baithaksthiti) - Vajrasana, Padmasan, Vakrasan, Ardha-Pashchimotanasanan
  - Supine (Shayansthiti) - Uttan Padaasan(Ekpad/Dwipad), Pavanmuktasana, Viparitakarani Aasan, Khandarasan, Shavasana
  - Prone (Viparitshayansthiti) - Vakrahasta, Bhujangasana, Saralhasta Bhujangasana, Shalabhasana(Ekpad/Dwipad), Makarasana
  - Standing (Dhandsthiti) - Tadasana , TiryakTadasana, Virasana, Ardh Chakrasana
- Primary Study of Swasana: Dirghaswasana, Santhaswasana, JaladSwasana - 6 Types
- Pranayama : Anuloma-viloma, Bhramari

Course Outcome:

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

CO No.	CO	Cognitive level
AC201C.1	Identify and practice some Yoga asanas regularly in their life to remain healthy.	2
AC201C.2	Provide guidance and practice about Yoga to their friends, parents and relatives.	3

AC-201(D): Introduction to Indian Music

(Personality and Cultural Development Related Audit course; Practical; 2 Credits)

(Optional: Campus-level)

Course Objectives:

- To motivate students towards Indian music and provide them minimum required training.

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- Definition and brief about generation of Swar, Saptak, Thaat, Raag, Aavartan, Khatka, Murkee, Taal, Aalaap etc.
- Taal and its uses - Treetaal, Daadraa, Zaptaal, Kervaa.
- Information of Badaakhyaal, Chhotaakhyaal (one), Sargam, Lakshangeet (information
- Detailed information of Tambora
- Detailed information of Harmonium and Tablaa.
- Five filmy songs based on Indian Classical Music (Theory and Presentation)
- Sound Management - Basic information of Sound Recording (including Practicals)
- Composition of Music as per the Story
- Preparing news write-ups of the Seminars, Library Musical Programmes held at the Akashwani, by personal visits.

Course Outcome:

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

CO No.	CO	Cognitive level
AC201D.1	Identify different types of Indian music.	3
AC201D.2	Develop more interest to learn and practice Indian music.	4

Semester- III

Course Code: **CA-301** **Web Designing** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) Develop skills in analyzing the usability of a web site and understand how to plan and conduct user research related to web usability.
2) Learn the language of the web: HTML, XML and CSS.
3) Learn techniques of responsive web design, including media and queries.

Unit-I **[05]** Max Marks:**10**

Introduction to Web Development: Components of Web application, Static vs. dynamic web pages, A survey of browsers, servers and scripting languages, URL, Introduction to HTML, HTML5, XHTML and CSS, Semantic markup, Web Page Designing Principles, Page layout, Website organization

Unit-II **[10]** Max Marks:**15**

HTML 5.0: Structure of HTML5 Document, Elements, tags and attributes, DOCTYPE declaration, HEAD section, Coding text elements, Headings and paragraphs, Inline elements for formatting and emphasizing text, div and span elements, Events, WEB Form2.0, SVG, Canvas, Audio &Video, Geolocation, Drag & Drop, Web Workers.

Unit-III **[10]** Max Marks:**20**

CSS to format elements of a web page: CSS applications, Selectors: Basic Rule, Grouping, class and ID selectors, attribute selectors, document structure, Specificity, Inheritance, cascade, Values and Units, Fonts, Colors Working with text, text alignment, spacing(letter/word), Text decoration, Text Shadows, CSS box model, Spacing, borders and backgrounds, Page layout using CSS, Floating elements, Multicolumn layout, Ways to include CSS in a web page.

Unit-IV **[15]** Max Marks:**20**

HTML and CSS skills: Working with links and lists, Working with images, Working with tables, Working with forms, Adding audio, video to web pages, JavaScript for image rollovers, image swaps, slide shows, tabbed data and data validation

Unit-V **[10]** Max Marks:**20**

Core Concepts of XML: Parts of an XML document, Document Prolog, The XML declaration, The document type declaration, Elements, Attributes, Namespaces, Entities, Comments, CDATA Section, Processing instructions, XSL, Displaying XMLwith CSS, JAVA Script, XSLT

Unit-VI **[10]** Max Marks:**15**

Modeling Information: Simple Data storage, Dictionaries, Records, XML and Databases, Narrative Documents, Flows and sections, Blocks and inlines, Complex structures, Metadata, Linked Objects

References:

1. Anne Boehm, Murach's HTML, XHTML and CSS, Shroff Publishers and Distributers Pvt. Ltd., ISBN 13: 978-93-5023-095-4
2. Learning XML, Erik T. Ray, O'Reilly, Shroff Publishers and Distributers Pvt. Ltd., ISBN 13: 978-81-8404-896-4
3. Learning Web Design
4. Eric A. Meyer, CSS: The Definitive Guide, Visual Presentation for the Web, 3rd Edition, O'Reilly Media, November 2006, ISBN:978-0-596-52733-4| ISBN 10:0-596-52733-0(Print), ISBN 978-0-596-15940-5, 10:0-596-15940-4(Ebook)
5. Benoit Marchal, XML by Example, 2nd Edition, Microsoft Press 2001, ISBN-10: 0-7897-2504-5, ISBN-13: 978-0-7897-2504-2.

Auxiliary Resources:

https://www.tutorialspoint.com/html5/

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA301C.1	Demonstrate simple and impressive web page design techniques from basic to advance to focus on goal oriented and user centric designs.	3
CA301C.2	Set up page layouts, color schemes, typography in the designs.	6
CA301C.3	Write valid and concise code for webpages using XML, CSS and HTML.	6

Course Code: **CA-302** **Design and Analysis of Algorithms** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) To understand Basic concepts of algorithms, algorithm design techniques and analyze the performance of algorithms.
2) To learn Searching and traversal algorithms for graphs.
3) To understand Nondeterministic algorithms and NP class of problem.

Unit-I **[10]** Max Marks:**15**

What Is An Algorithm?, Algorithm Specification, Pseudocode Conventions, Recursive Algorithms, Complexity, Asymptotic Notation, Practical Complexities And Performance Measurement

Tree And Graph Representations, Binary Trees Basics, Heaps And Heap Sort, Sets And Disjoint Set Union And Find.

Unit-II **[12]** Max Marks:**15**

Divide And Conquer:General Method, Binary Search, Finding Maximum And Minimum, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

Unit-III **[08]** Max Marks:**15**

Greedy Method: General Method, Knapsack Problem, Huffman Code, Minimum-Cost

Spanning Trees (Prim's & Kruskal's Algorithm), Optimal Storage On Tapes, Single-Source Shortest Paths.

Unit-IV **[08]** Max Marks:**15**

Dynamic Programming: General Method, All-Pair Shortest Path, Matrix Chain Multiplication, Longest Common Sub Sequence, 0/1knapsack, Flow Shop Scheduling

Unit-V **[06]** Max Marks:**15**

Basic Search and Traversal Techniques: Breadth First Search And Traversal, Depth First Search And Traversal, Spanning Trees.

Unit-VI **[08]** Max Marks:**15**

Backtracking: General Method, Constrains, 8-Queens Problem Graph Coloring

Unit-VII **[08]** Max Marks:**10**

NP-Hard and NP-Complete Problems: Basic Concepts, Nondeterministic Algorithms, Polynomial Time, Polynomial-Time Verification, The Classes NP-Hard And NP-Complete, NP-Completeness And Reducibility, NP-Completeness Proofs, NP-Complete Problems

References:

1. Horowitz E. and Sahni S. "Fundamentals of computer Algorithms" Galgotia publications.
2. Horowitz E., Sahni S. and Rajshekaran S(),Computer Algorithms, Computer Science Press.
3. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani(2006), Algorithms. McGraw-Hill publications. ISBN 9780073523408
4. Cormen, Leiserson and Rivest, Introduction to Algorithms,: Prentice Hall of India ISBN: 978-81-203-4007-7

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA302C.1	Analyze the asymptotic performance of algorithms and write rigorous correctness proofs for algorithms.	4
CA302C.2	Design and analyze divide-and-conquer, greedy and dynamic-programming based algorithms.	4
CA302C.3	Model problems using backtracking, and to classify nondeterministic polynomial time algorithms.	6

Course Code: **CA-303** **Mathematical Foundations of Computer Science-II** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) To introduce the concepts of induction, recursion and advance counting techniques.
2) To study descriptive statistics and probability theory and probability distributions in order to build the necessary foundation for machine learning.
3) To understand stochastic processes and apply Markov chains, Hidden Markov Model (HMM), Chapman-Kolmogorov equations for solving problems.

Unit-I **[15]** Max Marks:**25**

Induction and Recursion: Mathematical Induction, Strong Induction and Well Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness, The Towers of Hanoi, Merge Sort, Linear Recurrences, Divide-and-Conquer Recurrences, A Feel for Recurrences

Unit-II **[15]** Max Marks:**20**

Advance Counting Techniques: Recursive Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

Unit-III **[05]** Max Marks:**10**

Statistics: Population and sample, parameters and statistics: definition, types: Descriptive and Inferential, applications, Descriptive Statistics: Mean, median, mode and standard deviation, variance, Graphical statistics

Unit-IV **[15]** Max Marks:**20**

Probability: Making decisions under uncertainty, Classical definition of Probability, Events and their Outcomes, Rules of Probability, Probability axioms, Random variables (discrete and continuous), Joint and Conditional probability, independence and Bayes theorem, Distribution of a random vector, Probability mass function, Probability density function and distribution function. Distributions: Binomial, Poisson, Uniform, Exponential, Normal.

Unit-V **[10]** Max Marks:**15**

Stochastic Processes: Definitions and classifications of Stochastic Processes, discrete and continuous Markov models, Hidden Markov Models, Chapman-Kolmogorov equation

References:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications 6th Ed, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007 ISBN 10: 0070681880
2. Michael Baron (2014) Probability and Statistics For Computer Scientists Second Edition, CRC press. ISBN: 978-1-4822-1410-9
3. Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1996): Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd.
4. Croxton F.E, Cowden D.J and Kelin S (1973): Applied General Statistics, Prentice Hall of India ISBN 10: 0201089947 ISBN 13: 9780201089943
5. Hogg, Robert V. & Craig Allen T. (2008). Introduction to Mathematical Statistics, Pearson Education ISBN 0-02-978990-7
6. Goon A.M., Gupta M.K., Dasgupta. B. (2001), Fundamentals of Statistics, Volume I and II, World Press, Calcutta.
7. Ross, S. (2005). Introduction to Probability Models, (6th Ed. Academic Press). ISBN 978-0-12-375686-2
8. Medhi, J. (1994). Stochastic Processes, (2nd Ed. New Age Publisher) ISBN : 978-93-86286-48-2

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA303C.1	Demonstrate their understanding of and apply methods of mathematics in computer science to subsequent courses in algorithm design and analysis.	3
CA303C.2	Analyze the behavior of the data, model the data using statistical measures and represent it graphically on paper without using available computerized tools.	4
CA303C.3	Apply mathematical foundations, probability theory in the modeling and design of computational systems in a way that demonstrates comprehension of the tradeoffs involved in design choices.	3

1)

Course Code: **CA-304** **Artificial Intelligence** *Clock Hours:* **60**

Total Marks: **100**

***Course Objectives*:**

1) Gain a historical perspective of AI and its foundations.
2) Study the concepts of Artificial Intelligence and investigate applications of AI techniques in intelligent agents
3) Learn various peculiar search strategies for AI and the methods of solving problems using Artificial Intelligence.

Unit-I **[08]** Max Marks:**10**

Introduction: Overview and Historical Perspective, Turing test, Physical Symbol Systems and the scope of Symbolic AI, Agents.

Unit-II **[06]** Max Marks:**10**

State Space Search: Depth First Search, Breadth First Search, DFID.

Unit-III **[08]** Max Marks:**12**

Heuristic Search: Best First Search, Hill Climbing, Beam Search, Tabu Search.

Unit-IV **[08]** Max Marks:**15**

Randomized Search: Simulated Annealing, Genetic Algorithms, Ant Colony Optimization.

Unit-V **[08]** Max Marks:**12**

Problem Decomposition: Goal Trees, AO*, Rule Based Systems, Rete Net.

Unit-VI **[06]** Max Marks:**12**

Game Playing: Minimax Algorithm, AlphaBeta Algorithm, SSS*.

Unit-VII **[08]** Max Marks:**14**

Planning and Constraint Satisfaction: Domains, Forward and Backward Search, Goal Stack Planning, Plan Space Planning, Graphplan, Constraint Propagation.

Unit-VIII **[08]** Max Marks:**15**

Logic and Inferences: Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward chaining.

References:

1. Deepak Khemani (2013). A First Course in Artificial Intelligence, McGraw Hill Education (India).
2. Elaine Rich and Kevin Knight (1991). Artificial Intelligence, Tata McGraw Hill.
3. Stuart Russell and Peter Norvig (2009). Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA304C.1	Identify problems that are amenable to solution by AI methods.	2
CA304C.2	Identify appropriate AI methods to solve a given problem.	2
CA304C.3	Design smart system using different informed search / uninformed search or heuristic approaches.	6

*Course Code:***CA-305 (A)** **Optimization Algorithms** *Clock Hours:***60**

Total Marks: **90**

Course Objectives:

1) To introduce with the branch of OR, its role in decision making and to list out various types of applications of operations research (OR).
2) To explain Linear Programming Problem (LPP) and practice with techniques to solve various types of LPP (transportation problem, assignment problems, special cases of duality, Integer programming problems)
3) Describe the significance, concept of game theory and algorithms to solve game theory problems.

Unit-I **[05]** Max Marks:**08**

Overview of operations Research: Introduction, Applications, Role of OR in Decision Making, Feasible and optimal Solutions

Unit-II **[15]** Max Marks:**20**

Linear Programming: Special Types: Transportation Problem as LPP, Initial Basic Feasible Solution, North West corner Rule, Lowest Cost Method, Vogel's Approximation Method, MoDi method for optimization, Degeneracy.

Assignment problem, Hungarian Method, Special cases of assignment problem

Unit-III **[18]** Max Marks:**24**

Linear Programming Problems: Introduction, Formulation of Mathematical model of LPP, Standard form of linear programming problems, Solving LPP using Graphical method, Infeasible LPP, Unbounded LPP, Basic feasible solutions, Simplex method for solving LPP, augmentation using Slack and artificial variables, Big M and two phase method, Degeneracy, alternative optima, Interpretation of final Simplex table, Duality: concept, applications and example.

Unit-IV **[06]** Max Marks:**08**

Integer Programming: Introduction, How it differs from LPP, Pure and mixed integer programming problems, Binary IPP, Techniques to solve IPP.

Unit-V **[08]** Max Marks:**15**

Network Models: Definitions, Applications, Representation of a problem in network form, Critical Path Analysis, Resource planning, Giantt Chart.

Unit-VI **[08]** Max Marks:**15**

Game Theory : Concept, Two party zero sum game, Pay off matrix, Pure and mixed strategy games, Rule of Dominance, Subgame method, Brown's Algorithm

References:

1. Hamdy Taha (2010). Operations Research: An Introduction. Pearson Education. ISBN: 978-0132555937
2. L C Jhamb. Quantitative Techniques For Managerial Decisions Vol I, Vol II. Everest Publishing House, ISBN: 8186314628
3. PanneerSelvan R (2006). Operations Research. Prentice Hall of India. ISBN: 978-8120329287

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA305AC.1	Differentiate between feasible and optimal solution.	4
CA305AC.2	Apply solving techniques to all types of LPP.	3
CA305AC.3	Apply solving techniques to network problems and game theory problems as well.	3

Course Code: **CA-305 (B)** **Data Warehousing and Data Mining (DWDM)** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) To comprehend evolution of decision making, operational vs decision support system and the concept of data warehouse.
2) To study the significance of analytical processing, importance of data pre-processing and to learn various data pre-processing techniques/methods.
3) Understand and apply various techniques/algorithms to obtain meaningful patterns from data (Association mining, classification and clustering)

Unit-I **[08]** Max Marks:**12**

Introduction to Data Warehousing: Evolution of decision system, Failure of past decision support system, Operational v/s decision support systems, Data warehousing lifecycle, Architecture, Building blocks, Components of DW, Data Marts and Metadata

Unit-II **[08]** Max Marks:**12**

Data Pre-processing: need for pre-processing of the data, Descriptive data summarization, Data cleaning, Data Integration and transformation, Data reduction, Data discretization and concept hierarchy generation.

Unit-III **[10]** Max Marks:**15**

OLAP Analytical Processing: OLAP in Data warehouse, Demand for online analytical processing, need for multidimensional analysis, limitations of other analysis methods, OLAP definitions and rules, OLAP characteristics, major features and functions, OLAP models-ROLAP, MOLAP, HOLAP, Differentiation, Data cubes and operations on cubes.

Unit-IV **[06]** Max Marks:**09**

Data Mining: Introduction-Data Mining functionalities, Classification of Data Mining Systems, basic Data Mining task, Data Mining Issues

Unit-V **[08]** Max Marks:**12**

Association Rule Mining: Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

Unit-VI **[10]** Max Marks:**15**

Classification and Prediction : Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Unit-VII **[10]** Max Marks:**15**

Cluster Analysis : Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis

References:

1. Jiawei Han and MichelineKamber "Data Mining Concepts and Techniques" Second Edition, Elsevier, Reprinted 2008.
2. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education. 2001.
3. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann. 2000.
4. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001
5. Tan Steinbach, Vipin Kumar, Introduction to Data mining, Pearson Eduction
6. Jarke Vassiliou, Fundamentals of Data Warehouses, IInd Edition, Springer
7. Anahory Murray, Data Warehousing in Real World, Pearson Education
8. Paulraj Ponniah , Data Warehousing.

Course Outcomes:

After this course students shall be able to –

CO No.	CO	Cognitive level
CA305BC.1	Explain organization of data warehousing and data marts and differentiate between OLTAP and OLAP.	2
CA305BC.2	Apply data pre-processing techniques.	3
CA305BC.3	Solve problems related with various aspects of data mining and write basic algorithms for extracting patterns from data.	3

Course Code: **CA Lab-V** **LAB on Design and Analysis of Algorithms** *Total Marks:* **100**

Course Objectives:

1) To convert the algorithms to code, measure the complexities at run time and modify the algorithms for efficiency.

2) To debug and test the programs.
3) To conclude using profile of outcomes.

Laboratory Requirements:

OS: Windows/Linux,

Programming Language: C++/Java/C#

1. Write a program for creating max./min. heap using
   - INSERT
   - ADJUST/HEAPIFY
2. Write a program to implement union and find operation.
3. Write a program to find minimum and maximum form a given array.
4. Write a program for searching element form given array using binary search for n=1000,2000,3000 find exact time of execution.
5. Write a program for sorting given array in ascending/descending order with n=1000,2000,3000 find exact time of execution using
   - Heap sort
   - Merge sort
   - Quick sort
6. Write a program for matrix multiplication using Strassen's matrix multiplication.
7. Write a program to find solution of Knapsack instant.
8. Write a program to find shortest path using single source shortest path.
9. Write a program to find Minimum-Cost Spanning Trees (Prim's & Kruskal's Algorithm).
10. Write a program to find shortest path using all pair path.
11. Write a program to find longest common subsequence.
12. Write a program to implement breadth first and depth first search.
13. Write a program to implement breadth first and depth first traversal.

    Write a program to find all solutions for 8-queen problem using backtracking.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABVC.1	Construct logic for the algorithms designed using designing techniques.	3
CALABVC.2	Posterior analysis of the algorithms.	4
CALABVC.3	Debug, test and profile the algorithms, modify to improve performance of the algorithms.	4

Course Code: **CA Lab-VI** **LAB on Web Designing (HTML/XML/CSS/Navigation)** *Total Marks:* **100**

Course Objectives:

1) Become familiar with graphic design principles that relate to web design and learn how to implement these theories into practice.
2) Learn the language of the web: HTML, XML, and CSS; learn techniques of responsive web design, including media queries; Learn CSS grid layout and flexbox.

3) Able to embed social media content into web pages.

Demonstrate following Assignments with appropriate HTML tags and CSS :

1. Design a web page for clickable table of contents (TOC) of your first semester syllabus. Every click should display detailed content.
2. Design a web page for online books catalog.
3. Design a first page of online newspaper.
4. Design a web page for lecture schedule of current semester.
5. Demonstrate various CSS features
6. Design a web page that displays student feedback form for a scheduled course.
7. Design a web page that allows mp3 downloads.
8. Design a web page for nursery for plant selection using XML.
9. Design a web page for restaurant/ice cream parlor using XML.
10. Create a dictionary database using XML.
11. Design a narrative document using XML.
12. Display XML file using CSS
13. Display XML file of your choice using XSL
14. Display XML file using DSO data binding
15. Demonstrate Event Handling.
16. Draw Circle, Rectangle, Line, Ellipse and Polygon using SVG.
17. Create a Drawing Application with Canvas using HTML5.
18. Display Audio & Video playlist on browser using HTML5.
19. Display your location and location's coordinates of Longitude and latitude on Google Map.
20. Create a web page for shopping cart using Drag and Drop Events.
21. Design a web page which demonstrates Web Workers feature.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABVIC.1	Apply markup languages for processing, identifying, and presenting of information in web pages.	3
CALABVIC.2	Use scripting languages and web services to transfer data and add interactive components to web pages and create and manipulate web media objects using editing software.	3
CALABVIC.3	Incorporate aesthetics and formal concepts of layout and organization to design websites that effectively communicate using visual elements.	3

AC-301(A): Computer Skills

(Technology + Value added Audit course; Practical; 2 Credits)
(Optional: Campus + Program level)

Course Objectives:

- To inculcate different daily useful computer skills among students.

Unit 1 Elements of Information Technology **2 hrs**

1.1 Information Types: Text, Audio, Video, and Image, storage formats
1.2 Components: Operating System, Hardware and Software, firmware
1.3 Devices: Computer, Mobile Phones, Tablet, Touch Screen, Scanner, Printer, Projector,smart boards
1.4 Processor & Memory: Processor functions, speed, Memory types: RAM /ROM /HDD /DVD-ROM/Flash drives, memory measurement metrics

Unit 2 Office Automation-Text Processing **5 hrs**

2.1 Views: Normal View, Web Layout View, Print Layout View, Outline View, ReadingLayout View
2.2 Working with Files: Create New Documents, Open Existing Documents, SaveDocuments to different formats, Rename Documents, Close Documents
2.3 Working with Text: Type and Insert Text, Highlight Text, Formatting Text, Delete Text,Spelling and Grammar, paragraphs, indentation, margins
2.4 Lists: Bulleted and Numbered Lists,
2.5 Tables: Insert Tables, Draw Tables, Nested Tables, Insert Rows and Columns, Moveand Resize Tables, Moving the order of the column and/or rows inside a table, TableProperties
2.6 Page Margins, Gutter Margins, Indentations, Columns, Graphics, Print Documents,
2.7 Paragraph Formatting, Paragraph Attributes, Non-printing characters
2.8 Types of document files: RTF, PDF, DOCX etc.

Unit 3 Office Automation-Worksheet Data Processing **5 hrs**

3.1 Spreadsheet Basics: Adding and Renaming Worksheets, Modifying Worksheets,
3.2 Moving Through Cells, Adding Rows, Columns, and Cells, Resizing Rows and Columns, Selecting Cells, Moving and Copying Cells
3.3 Formulas and Functions: Formulas, Linking Worksheets, Basic Functions, AutoSum, Sorting and Filtering: Basic Sorts, Complex Sorts, Auto-fill, Deleting Rows, Columns, and Cells
3.4 Charting: Chart Types, drawing charts, Ranges, formatting charts

Unit 4 Office Automation- Presentation Techniques and slide shows **6 hrs**

4.1 Create a new presentation, AutoContent Wizard, Design Template, Blank Presentation,Open an Existing Presentation, PowerPoint screen, Screen Layout
4.2 Working with slides: Insert a new slide, Notes, Slide layout, Apply a design template,Reorder Slides, Hide Slides, Hide Slide text, Add content, resize a placeholder or textbox, Move a placeholder or text box, Delete a placeholder or text box, Placeholder orText box properties, Bulleted and numbered lists, Adding notes
4.3 Work with text: Add text and edit options, Format text, Copy text formatting, Replacefonts, Line spacing, Change case, Spelling check, Spelling options
4.4 Working with tables: Adding a table, Entering text, Deleting a table, Changing rowwidth, Adding a row/column, Deleting a row/column, Combining cells

,Splitting a cell,Adding color to cells, To align text vertically in cells, To change table borders,Graphics, Add clip art, Add an image from a file, Save & Print, slide shows, slideanimation/transitions.

Unit 5 Internet & Applications: 4 hrs

5.1 Computer Network Types: LAN, PAN, MAN, CAN, WAN, Defining and describing theInternet, Brief history, Browsing the Web, Hypertext and hyperlinks, browsers,Uniform resource locator

5.2 Internet Resources: Email, Parts of email,

5.3 Protecting the computer: Password protection, Viruses, Virus protection software,Updating the software, Scanning files, Net banking precautions.

5.4 Social Networking: Features, Social impact, emerging trends, issues, Social Networking sites: Facebook, Twitter, linkedin, orkut, online booking services

5.5 Online Resources: Wikipedia, Blog, Job portals, C.V. writing

5.6 e-learning: e-Books, e-Magazines, e-News papers, OCW(open course wares): Sakshat(NPTEL) portal, MIT courseware

Unit 6 Cloud Computing Basics 3 hrs

6.1 Introduction to cloud computing

6.2 Cloud computing models: SAS, AAS, PAS

6.3 Examples of SAS, AAS, PAS (DropBox, Google Drive, Google Docs, Office 365 Prezi, etc.)

Suggested readings:

1. TCI, "Introduction to Computers and Application Software", Publisher: Jones & Bartlett Learning, 2010, ISBN: 1449609821, 9781449609825
2. Laura Story, Dawna Walls, "Microsoft Office 2010 Fundamentals", Publisher: Cengage Learning, 2010, ISBN: 0538472464, 9780538472463
3. June Jamrich Parsons, Dan Oja, "Computer Concepts Illustrated series", Edition 5, Publisher Course Technology, 2005, ISBN 0619273550, 9780619273552
4. Cloud computing online resources

Course Outcome:

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC301A.1	Identify their lacunas about some computer skills and try to overcome the same.	2
AC301A.2	Practice the learned computer skills in real life and do their jobs more effectively.	3

AC-301(B): Cyber Security

(Technology + Value added Audit course; Practical; 2 Credits)
(Optional: Campus + Program level)

Course Objectives:

- To make students aware of different daily useful cyber security skills/rules.

Unit 1 Networking Concepts Overview 3 hrs

Basics of Communication Systems, Transmission Media, ISO/OSI and TCP/IP models, Network types: Local Area Networks, Wide Area Networks, Internetworking, Packet Formats, Wireless Networks: Wireless concepts, Advantages of Wireless, Wireless

network architecture, Reasons to use wireless, Internet

Unit 2 **Security Concepts** **7 hrs**

Information Security Overview, Information Security Services, Types of Attacks, Goals for Security, E-commerce Security, Computer Forensics, Steganography.
Importance of Physical Security, Biometric security & its types, Risk associated with improper physical access, Physical Security equipments.
Passwords: Define passwords, Types of passwords, Passwords Storage – Windows & Linux.

Unit 3 **Security Threats and vulnerabilities** **7 hrs**

Overview of Security threats, Hacking Techniques, Password Cracking, Types of password attacks, Insecure Network connections, Wi-Fi attacks & countermeasures, Information Warfare and Surveillance.
Cyber crime: e-mail related cyber crimes, Social network related cyber crimes, Desktop related cyber crimes, Social Engineering related cyber crimes, Network related cyber crimes, Cyber terrorism, Banking crimes

Unit 4 **Cryptography** **5 hrs**

Understanding cryptography, Goals of cryptography, Types of cryptography, Applications of Cryptography, Use of Hash function in cryptography, Digital signature in cryptography, Public Key infrastructure

Unit 5 **System & Network Security** **3 hrs**

System Security: Desktop Security, email security: PGP and SMIME, Web Security: web authentication, Security certificates, SSL and SET, Network Security: Overview of IDS, Intrusion Detection Systems and Intrusion Prevention Systems, Overview of Firewalls, Types of Firewalls, VPN Security, Security in Multimedia Networks, Fax Security.

Unit 6 **OS Security** **2 hrs**

OS Security Vulnerabilities updates and patches, OS integrity checks, Anti-virus software, Design of secure OS and OS hardening, configuring the OS for security, Trusted OS.

Unit 7 **Security Laws and Standards** **3 hrs**

Security laws genesis, International Scenario, Security Audit, IT Act 2000 and its amendments.

Suggested readings:

1. Skills Factory, Certificate in Cyber Security, Text Book Special edition, Specially published for KBC NMU, Jalgaon
2. BPB Publication, “Fundamentals of Cyber Security”, Mayank Bhushan, Rajkumar Singh Rathore , Aatif Jamshed
3. CreateSpace Independent Publishing Platform, “Cyber Security Basics”, Don Franke, ISBN-13: 978-1522952190ISBN-10: 1522952195

Course Outcomes:

After this course students shall be able to –

CO No.	CO	Cognitive level
AC301B.1	Practice learned cyber security skills/rules in real life.	3
AC301B.2	Provide guidance about cyber security skills/rules to their friends, parents and relatives.	2

AC-301(C): Linux (Spoken Tutorial Course)

(Technology + Value added Audit course; Practical; 2 Credits)
(Optional: Campus + Program level)

Course Objectives:

- To pass on the knowledge of technology and free and open Source software (FOSS) by self-paced learning.
- To learn linux as FOSS (free and open source software)

To be completed using IIT Bombay's SPOKEN TUTORIAL online Courseware. It is mandatory for the students to complete the credits of this course along with appearing for the online examination conducted by Spoken Tutorial IIT Bombay. Syllabus for Spoken Tutorial Courses AC-301 (C): Linux is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India

***Course Outcome*:**

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC301C.1	Apply the self-paced learning methodology to Linux operating system	3
AC301C.2	Design and solve problems using Linux operating system.	6

AC-301(D): Advance C++ (Spoken Tutorial Course)

(Technology + Value added Audit course; Practical; 2 Credits)
(Optional: Campus + Program level)

Course Objectives:

- To pass on the knowledge of technology and free and open Source software (FOSS) by self-paced learning.
- To learn advance C++ as FOSS (free and open source software)

To be completed using IIT Bombay's SPOKEN TUTORIAL online Courseware. It is mandatory for the students to complete the credits of this course along with appearing for the online examination conducted by Spoken Tutorial IIT Bombay. Syllabus for Spoken Tutorial Courses AC-301 (D) :Advance C++is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India

***Course Outcome*:**

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC301D.1	Apply the self-paced learning methodology to advance C++.	3
AC301D.2	Design and solve problems using advance C++ .	6

Semester-IV

Course Code: **CA-401** **High Performance Computing Paradigms and Applications** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) Comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications
2) To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.
3) To provide knowledge of cloud concepts capabilities across the various cloud service models which includes IaaS, PaaS and SaaS; and learn how to use Cloud Services, implementation of Virtualization, Task Scheduling algorithms.

Unit-I **[06]** Max Marks:**20**

Basics of Cloud Computing: Introduction to Distributed Systems, Single System Image, Naming and Synchronization Communication in DS, Load Balancing, Process Migration, Fault Tolerant Systems. Introduction to Grid and Cluster Computing.

Unit-II **[06]** Max Marks:**15**

Introduction to Cloud Computing: Roots of Cloud Computing, Layers and Types of Clouds, Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, and Challenges and Opportunities

Unit-III **[06]** Max Marks:**10**

Virtualization and Resource Provisioning in Clouds: Introduction and Inspiration, Virtual Machines (VM), VM Provisioning and Manageability, VM Migration Services, VM Provisioning in the Cloud Context, and Future Research Directions.

Unit-IV **[10]** Max Marks:**10**

Cloud Computing Architecture: Cloud Benefits and Challenges, Market-Oriented Cloud Architecture, SLA-oriented Resource Allocation, Global Cloud Exchange; Emerging Cloud Platforms, Federation of Clouds

Unit-V **[12]** Max Marks:**15**

Programming Enterprise Clouds using Aneka: Introduction, Aneka Architecture, Aneka Deployment, Parallel Programming Models, Thread Programming using Aneka, Task Programming using Aneka, and MapReduce Programming using Aneka, Parallel Algorithms, Parallel Data mining, Parallel Mandelbrot.

Unit-VI **[12]** Max Marks:**15**

Advanced Topics and Cloud Applications: Integration of Private and Public Clouds, Cloud Best Practices, GrepTheWeb on Amazon Cloud, ECG Data Analysis on Cloud using Aneka, Hosting Massively Multiplayer Games on Cloud.

Unit-VII **[08]** Max Marks:**15**

Practical Related Topics: Topics related to Practical hands on will be added later on.

References

1. A. S Tanenbaum and M.V. Steen(2007), Distributed Systems: Principles and Paradigms, Second Edition, Pearson Prentice Hall Publication, 2007, ISBN:0-13-239227-5
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi(2013), Mastering Cloud

Computing, Tata McGraw Hill, New Delhi, India, 2013 **ISBN**-13: 978-1-25-902995-0
3. Rajkumar Buyya, James Broberg , Andrzej M. Goscinski(2011), Cloud Computing: Principles and Paradigms, Wiley India Publication, 2011, ISBN: 978-0-470-88799-8
4. Toby Velte, Anthony Velte, Robert Elsenpeter (2009), Cloud Computing: A Practical Approach, Tata McGraw Hill Publication,2009, ISBN 0071626948 / 9780071626941
5. Barrie Sosinsky (2011), Cloud Computing Bible, Wiley Publishing India Pvt Ltd.,2011, ISBN: 978-0-470-90356-8

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA401C.1	Analyze the Cloud computing setup with its vulnerabilities and applications using different architectures.	4
CA401C.2	Design suitable Virtualization concept, Cloud Resource Management.	6
CA401C.3	Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application.	6

Course Code: **CA-402** **Web Application Technology** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) .Net Framework and creating ASP.Net web applications using standard .net controls.
2) Use Web Services and develop simple and complex applications using .Net framework
3) Maintain session and controls related information for user used in multi-user web applications

Unit-I **[10]** Max Marks:**15**

Desktop Computing vs. Internet Computing, Internet computing infrastructure, Client side scripting vs. Server Side Scripting technologies, Web Server basics and configuration: IIS, Apache etc., Web site hosting basics, Web Publishing, HTML, introduction to .NET framework, Features of .NET frameowork:CTS,CLS,CLR,.NET technologies, languages'C#.NET,VB.NET, basics of ASP.NET page framework, Visual studio .NET IDE, Page Life Cycle, PostBack, Viewstate, Page directives, ASP.Net page execution cycle, HTTP Pipeline, HTTP Application, HTTP Request, HTTP Response classes, HTTP Modules and HTTP Handlers, State Management, Role of *Global.asax*, Application configuration using *web.config* file

Unit-II **[15]** Max Marks:**25**

ASP.NET Control hierarchy, HTML Server Controls, Web Server Controls, User and Server controls, Validation Controls, List bound controls:dropdown lists, list boxes, Repeater, DataList, Data Grid, DataGridView,FormsView controls, Data binding to List Bound Controls, Templating and Styling of ASP.NET server controls

Unit-III **[20]** Max Marks:**25**

Web Page Designing principles, CSS anatomy, Anatomy of Master Pages, nesting master pages, Site map file, Web site Navigation controls, properties:TreeView, Sitemap Path, Menu, Other Navigation methods: Response.Redirect(), Server.Transfer(), Personalization through Profiles, Themes/Skins, Web Site security basics: authentication modes:Windows,Forms,passport, authorization, roles/Membership, access rules, login controls,Web services: working, anatomy, hosting

Unit-IV **[15]** Max Marks:**25**

Database technology: ADO.NET, Anatomy/architecture of ADO.NET, working with Connection, Command, Data Adaptor, DataReader, DataSet, DataTable objects, Editing data in Data Tables, concurrency control. Introduction to MVC, Data Reports

References:

1. Richard Anderson, Brian Francis, Alex Homer, Rob Howard, David Sussman, Karli Watson(2002), Professional ASP.NET 1.0, Special Edition, Wrox Press Ltd., 2002, ISBN 1-861007-0-3-5.
2. Chris Hart, John Kauffman, Dave Sussman, and Chris Ullman(2006), Beginning ASP.NET 2.0, Wiley Publishing, Inc., 2006, ISBN-13: 978-0-7645-8850-1, ISBN-10: 0-7645-8850-8.
3. Beginning ASP.NET 4: in C# and VB**,** Imar Spaanjaars, Wiley Publishing, Inc 2010., ISBN: 978-0-470-50221-1
4. Bill Evjen, Scott Hanselman, Devin Rader (2008), Professional ASP .NET 3.5 in C# and VB, Wiley Publishing Inc.,2008 ISBN:978-0-470-18757-9.
5. Dino Esposito (2008), Programming Microsoft ASP.NET 3.5, Second Edition, Microsoft Press, 2008, ISBN-10: 0735625271, ISBN-13: 978-0735625273

Auxiliary Resources:

d. Website URLs

https://www.asp.net/

http://asp.net-tutorials.com/

e. Video Links

1. https://www.asp.net/web-forms/videos
2. https://www.youtube.com/playlist?list=PL6n9fhu94yhXQS_p1i-HLIftB9Y7Vnxlo&feature=view_all

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA402C.1	Design web applications using ASP.NET.	6
CA402C.2	Debug and deploy ASP.NET web applications.	3
CA402C.3	Create database driven ASP.NET web applications and web services.	6

Course Code: **CA-403** **Machine Learning** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) The course gives understanding of fundamentals of Machine Learning such as its types, applications and other preliminaries.
2) Course gives fair idea about all important techniques of Machine Learning such as Classification, Regression and Clustering.
3) It also introduces Neural Network model and its applications to Machine Learning and touching Deep Learning.

Unit-I **[08]** Max Marks:**10**
Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation

Unit-II **[08]** Max Marks:**15**
Linear regression, Decision trees, overfitting

Unit-III **[09]** Max Marks:**15**
Instance based learning, Feature reduction, Collaborative filtering based recommendation

Unit-IV **[08]** Max Marks:**15**
Probability and Bayes learning

Unit-V **[09]** Max Marks:**15**
Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM

Unit-VI **[09]** Max Marks:**15**
Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network

Unit-VII **[09]** Max Marks**:15**
Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model

References:

1. Tom Mitchell (1997). Machine Learning. First Edition, McGraw- Hill.
2. Ethem Alpaydin (2009). Introduction to Machine Learning Edition 2. The MIT Press.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA403C.1	Acquire in-depth knowledge of various facets of Machine Learning methods/techniques and algorithms.	2
CA403C.2	Envisage practical application of Machine Learning to Business and Research Computational problems.	3
CA403C.3	Use knowledge of Machine Learning for product/service development.	3

Course Code: **CA-404** **Computer Graphics and Digital Image Processing** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) The fundamental knowledge and basic technical competence in the field of Computer Graphics and Digital Image Processing.
2) Give an in-depth knowledge about 2D and 3D transformation algorithms.

3) Provide awareness about the current technologies and issues specific to Digital Image Enhancement, Restoration, Segmentation, Color Image Processing, and Morphological Image Processing.

Unit-I **[08] Max Marks:12**

Introduction to Computer Graphics and Output Primitives: Overview of Computer Graphics, Its Applications and Software, Representation in Graphics, Vector Graphic Display, Raster Graphics Display, I/O Devices, Representing Image, Straight Line, Line Drawing Algorithm, DDA, Bresenham's Line Algorithm, Circle-generating algorithm, Ellipse-generating Algorithm, Polygon Filling Algorithm.

Unit-II **[06] Max Marks:12**

Two-Dimensional Transformation: Matrix and transformation, 2D Basic transformation, Homogeneous coordinates, Translation, Scaling and Rotation of straight line or polygon, Combined Transformation, Rotation about an arbitrary point/line, Reflection and Shearing Transformation, Viewing Transformation, Clipping, Cohen-Sutherland line clipping.

Unit-III **[06] Max Marks:12**

Three-Dimensional Transformation :Introduction, Matrix representation of 3D Transformation, 3D Translation, Scaling, Rotation, Composition of 3D Transformation, Projection, Orthographic, Isometric, Oblique Projection, Perspective Projection, One-Two-Three point perspective Projection.

Unit-IV **[08] Max Marks:12**

Introduction to Digital Image Processing & Applications: Digital Image Processing. Applications of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image Sensing and Acquisition. Image Sampling and Quantization. Some Basic Relationships Between Pixels.

Unit-V **[10] Max Marks:15**

Image Enhancement: Background, Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods,

Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering,

Unit-VI **[10] Max Marks:15**

Image Restoration and Color Image Processing: A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening.

Unit VII. Morphological Image Processing & Segmentation **[06] Max Marks:12**

Detection of Discontinuities, Edge linking & Boundary Detection, Thresholding, Region based segmentation Laplacian of Gaussian, Derivative of Gaussian, Canny Edge Detection, Morphological operation: Dilation erosion, Opening & Closing, Basic Morphological Algorithm, Image representation schemes.

Unit VIII. MATLAB Image processing toolbox [06] Max Marks:10

Introduction to MATLAB, Matrix Operations, Introduction to Image Processing Tool Box, Image Read & Write, Filters (spatial and frequency domain), Image Restoration and Reconstruction, Morphological Operations, Edge Detection and linking, Segmentation

References:

1. Amarendra N Sinha, Arun D. Udai, (2008). Computer Graphics, TMH publication ISBN-13 : 978-0-07-063437-4.
2. D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition ISBN-13: 978-0135309247
3. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Edition, McGraw-Hill International Edition, ISBN-13:978-0-07-0486775
4. R.C.Gonzalez & R.E.Woods, Digital Image Processing, Pearson Education, 3rd edition, ISBN. 13:978-0131687288
5. S. Jayaraman Digital Image Processing TMH (McGraw Hill) publication, ISBN-13:978-0-07-0144798
6. Gonzalez, Woods & Steven, Digital Image Processing using MATLAB, Pearson Education, ISBN-13:978-0130085191

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA404C.1	Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics and Digital Image Processing; expose students to MATLAB Image Processing Toolbox.	6
CA404C.2	Demonstrate various algorithms for scan conversion and filling of basic primitives objects and their comparative analysis and applied 2-D and 3-D geometric transformations, viewing and clipping on graphical objects.	3
CA404C.3	Use the Mathematics for digital image representation, image acquisition, image transformation, image enhancement and restoration.	3

Course Code: **CA-405(A)** **Accounting and Management Control** *ClockHours:***60** *Total Marks:***100**

Course Objectives:

1) To introduce the basic principles of accounting, financial accounting and ratio analysis.

2) To study cost accounting, standard costing and marginal costing.
3) To understand responsibility accounting, budgeting and budget control.

Unit-I **[05]** Max Marks:**10**

Principles of Accounting - Concepts - Conventions – Principles, methods of accounting, accounting systems, types of accounts.

Unit-II **[15]** Max Marks:**20**

Financial Accounting –books of accounts, Journal, ledger, trial balance, Financial Statements.

Unit-III **[07]** Max Marks:**10**

Ratio Analysis, meaning, importance, scope, limitations, types of variances, calculation of variances.

Unit-IV **[06]** Max Marks:**10**

Cost Accounting - Concept of Cost, Elements of Cost, cost classification, methods and techniques of costing.

Unit-V **[06]** Max Marks:**10**

Fund Flow Statement, Concept, importance, Simple Problems, Cash Flow Statement, Concept, Advantages, Simple Problems.

Unit-VI **[06]** Max Marks:**10**

Standard Costing: concept, types of variances, computation of material cost variances, Labor Cost variances, and overhead cost variances.

Unit-VII **[05]** Max Marks:**10**

Marginal Costing, importance, Marginal Costing Vs Absorption Costing, importance, Break-even Analysis, break even chart.

Unit-VIII **[05]** Max Marks:**10**

Budgeting and Budgetary Control, Benefits, Zero Base Budgeting, Traditional Budgeting Vs Zero Base Budgeting, types of budget - fixed, flexible, cash budget.

Unit IX: **[05]** Max Marks:**10**

Responsibility Accounting: Responsibility Centre's, Types of Responsibility Centre's(Cost, Revenue, Profit, Investment), Responsibility, Performance Reporting: Measuring Divisional Performance, Non – Financial Measures of Performance.

References:

1. Dr. SakshiVasudeva, (2010)," Accounting For Business Managers", Himalaya Publishing House. ISBN-10: 8184885636
2. Dr. Jawahar Lal, (2017) "Accounting For Management", Himalaya Publishing House, ISBN 81 78663856
3. Bhattacharya, S.K. and Dearden, John. (1997), "Accounting for Management : Text and Cases",3rd edition, Vikas Publishing House ISBN 10- 8125905537
4. Chadiwick.(1996)," The Essence of Financial accounting", Prentice Hall, ISBN-10: 0133565106
5. Horngren, Sundem and Selto (1993),"Introduction to management accounting ", 9th edition,Prentice Hall, ISBN- 0134820924

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA405AC.1	Acquire knowledge of accounting procedures and financial management processes.	2
CA405AC.2	Use accounting principles studied at different levels for automation of business.	3
CA405AC.3	Create entrepreneur in the field of information technology.	3

Course Code: **CA-405(B)** **Data Analytics** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) This course will cover fundamental algorithms/techniques used in data analytics and will provide exposure to theory as well as practical systems and software used in data analytics.
2) The statistical foundations will be covered first, followed by various machine learning and data mining algorithms.
3) 3. Technological aspects like data management (Hadoop), scalable computation (MapReduce) and visualization will also be covered. In summary, this course

Unit-I **[10]** Max Marks:08

Data Definitions and Analysis Techniques

- Elements, Variables, and Data categorization
- Levels of Measurement
- Data management and indexing
- Introduction to statistical learning and R-Programming

Unit-II [10] Max Marks:10

Descriptive Statistics

- Measures of central tendency
- Measures of location of dispersions
- Practice and analysis with R

Unit-III [13] Max Marks:15

Basic analysis techniques

- Statistical hypothesis generation and testing
- Chi-Square test
- t-Test
- Analysis of variance
- Correlation analysis
- Maximum likelihood test
- Practice and analysis with R

Unit-IV **[15]** Max Marks:17

Data analysis techniques

- Regression analysis

- Classification techniques
- Clustering
- Association rules analysis
- Practice and analysis with R

Unit-V **[12]** Max Marks:10

Case studies and projects

- Understanding business scenarios
- Feature engineering and visualization
- Scalable and parallel computing with Hadoop and Map-Reduce
- Sensitivity Analysis

References:

1) Probability & Statistics for Engineers & Scientists (9th Edn.), Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Prentice Hall Inc.
2) The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.), Trevor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014
3) An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013
4) Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer
5) Mining Massive Data Sets, A. Rajaraman and J. Ullman, Cambridge University Press, 2012
6) Advances in Complex Data Modeling and Computational Methods in Statistics, Anna Maria Paganoni and Piercesare Secchi, Springer, 2013
7) Data Mining and Analysis, Mohammed J. Zaki, Wagner Meira, Cambridge, 2012
8) Hadoop: The Definitive Guide (2nd Edn.) by Tom White, O'Reilly, 2014
9) MapReduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems, Donald Miner, Adam Shook, O'Reilly, 2014
10) Beginning R: The Statistical Programming Language, Mark Gardener, Wiley, 2013

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA405BC.1	Find a meaningful pattern in data; graphically interpret data.	5
CA405BC.2	Implement the analytic algorithms.	5
CA405BC.3	Handle large scale analytics projects from various domains; Develop intelligent decision support systems.	6

Course Code: **CA LAB-VII** **LAB on Computer Graphics and Digital Image Processing** *Total Marks:* **100**

Course Objectives:

1) The fundamental knowledge and basic technical competence in the field of Computer Graphics and Digital Image Processing.
2) Give an in-depth knowledge about 2D and 3D transformation algorithms.
3) Provide awareness about the current technologies and issues specific to Digital Image Enhancement, Restoration, Segmentation, Color Image Processing, and Morphological Image Processing.

1. Line drawing algorithm (DDA and Bresenham's Line Algorithm)
2. Circle drawing algorithm
3. Ellipse drawing algorithm
4. Polygon filling algorithm
5. Windowing and clipping algorithm (Point, line and polygon clipping)
6. Composite 2-D transformation, (rotation, scaling & reflection)
7. 3-D geometric transformation (rotation, scaling & reflection)
8. Introduction to Image Processing Toolbox
9. Read an 8 bit image and then apply different image enhancement techniques:
   a) Brightness improvement
   b) Brightness reduction
   c) Thresholding
   d) Negative of an image
   e) Log transformation
   f) Power Law transformation.
10. Implement different interpolation techniques using MATLAB/ SciLab
11. Read an image, plot its histogram then do histogram equalization. Comment about the result.
12.
    a) Implement Gray level slicing (intensity level slicing) in to read cameraman image.
    b) Read an 8 bit image and to see the effect of each bit on the image.
    c) Read an image and to extract 8 different planes i.e. 'bit plane slicing."
13. Implement various Smoothing spatial filter.
14. Read an image and apply
    1) Gaussian 3x3 mask for burring
    2) High pass filter mask with different masks
    3) Laplacian operator with center value positive and negative
    4) High boost filtering.
15. Write a program to implement various low pass filters and high pass filter in frequency domain.
16. Write a program for erosion and dilation, opening & closing using inbuilt and without inbuilt function.
17. Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts)
18. Implement various noise models and their Histogram
19. Implement inverse filter and wiener filter over image and comment on them

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABVIIC.1	Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics and Digital Image Processing;	6
CALABVIIC.2	Implement various algorithms for scan conversion, filling objects, 2-D and 3-D geometric transformations, viewing and clipping on graphical objects;	5
CALABVIIC.3	Make use of MATLAB and Image Processing Toolbox to implement image transformation, image enhancement in spatial and frequency domain.	3

1)

Course Code: **CA LAB-VIII**

LAB on High Performance Computing (HPC) and Web Application Technology

Total Marks: **100**

Course Objectives:

1) To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.
2) Set up a programming environment for ASP.Net programs, configure an ASP.Net application, creating standard .net controls based and data driven web application using ASP.Net; Maintain session and controls related information for user used in multi-user web applications
3) Understand the fundamentals of developing modular application by using object oriented methodologies

High Performance Computing

Practical's on HPC

The syllabus of Practical on HPC will be prepared before the beginning of the Fourth Semester by the Instructors based on the content of CA-401 Theory course. This will cover demonstration of use of IaaS, PaaS and SaaS along with some case studies such as Amazon EC2, Amazon S3, Aneka, Google AppEngine.

Web Application Development Technology Practical Assignments

- Demonstrate followings in IIS:
- Creation of Virtual Directory, Home directory, Home page, hosting of website
- Demonstrate Page Life Cycle of ASP.NET. Use important page events for your demonstration.
- Write VB.Net/C# console applications to demonstrate: OO concepts: polymorphism, encapsulation, inheritance, interface inheritance, abstract classes/methods, overloading, overriding, collection classes, properties
- Demonstrate concept of postback and viewstate using web form server controls of ASP.NET
- Demonstrate various Web form server controls using sample data entry screen form for

registering for a service on website. Also use validation controls to validate input data.

- Demonstrate DropDown List box, CheckButtonList, RadioButtonList controls.
- Demonstrate Databinding using Hashtable, ArraryList, DataTable data sources.
- Demonstrate Repeater control with the help of various templates.
- Demonstrate paging, sorting,filtering of data in asp:DataGrid/DataGridView.
- Demonstrate editing process in DataGrid and DataList controls. Make use of necessary templates for proper visual appearance.
- Demonstrate State Management features of ASP.NET using sample shopping cart application.
- Create sample website for demonstrating use of Profiles/Themes using skin files.
- Demonstrate Master Pages and website navigation controls(sitemap path, treeview, menu) using SiteMap file.
- Demonstrate Properties of website navigation controls.
- Demonstrate Authorization/Authentication using Login controls and Roles/Membership/AccessRules
- Demonstrate creation of simple/complex DataReader/DataSet Objects.
- Demonstrate editing in DataTable objects.
- Demonstrate Web Service hosting, access in ASP.NET

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABVIIIC.1	Apply and design suitable Virtualization concept, Cloud Resource Management.	3
CALABVIIIC.2	Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application.	6
CALABVIIIC.3	Design web applications using ASP.NET, use ASP.NET controls, debug and deploy ASP.NET web applications, create database driven ASP.NET web applications and web services.	6

AC-401(A): Human Rights

(Professional and Social + Value Added Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives :

- To make students aware about human rights and human values.

Unit	Content	Hours
Unit 1	**Introduction to Human Rights** 1.1 Concept of Human Rights 1.2 Nature and Scope of Human Rights 1.3 Fundamental Rights and Fundamental Duties 1.4 Interrelation of Rights and Duties	**6 hrs.**
Unit 2	**Human Rights in India** 2.1 Meaning and Significance of **:** 1) Right to Equality 2) Right to Freedom, 3) Right against Exploitation, 4)	**8 hrs.**

	Right to Freedom of Religion, 5) Cultural and Educational Rights, and 6) Right to Constitutional Remedies. 2.2 Constitutional Provisions for Human Rights 2.3 Declaration of Human Rights 2.4: National Human Rights Commission	
Unit 3	**Human Values** 3.1: Meaning and Definitions of Values 3.2: Importance of values in the life of Individual 3.3: Types of Values 3.4: Programmes for conservation of Values	**8 hrs.**
Unit 4	**Status of Social and Economically Disadvantaged people and their rights** 4.1: Rights of women and children in the context of Social status 4.2: The Minorities and Human Rights 4.3: Status of SC/ST and other Indigenous People in the Indian Scenario 4.4: Human rights of economically disadvantaged Society	**8 hrs.**
Suggested readings: 1. Human rights education – YCMOU, Nasik 2. Value education – SCERT, Pune 3. Human rights reference handbook – Lucille whare		

Course Outcome:

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC401A.1	Practice the learned issues under human rights and human values in real life.	3
AC401A.2	Provide social justices to people around them and provide guidance about human rights to their friends, parents and relatives.	5

AC-401(B): Current Affairs

(Professional and Social + Value Added Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives :

- To make students updated about current affairs of India and world.

	Title	Content	Hours
Unit 1	Politics & Economy	• National & International Political Activity, Organization. • Economy & Business, Corporate world	08
Unit 2	Awards and recognitions	• National & International Awards and recognitions • Books and authors	07
Unit 3	Science & Technology	• Software, Automobile, Space Research • New inventions and discoveries	07
Unit 4	Environment & Sports	• Summit & conference, Ecology & Climate, Organization. • National & International Games, Olympics, commonwealth etc.	08
Suggested readings (Use recent years' data and current literature): 1. India 2019, by Publications Division Government of India 2. Manorama Year Book by Philip Mathew, 3. India 2019, Rajiv Maharshi 4. Quick General Knowledge 2018 with Current Affairs Update, Disha Experts			

5. General Knowledge 2018: Latest Who's Who & Current Affairs by RPH Editorial Board.

***Course Outcome*:**

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC401B.1	Identify important issues currently/ recently happening in India or world.	5
AC401B.2	Summarize current affairs regularly.	6

AC-401(C): Java (Spoken Tutorial Course)

(Professional and Social + Value Added Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives:

- To pass on the knowledge of technology and free and open Source software (FOSS) by self-paced learning.
- To learn java as FOSS (free and open source software)

To be completed using IIT Bombay's SPOKEN TUTORIAL online Courseware. It is mandatory for the students to complete the credits of this course along with appearing for the online examination conducted by Spoken Tutorial IIT Bombay. Syllabus for Spoken Tutorial Courses AC-401 (C): Java is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India

***Course Outcome*:**

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC401C.1	Apply the self-paced learning methodology to java programming	3
AC401C.2	Design and solve problems using java programming.	6

AC-401(D): PHP & MySQL (Spoken Tutorial Course)

(Professional and Social + Value Added Audit course; Practical; 2 Credits)
(Optional: Campus-level)

Course Objectives:

- To pass on the knowledge of technology and free and open Source software (FOSS) by self-paced learning.
- To learn advance PHP and MySQL as FOSS (free and open source software)

To be completed using IIT Bombay's SPOKEN TUTORIAL online Courseware. It is mandatory for the students to complete the credits of this course along with appearing for the online examination conducted by Spoken Tutorial IIT Bombay. Syllabus for Spoken Tutorial Courses AC-401 (D): PHP & MySQL is available at https://spoken-tutorial.org developed at IIT Bombay for MHRD, Government of India

***Course Outcome*:**

After completion of this course, students shall be able to:

CO No.	CO	Cognitive level
AC401D.1	Apply the self-paced learning methodology to PHP and MySQL	3
AC401D.2	Design and solve problems using PHP and MySQL.	6

Semester- V

Course Code: **CA-501** **Compiler Construction** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) To cover the major topics in compiler design with emphasis on solving the problems encountered in designing a compiler regardless of the source language or the target machine.

Unit-I **[05]** Max Marks:**10**

Introduction to Compilation

Compiler Basics, Issues in Compilation, Phases of Compilation: the Analysis – Synthesis Model, Compiler Construction Tools.

Unit-II **[06]** Max Marks:**15**

Designing a Lexical Analyzer

Role of Lexical Analysis, Input Buffering, Specification of Tokens, Recognition of Tokens, Finite automata, Conversion from regular expression to NFA, Deterministic finite automata, Conversion from NFA to DFA, Minimization of DFA, Creating Lexical Analyzer with LEX.

Unit-III **[15]** Max Marks:**30**

Designing Syntax Analyzer

Role of Syntax Analyzer, Classification of parsers, **Top-Down Parsing:** Introduction, Problems in top-down parsing, Recursive Parsing, Problems in Recursive Procedures, Predictive Parsing, Error Handling in Predictive Parsers, **Bottom Up Parsing**: Shift Reduce Parser, Actions of shift reduce parser, Construction of parse tree, Operator Precedence Parsing, Components of operator precedence parsers, Parsing action, Construction of operator precedence parsers, Error reporting and recovery in operator precedence Parsers, Advantages and disadvantages of operator precedence Parsing. LR Parsing: Simple LR parser, LR (1) parser, LALR parser.

Unit-IV **[10]** Max Marks:**15**

Intermediate Code Generation

Need For Intermediate Code Generation, Intermediate Forms: Polish Notation, Quadruples, Triples, Indirect Triples & Blocks.

Unit-V **[10]** Max Marks:**15**

Code Optimization

Introduction, need for code optimization, Classification of code optimization techniques: Optimization techniques that work on machine code, Optimization techniques that work on intermediate forms of source code i.e. Optimization with in Basic Blocks: Folding, Redundant operation elimination, Optimization with in Loop: Strength Reduction, Dead code elimination, Moving operation within block out of block.

Unit-VI **[10]** Max Marks:**15**

Symbol Table Organization

Introduction, Methods of organizing a symbol table: Unsorted, sorted symbol tables, binary search, hashing, its advantages, disadvantages, Collision, Collision resolution techniques: Rehashing, Chaining.

References:

1. Aho A.V., R. Sethi and J.D. Ullman. Compiler Principle, Techniques and Tools: Addison Wesley, ISBN 0-321-48681-1.
2. Barret, Couch. Compiler Construction Theory and Practice: Computer Science series, Asian Student Ed, ISBN 978-0574213358
3. Dhamdhere D.M. Compiler Construction Principle and Practice: McMillan India, ISBN 9780333904060
4. Gres D. Compiler Construction for Digital Computer: Wiley, ISBN 047132776X.
5. David Galles (2009). Modern Compiler Design: Pearson Education, ISBN 9788131709412

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA501C.1	Understand the basic structure of compiler, concepts and terminology in programming languages.	2
CA501C.2	Explain lexical analysis, finite state techniques, scanner generator, parsing, kinds of parsers, designing lexical analyzer, scanner and parsers, principal ideas with intermediate code generation, optimizations.	2
CA501C.3	Understanding of all concepts is essential to design compiler in general for programming languages.	2

Course Code: **CA-502** **Software Engineering** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) Knowledge of basic Software Engineering methods, practices and their appropriate application; Describe software engineering layered technology and Process frame work which includes general understanding of software process models.

2) Understanding of software requirements, SRS documents, role of project management which includes planning, scheduling, risk management and Quality of product; Describe data models, functional models and behavioral models.
3) Understanding of implementation issues such as modularity, coding standards, verification and validation which includes software testing approaches.

Unit-I **[10]** Max Marks:**10**

Introduction and Process Models: Nature of Software, Software Engineering the process, Software Myths. Process Models: Generic process model, Prescriptive process models, Specialized process models, Unified process, Personal and Team process model, Process Technology, Product and Process. Agility, cost of change, Agile process, Extreme Programming, Agile Process models: Adaptive Software development, Scrum, Dynamic system development model, Crystal, Feature Driven development, Lean Software development, Agile modelling, Agile Unified process. Tool set for Agile process

Unit-II **[10]** Max Marks:**15**

Requirement Analysis and Modelling: Requirement Engineering, Establishing Groundwork, Eliciting Requirements Developing Use cases, Building Requirement model, Negotiating and Validating requirements. Requirement analysis, Scenario based modelling, UML models that supplements use case, Data modelling concepts, class based modelling. Requirement Modelling strategy, Flow oriented modelling, Creating Behavior model, Pattern for Requirement modelling.

Unit-III **[08]** Max Marks:**15**

Quality Assurance and Change Management: Elements of SQA, SQA Tasks, Goal and Metrics, Formal approaches to SQA, Software Reliability, ISO 9000 Quality standards, SQA Plan. Software Configuration Management, SCM Repository, SCM process

Unit-IV **[11]** Max Marks:**20**

Design Concept: Design process, Design Concept: Abstraction, Architecture, Pattern, Separation of concept, Modularity, Information hiding, Functional independence, Refinement, Aspects, Refactoring. Design Model: Data design element, Architectural design element, Interface design element, Component level design element, Deployment level design element.

Unit-V **[11]** Max Marks:**20**

Architectural and Component Level Design: Software Architectures, Architectural Genres, Architectural styles, Architectural design, Accessing alternatives Architectural design, Architectural mapping using dataflow. Introduction to component, Designing class based component, Conducting component level design, Designing traditional component, component based development.

Unit-VI **[10]** Max Marks:**20**

Software Testing: Strategic approach to software testing, Test strategies for conventional software, Validation Testing, System testing, Software testing fundamentals, Internal and external view of testing, White box testing, Basic path testing, Control structure testing,

Black box testing, model based testing, Testing for specialized Environment, Architectures and applications.

References:

1. R. S. Pressman(2010), "Software Engineering: A Practitioner's Approach", McGraw-Hill International Edition, Seventh Edition, 2010, ISBN:978-007-126782-3.
2. Pankaj Jalote(2010), "Software Engineering: A Precise Approach", Wiley India Pvt. Limited, 2010 ISBN: 978-81-265-2311-5.
3. K. K. Aggarwal and Yogesh Singh(2008), "Software Engineering", Third Edition, New Age International Publishers, 2008, ISBN:978-81-224-2360-0.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA502C.1	Apply software engineering principles and techniques, to develop, maintain and evaluate large-scale software systems.	3
CA502C.2	Produce efficient, reliable, robust and cost-effective software solutions.	4
CA502C.3	Work as an effective member or leader of software engineering teams and manage time, processes and resources effectively by prioritizing competing demands to achieve personal and team goals.	3

Course Code: **CA-503** **Natural Language Processing** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) The prime objective of this course is to introduce the students to the field of Language Computing and its applications ranging from classical era to modern context.
2) Course also aims to provide understanding of various NLP tasks and NLP abstractions such as Morphological analysis, POS tagging, concept of syntactic parsing, semantic analysis etc.
3) Course provide knowledge of different approaches/algorithms for carrying out NLP tasks; it also discusses concepts of Language grammar and grammar representation in Computational Linguistics.

Unit-I **[08]** Max Marks:**12**

Introduction to NLP, brief history, NLP applications: Speech to Text(STT), Text to Speech(TTS), Story Understanding, NL Generation, QA system, Machine Translation, Text Summarization, Text classification, Sentiment Analysis, Grammar/Spell Checkers etc., challenges/Open Problems, NLP abstraction levels, Natural Language (NL) Characteristics and NL computing approaches/techniques and steps, NL tasks: Segmentation, Chunking, tagging, NER, Parsing, Word Sense Disambiguation, NL Generation, Web 2.0 Applications : Sentiment Analysis; Text Entailment; Cross Lingual Information Retrieval (CLIR).

Unit-II **[12]** Max Marks:**16**

Text Processing Challenges, Overview of Language Scripts and their representation on

Machines using Character Sets, Language, Corpus and Application Dependence issues, Segmentation: word level(Tokenization), Sentence level. Regular Expression and Automata Morphology, Types, Survey of English and Indian Languages Morphology, Morphological parsing FSA and FST, Porter stemmer, Rule based and Paradigm based Morphology, Human Morphological Processing, Machine Learning approaches.

Unit-III **[12]** Max Marks:**18**

Word Classes ad Part-of-Speech tagging(POS), survey of POS tagsets, Rule based approaches (ENGTOWL), Stochastic approaches(Probabilistic, N-gram and HMM), TBL morphology, unknown word handling, evaluation metrics: Precision/Recall/F-measure, error analysis.

Unit-IV **[15]** Max Marks:**22**

NL parsing basics, approaches: TopDown, BottomUp, Overview of Grammar Formalisms: constituency and dependency school, Grammar notations CFG, LFG, PCFG, LTAG, Feature-Unification, overview of English CFG, Indian Language Parsing in Paninian Karaka Theory, CFG parsing using Earley's and CYK algorithms, Probabilistic parsing, Dependency Parsing: Covington algorithm, MALT parser, MST parser.

Unit-V **[15]** Max Marks:**22**

Concepts and issues in NL, Theories and approaches for Semantic Analysis, Meaning Representation, word similarity, Lexical Semantics, word senses and relationships, WordNet (English and IndoWordnet), Word Sense Disambiguation: Lesk Algorithm Walker's algorithm, Coreferences Resolution:Anaphora, Cataphora.

References:

1. Indurkhya, N., & Damerau, F. J. (2010), *Handbook of Natural Language Processing, 2nd Edition.* New York: CRC Press Taylor and Francis Group, Boca Raton London, New York. ISBN-10: 1420085921, ISBN-13: 978-1420085921
2. Martin, J. H., & Jurafsky, D.(2013), *Speech and Language Processing*, Pearson Education India; 2 edition, ISBN-10: 9332518416, ISBN-13: 978-9332518414
3. Manning, Christopher and Heinrich, Schutze(1999), Foundations of Statistical Natural Language Processing", MIT Press, ISBN-10: 0262133601, ISBN-13: 978-0262133609.
4. Akshar Bharati, Chaitanya, V., Kulkarni, A., & Sangal, R. (July 1997). *Machine translation in Stages* (Vol. 10 no. 3). Mumbai: NCST, Mumbai.
5. Bharati, A., Chaitanya, V., & Sangal, R. (1995). *Natural Language Processing: A Paninian Perspective*, New Delhi: Prentice Hall of India, ISBN 10: 8120309219, ISBN 13: 9788120309210.
6. Steven Bird, Edward Loper (2016),Natural Language Processing With Python, Ed. 2, O'Reilly Media,ISBN 1491913428, 9781491913420

Auxiliary Resources:

Web Links

1. https://see.stanford.edu/Course/CS224N
2. https://web.stanford.edu/~jurafsky/NLPCourseraSlides.html
3. https://stp.lingfil.uu.se/~nivre/docs/ACLslides.pdf

Video Links

1. http://www.nptelvideos.in/2012/11/natural-language-processing.html
2. https://www.youtube.com/playlist?list=PL6397E4B26D00A269

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA503C.1	Understand issues and challenges in Natural Language Processing and NLP applications and their relevance in the classical and modern context.	2
CA503C.2	Understand Computational techniques and approaches for solving NLP problems and develop modules for NLP tasks and tools.	2
CA503C.3	Understand various grammar formalisms, which they can apply in different fields of study.	2

Course Code: **CA-504** **Mobile Application Development** *Clock Hours:* **60**

Total Marks: **100**

Course Objectives:

1) Understand basics of mobile application development and get introduced Android platform and its architecture.
2) To learn activity creation and Android UI designing.
3) To be familiarized with Intent, Broadcast receivers and Internet services, SQLite Database and content providers; to integrate multimedia, camera and Location based services in Android Application.

Unit- I **[10]** Max Marks:**10**

Mobile Application Development: Introduction to handheld devices (Palm, Pocket Pc, Symbian OS smart phones, MS windows based smart phones, BlackBerry, iphone etc.), features of handheld devices, Device Applications Vs Desktop application, overview of application development platforms (OS-Palm OS, Symbian, BlackBerry, Windows CE, OS for iphone, Android), Programming Languages (C/C++, JAVA), IDE tools. Comparison of Android with other Mobile OS. Comparative study of all versions of Android.

[Note: The unit is to be thought with respect to current scenario of Mobile Development hence above contents may change]

Unit-II **[12]** Max Marks:**15**

Hello, Android and Installations: Background, What is android and what isn't, Open Mobile Development Platform, Native Android Applications, Android SDK Features, Introducing the Open Handset Alliance, What Does Android Run On? Why Develop for Android?, Introducing the Development Framework. What Comes in the Box, Developing for Android, Developing for Mobile Devices, Android Development Tools as per current version, Installations, Emulator.

Unit-III **[16]** Max Marks:**20**

Creating Applications, activities and User Interfaces: What Makes an Android Application?, Introducing the Application Manifest. Using the Manifest Editor. The Android Application Life Cycle. Understanding Application Priority and Process States. Externalizing Resources. A Closer Look at Android Activities. Fundamental Android UI Design. Introducing Views. Introducing Layouts and fragments, Using Adapters, Creating New Views.

Unit-IV **[12]** Max Marks:**20**

Intents, Broadcast Receivers, and the Internet: Introducing Intents, Creating Intent Filters and Broadcast Receivers, Using Internet Resources. Introducing Dialogs and Action Bars, Creating and Using Menus.

Unit-V **[06]** Max Marks:**15**

Working in the Background: Introducing Services, Using Background Worker Threads, Using Toast, Introducing Notifications, Using Alarms.

Unit-VI **[12]** Max Marks:**15**

Data Storage, Retrieval, and Sharing: FILES, SAVING STATE, AND PREFERENCES: Saving Application Data, Creating and Saving Shared Preferences, Retrieving Shared Preferences, Introducing the Preference Framework and the Preference Activity, Persisting the Application Instance State, Including Static Files as Resources, Working with the File System.

DATABASES AND CONTENT PROVIDERS: Introducing Android Databases, SQLite Databases, Content Providers, Introducing SQLite, Content Values and Cursors, Working with SQLite Databases, Creating Content Providers.

References:

1. Reto Meier. Professional Android Application Development, Wrox Publications ISBN: 978-0-470-34471-2.
2. Rick Rogers, John Lombardo, Zigurd Mednieks, G. Blake Meike. Android Application Development: Programming with the Google SDK. O'Reilly ISBN 10: 0596521472 / ISBN 13: 9780596521479.
   Auxiliary Resources:
   https://developer.android.com/index.html

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA504C.1	Compare android with other smartphone OS and desktop OS; Able to understand software stack of android OS.	4
CA504C.2	Understand Activity lifecycle, UI management, use Intent, Broadcast receivers and Internet services.	2
CA504C.3	Effectively use SQLite Database and content providers, multimedia, camera and Location based services in Android Application.	3

Course Code: **CA-505 (A)** **CMS: Drupal Website Development Framework** *Clock Hours:* **60** *Total Marks:* **100**

Course Objectives:

1) Distinguish between various content management systems capabilities
2) Create and customize contents for web pages; Create lists, views in drupal and Identify appropriate plugins, modules and themes for an application
3) Create websites using Wordpress and Drupal

Unit-I **[05]** Max Marks:**05**

PHP Overview: PHP syntax highlights, PHP arrays, Superglobal Arrays, PHP and MySQL

Unit-II **[08]** Max Marks:**10**

CMS: Definition, Advantages, Challenges. Survey of CMS systems and their features and comparison.

Drupal Introduction and Installation: History, Drupal community, Professional support , The Drupal association, Drupal Installation: single Drupal website, Installation Profiles, Installing , Acquia's stack installer, Don't Hack Core, Core Files , Sites Folder, Inheritance and Overrides.

Unit-III **[07]** Max Marks:**15**

Drupal Website Development: Adding Content , Differences between Articles and Pages , Modifying the Defaults, Modifying your Menus, Adding Blocks to your website, Getting in contact, Adding the Contact Form to Your Main Menu, Summing Up the Contact Form , Exploring your site's permissions, Creating a members-only site, Exploring Roles, Wrapping up Users and Permissions.

Unit-IV **[10]** Max Marks:**20**

Administration-Configuration, Modules, and Reporting: Configuration, System — Site Information, Regional and Language — Settings, Media, Media — File System, Temporary Directory , PHP File Size Limitations , Media — Image Toolkit, Web Services, Web Services — RSS Publishing, Web Services — Feed Aggregator, Content Authoring — Text Formats, Explore the filtered html text format, Choosing Roles and the Importance of the Order.

Unit-V **[10]** Max Marks:**20**

Blocks, Menus, Themes and Content: Blocks, Block Visibility, Block Visibility Using PHP, Menus, url aliases aka custom paths, Themes, Theme Global Settings, Content, Nodes, Creating Custom Content types, Submission Form Settings, Publishing Options, Display Settings, Comment Settings, Menu Settings, Adding an Image Upload Field, Multiple Fields for Multiple Images? Permissions, Digging Deeper into Fields, Content Construction Kit (CCK), Views, Content Moderation, Comments, Permissions, WYSIWYG.

Unit-VI **[10]** Max Marks:**15**

User Management: Creating User Accounts, Creating Accounts, Canceling Accounts, Setting Up Account E-Mails, using OpenID, Creating Roles and Permissions, Creating Custom User Profiles, User Sessions.

Triggers, Actions, Workflow, and Rules: Triggers and Actions, Workflow, Rules, Features

of the Rules Module, Conditions, Scheduler and Rule Sets, Input Evaluators.

Unit-VIII **[10]** Max Marks:**15**

Views: Overview of Views, The Frontpage View, Displays and Style Settings, Creating a Photo Gallery, Arguments, Exposed Filters, Relationships and Permissions, Caching, Advanced Views.

Theming: Installing Themes, Configuring Themes, Custom Theming, Theme Functions, .info file, Regions and Template Files (.TPL.PHP), Swapping Theme Functions And Template Files, Theme Registry, Theme Engines.

References:

1. Beginning Drupal, Jacob Redding ,Wiley Publishing, Inc., 2010,ISBN:978-0-470-43852-7
2. Beginning PHP 5.3, Matt Doyle , Wiley Publishing, Inc., 2010, ISBN: 978-0-470-41396-8
3. Learning PHP and MySQL , Michele E. Davis ,Jon A. Phillips , 2nd edition, Published by O'Reilly Media, Inc., August 2007, ISBN-10: 0-596-51401-8 | ISBN-13: 978-0-596-51401-3.

Auxiliary Resources:

a) www.wiley.com , https://www.tutorialspoint.com/drupal/ , https://www.tutorialspoint.com/php/
b) https://www.youtube.com/watch?v=-DYSucV1_9w&list=PLtaXuX0nEZk9MKY_ClWcPkGtOEGyLTyCO , http://getlevelten.com/tutorial/course/getting-started-drupal-7 , https://www.tutorialspoint.com/listtutorial/PHP-Getting-Started-Video-Tutorial/5443 .

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA505AC.1	Compare and contrast between various content management systems; Enable and configure interactive capabilities.	4
CA505AC.2	Demonstrate critical thinking skills to design and create different contents.	4
CA505AC.3	Design and create content management system-based websites.	6

Course Code: **CA-505(B)** **Ruby on Rails** *Clock Hours:* **60**
Total Marks: **100**

Course Objectives:

1) Develop programming skills and logical ability with the use of Ruby Programming language platform.

2) Study of Ruby and Rails: Installation and Basics of Ruby, Core, Advanced, Rail Basics.
3) Understanding web application development using Rails framework.

Unit-I **[08]** Max Marks:**12**

Ruby Installation and Basics: Ruby/Rails Installation, Introduction to Ruby, Ruby naming convention, Interactive Ruby (IRB) & "ri" (Ruby Interactive) command-line tools, Ruby object, Ruby types: String, Hash, Symbol, Ruby class, Inheritance, Ways of creating Ruby object, Ruby methods, Methods Basics, Methods Advanced: Arguments, Visibility, Method with a! (bang), Modules, Control structures, Exception handling, Ruby operators, Regular expression

Unit-II **[10]** Max Marks:**15**

Ruby core: Basics of block, How does a block look like? Block passing and execution, Proc, & (Ampersand), lambda, Closure, What is and Why Meta-programming?, Ruby language characteristics (that make it a great metaprogramming language), Object#respond_to?, Object#send, Dynamic typing (and Duck typing), missing_method, define_method

Unit-III **[04]** Max Marks:**06**

Ruby I/O: File I/O, File inquiries, Directories, Navigation through Directories

Unit-IV **[10]** Max Marks:**15**

Ruby Advanced: Ruby OOPs concepts, Database Access, Web Application without framework, Sending email, Ruby - XML, XSLT and XPath

Unit-V **[10]** Max Marks:**15**

Ruby Advanced: Ruby TK (GUI for Ruby), Ruby – Multithreading Built in Functions, Variables, Constants, Ruby associated tools, Ruby - XML, XSLT and XPath

Unit-VI **[18]** Max Marks:**27**

Rails Basics: What is and Why Ruby on Rails? Building HelloWorld Rails application step by step, App directory structure (MVC), Environment, Rake, Gems, Generators, Migration, Console, Bundle, scaffolding, ORM (ActiveRecord), Action controller basics, Action Views, Helpers, Authentication.

References:

1. Yukihiro Matsumoto (2008), The Ruby Programming Language, Shroff; First edition, 2008, ISBN-10: 8184044925, ISBN-13: 978-8184044928
2. Michael Fitzgerald, Learning Ruby, Published by O'Reilly Media, Inc., May 2007, ISBN-10: 8184043341, ISBN-13: 978-8184043341
3. Rails AntiPatterns, Wesley Professional Ruby Series, 1st edition, 2010, ISBN-10: 0321604814, ISBN-13: 978-0321604811
4. Adam Gamble, Cloves Carneiro, Jr. Rida Al Barazi (2007), Beginning Rails4, Apress, 3rd edition, 2013 ISBN-13 (pbk): 978-1-4302-6034-9| ISBN-13 (electronic): 978-1-4302-6035-6

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA505BC.1	Understand Ruby Programming language with lexical and syntactic structure of Ruby programs, Datatypes and Objects, Expressions and Operators, Statements and Control Structures, Methods, procs, lambdas, and closures, Classes and modules, Reflection and Metaprogramming.	2

CA505BC.2	Use the Ruby TK (GUI for Ruby).	3
CA505BC.3	Design web applications using Rails framework.	6

Course Code: **CA LAB-IX** **LAB on Android Programming** *Total Marks:* **100**

Course Objectives:

1) To gain knowledge of installing Android Studio and Cross Platform Integrated Development Environment;
2) To learn designing of User Interface and Layouts for Android App, intents to broadcast data within and between Applications.
3) To use Content providers and Handle Databases using SQLite

1. Create "Hello World" application. That will display "Hello World" in the middle of the screen in the red color with white background with change in fonts & styles of text.
2. Create List with string taken from resource folder (res>>value folder). On changing list value change image.
3. Create android UI such that, one screen have radio button of the types of cars. On selecting any car name, next screen should show car details like: name, company name, and images if available, show different colors in which it is available.
4. Create android application that will display toast (Message) on android life cycle stages.
5. Create the application that will change color of screen based on selected option from the menu.
6. Create android application with login module. (Check username & password) on successful login, go to next screen. And on falling login, alert user using Toast.
7. Create android application that will display toast (Message) on specific interval time.
8. Create the android application that calls 3 native applications using intents.
9. Create the android application that will read phonebook contact using content providers and display in list on selecting specific contact makes a call to selected contact.
10. Create android application to take a picture using native application.
11. Create the android application that will send SMS using your android application.
12. Create android background application that will open activity on specific time.
13. Create the android application that will demonstrate shared preferences.
14. Create the android application that will call maps using android application.
15. Create android application to make Insert, Update, Delete and retrieve operation on employee database.

Course Outcome:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABIXC.1	Design and Implement User Interfaces and Layouts of Android App; Use Intents for activity and broadcasting data in Android App.	6

CALABIXC.2	Design and Implement Database Application and Content Providers.	6
CALABIXC.3	Experiment with Camera and Location Based service. Develop Android App with Security features.	3

Course Code: **CA LAB-X** **LAB on Drupal Framework/** *Total Marks:* **100**

LAB on Ruby on Rails

LAB on Drupal Framework

Course Objectives:

1) Install Drupal and Ruby on Rails
2) Managing and publishing web site using Drupal
3) Programming and web support using ruby.

1. Installation of Drupal.
2. Demonstrate menu Management in Drupal.
3. Write an application to create Blocks & Regions in Drupal.
4. Write an application to create Themes and Layouts in Drupal.
5. Demonstrate how to create Front Page & Static Pages in Drupal.
6. Demonstrate how to create Blogs & articles in Drupal.
7. Demonstrate how to create, modify, delete and publish content in Drupal.
8. Demonstrate User Management in Drupal.
9. Demonstrate URL Alias in Drupal.
10. Demonstrate Triggers and Actions in Drupal.
11. Demonstrate Views in Drupal.
12. Create a new custom theme with CSS in Drupal.

Ruby and Rails Assignments:

1. Demonstrate a Ruby Basic program which manipulate Hash, Array, Strings. Any five methods of each container. Also use !(bang) operator.
2. Write Ruby program which accepts user input and process it then print the result. Like radius.rb is a file which accept input as float and returns a calculated Area of cirletom@laptop:~/courses/ruby/asst$ ruby radius.rb
   Enter the radius: 2
   Area is: 12.5663708
3. Write a ruby program which prompts for and reads one line of input. It then echos the line, then prints it repeatedly, each time removing every second character. It continues until no more characters can be removed. Treat all characters alike; no special treatment for spaces or punctuation.
4. Demostrate Inheritence in Ruby by building a superclass called Bird from which our Duck, Goose, and Owl classes will derive their functionality. (http://www.gotealeaf.com/books/oo_ruby/read/inheritance)
5. Demonstrate a Ruby programs which uses loops like, each, times, do loop, etc. With having use of operators & exceptions which cause to break loop like devide by zero, etc.

6. Write a Ruby script which demonstrate use of blocks, lambd &proc.
7. Write a Ruby program which show duck typing, uses respond_to? Method.
8. Write a Ruby program which access private methods/attributes outside of class.
9. Write a Ruby program which define dynamic methods and method will return something also use missing_method. It should return some result to console if some method is missing.
10. Create a Basic Ruby on Rails web application which print “Hello World on web browser”
11. Create a Ruby on Rails web application which shows having Post Section. In which user can Insert, Edit, Delete Post, using scaffolding.
12. Create a Ruby on Rails web application with Post Model uses variuos type of server validation.
13. Create a Ruby on Rails web application which shows having Post Section. In which user can Insert, Edit, Delete Post, using scaffolding, using mysql database.
14. Create a Ruby on Rails web application using mysql database without scaffold. which shows having Post Section. In which user can Insert, Edit, Delete Post. Post have multiple comments, comments can also Insert, Edit, Delete with nestes routes.like “/posts/2/comments”
15. Create a Ruby on Rails web application using mysql database. Post is always belongs to user and user has many posts. Without login user cann't Insert, Delete or Edit Post, can only show post using devise gem.
16. 16.Create a Ruby Application having 3 to 4 .rb files interconnected with each other. Which demonstrate all above concept with Human readable console output.
17. Design a Ruby On Rails Web Application which deals with User, Registration Form, Validations, CSS, JavaScripts, Ajax, Associations, etc

***Course Outcomes*:**

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CALABXC.1	Develop websites using Drupal.	6
CALABXC.2	Build program using syntactic structure and APIs of Ruby Programming Language.	3
CALABXC.3	Design web applications using Rails framework.	3

Semester- VI

Full Time Industrial Training

Course Code: **CA-601** **Full Time Industrial Training** *Total Marks:* **300**

Course Objectives:

1) To provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
2) To enhance students' knowledge in a particular technology and to Increase self-confidence of students and helps in finding their own proficiency.
3) To cultivate student's leadership ability and responsibility to perform or execute the given task.

Twelve credits shall be awarded to the Industrial Training/Project course, which will commence in the VIth semester and the final work and report will be completed at the end of VIth Semester of MCA course. The student is expected to work on software development project. The project work should have coding part. Student will have to submit the bound project report in university prescribed format at the end of the semester. Student will have to appear for Project Viva-voce and the marks and the credits will be allotted at the end of VIth semester of MCA course.

Course Outcomes:

After completion of this course students shall be able to-

CO No.	CO	Cognitive level
CA601C.1	Handle specialized technology and update themselves with latest changes in technological world with ability to communicate effectively.	3
CA601C.2	Be multi-skilled IT professional with good technical knowledge, management, leadership and entrepreneurship skills.	5
CA601C.3	Be able to identify, formulate and model problems and find engineering solution based on a systems approach.	3