Annexure I

Cochin University of Science & Technology

MCA Curriculum and Syllabus

2020 Admission onwards

Department of Computer Applications
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Department of Computer Applications

Vision

To impart innovation-oriented education, to build globally competent and socially committed professionals.

Mission

M1: To impart the elementary expectations of Computer Applications through a well designed curriculum.

M2: To enhance the technical knowledge relevant to the industries.

M3: To mould ethical software professionals with intensive knowledge in computer science and applications.

M4: To provide globally recognized academic environment through industry – academia collaborations, digital learning and state of the art skill development

Program Educational Objectives, DCA CUSAT

PEO1: Apply Mathematics and Engineering to Design, develop and test softwares for Common societal problems.
PEO2: Develop efficient algorithms for solving computational and Research problems.
PEO3: Work in groups to understand software requirements and engage in applying technologies to achieve an outcome.
PEO4: Demonstrate a professional work ethics and assess the computing system for quality , security, utility and ethics.
PEO5: Engage in lifelong learning to keep pace with changing landscape of technologies for professional advancement.

Programme Articulation Matrix

	M1	**M2**	**M3**	**M4**
PEO1	**3**	**3**		
PEO2		**3**	**3**	
PEO3			**3**	
PEO4			**3**	**3**
PEO5		**2**	**3**	**3**

Program outcomes (Aligned with graduate attributes)

At the end of the program the student will be able to:

PO-1: Apply the knowledge of mathematics, statistics , and computer science to the solution of complex problems.

PO-2: Identify, formulate, review research literature, and analyze problems reaching validated conclusions.

PO-3: Design solutions for difficult problems and design softwares that meet the specified needs with appropriate consideration for the society.

PO-4: Use research-based knowledge and methods to conduct investigations on complex problems and provide valid conclusions.

PO-5: Create and apply appropriate techniques for requirement collection, development and testing using tools.

PO-6: Apply reasoning based on contextual knowledge to support societal, health, safety, legal and cultural issues.

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: **Role** effectively as an individual, and as a team member in diverse teams

PO-10: Communicate effectively by writing effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Apply knowledge and understanding of the engineering and management principles to one's own work.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Mapping of POs with PEOs

Programme Outcome	**PEO1**	**PEO2**	**PEO3**	**PEO4**	**PEO5**
Engineering Knowledge	**X**				
Problem Analysis	**X**	**X**	**x**		
Design / Development of Solution	**X**	**X**	**x**		
Conduct Investigation		**X**	**X**	**X**	
Modern Tool Usage	**X**		**X**		
Engineer and Society			**X**	**X**	
Environment and Sustainability				**X**	
Ethics			**X**	**X**	**X**
Individual and Team work	**X**		**X**		
Communication			**X**		
Project Management and Finance			**X**	**X**	**X**
Lifelong Learning	**X**	**X**	**X**	**X**	**X**

Eligibility Criteria

Any Science graduate with Mathematics as one of the subjects or graduate in Electronics / Information Technology/ Computer Science/ Computer Applications/ Engineering/ Technology with aggregate 60% marks or equivalent CGPA.

Programme Structure and Duration

The duration of the MCA Program shall be 2 years (4 semesters) . Every academic year shall have 2 semesters July to December (odd semester) and January to April (Even Semester)The duration of each semester shall have a minimum 75 working days . The vacation shall be May and June.

The curriculum and syllabus shall be approved by the Board of Studies, Academic Council and Faculty, Syllabus shall be modified once in two years for every subject. Also advanced electives can be included when it is required. All revisions shall be based on the recommendations of the concerned

board of studies. A mooc course shall be offered in first semester and an industry based course shall be offered in 3rd semester students to explore the industry skills.

Each semester shall have a maximum of 6 lecture based courses and 2 lab/ project based courses.

The medium of instruction, Examination, Lab/Project reports and presentations shall be in English.

Attendance

The main eligibility criteria for registering to the End Semester Examination are attendance in the course. The minimum attendance for appearing for the End Semester Examination is 75% attendance in each course. Condonation of shortage of attendance to a maximum of 25% in a semester and 2 times during the course may be granted by the authority.

Registration/Duration

The maximum duration for completing MCA Programme will be 6 years from the date of commencement of first semester.

Evaluation and Grading

There shall be a final semester examination for all the courses including Lab in every semester and classes shall be completed at least 7 days before the commencement of the examination.

The students in each semester evaluated through continuous evaluation . The ratio of Final and sessional examinations is 50:50.There shall be minimum two sessional examinations, each of 1.5hrs duration. Each test shall cover 40% of the syllabus and shall be for 20marks. Retest shall be permitted to the students who could not appear for the internal tests due to genuine reasons. ten days shall be utilised for conducting both internal evaluation tests.

There shall be separate passing minimum of 45% marks for the End- Semester examination and the student has to secure an aggregate of 50% when End- Semester examination and internal marks are taken together for every course in all the semesters for passing the programme.

Students are permitted to check the answer books of the final semester examination after evaluation to address the grievances.

The Department shall publish the marks obtained by the students, in the continuous assessment and semester end examination. If the student has any grievance, he/she can approach the concerned teacher and submit grievances with supporting documents/arguments. The teacher and the HOD will examine the case and decide on his/her grievance. If the student is not convinced with the decision, he/she can approach the appellate authority, which is the department council, in writing and the council shall

examine the same and take a final decision which has to be intimated to the student in writing. The decision of the appellate authority shall be final.

The final marks and grades obtained by the students shall be published in the notice board. Those who could not obtain atleast Grade D in total for a course will be declared as failed in that course. Those who fail in any core or elective course shall submit an application to the Head of the Department within 5 working days if necessary for a reexamination of the semester end examination. Within ten days of the display of the results in the notice board, the department shall conduct an additional semester end examination for these candidates. This reexamination is only to provide the student a chance to complete the course successfully. If he/she completes the course successfully making use of this additional chance, he/she will be awarded only a D grade enabling the candidate to be declared successful in that course. If he/she cannot make it up, he/she may repeat the semester end examination of that course in the next available chance. In this case, he/she may be awarded whatever grade he/she has secured. If the candidate fails in this chance also, for the successful completion of the programme, the student has to re-register and repeat those courses in which he/she has failed. In this case also, the student may be awarded whatever grade he/she has secured. The maximum duration for completing any PG degree programme will be 4 years

Grading, Calculation of GPA and CGPA

The following grades will be awarded based on the overall performance in each

Subject.

Range of marks	Grades	Weightage
90 and above	S-Outstanding	10
80 to 89	A-Excellent	9
70 to 79	B-Very good	8
60 to 69	C-Good	7
50 to 59	D-Satisfactory	6
Below 50%	F-Failed	0

Overall performance at the end of the semester will be indicated by Grade Point Average (GPA) calculated as follows. GPA = G1C1+G2C2+G3C3+……..GnCn C1+C2+C3+……Cn Where ‘G’ refers to the grade weightage and ‘C’ refers to the credit value of corresponding course undergone by the student. At the end of the final semester Cumulative Grade Point Average (CGPA) will be calculated based on the above formula, considering the Credits and Grades earned during the entire programme of study. Classification for the Degree/Diploma will be given as follows based on the CGPA:

First Class with distinction	8 and above
First Class	*6.5 and above
Second Class	6 and above

*Added the amendment vide Notification No.Conf.II/2941/2/2017(4) dated 05.08.2017/22.082017

Master of Computer Applications (MCA) Course Structure

(2020 Admission onwards)

Bridge Courses

Course Code	Subject	Hours			Marks		Credit
		L	T	P	Sessional	Final	
	Principles of Programming	12		6		50	
	Basic Mathematics for Computer Applications	12				50	

Semester I

Course Code	Subject	Hours			Marks		Credit
		L	T	P	Sessional	Final	
20-381-0101	Data Structures using C	3	1	2	50	50	3
20-381-0102	Mathematical Foundations and Numerical Techniques	3	1	2	50	50	3
20-381-0103	Digital Electronics and Computer Organization	3	1	3	50	50	3
20-381-0104	Database Management System	3	1		50	50	3
20-381-0105	Operating Systems (MOOC Course)	3	1	2	50	50	2

20-381-0106	C Programming LAB			4	50	50	2
20-381-0107	DBMS LAB			2	50	50	1
		2	1	1			2
Total							19

Semester II

Course Code	Subject	Hours			Marks		Credit
		L	T	P	Sessional	Final	
20-381-0201	Object Oriented Programming	3	1	2	50	50	3
20-381-0202	Design and Analysis of Algorithms	3	1		50	50	3
20-381-0203	Fundamentals of Software Engineering.	3	1	2	50	50	3
20-381-0204	Data Mining and Machine Learning	3	1	2	50	50	3
20-381-0205	Information Security	3	1	2	50	50	3
20-381-0206	JAVA Programming LAB.			4	50	50	2
20-381-0207	Data Mining LAB using Python				50	50	2
Total							19

Semester III

Course Code	Subject	Hours			Marks		Credit
		L	T	P	Sessional	Final	
20-381-0301	Data Communication and Networks	3	1	2	50	50	3
	Elective I	3	1	2	50	50	3
	Elective II	3	1	2	50	50	3
	Elective III (Industry Elective)	3	1	2	50	50	3
	Elective IV (IE)	3		2	50	50	3
20-381-0306	Mini Project			2	50		2
20-381-0307	Technical Communication	2	1	2	50	50	2
Total							19

Semester IV

Course Code	Paper	Marks		Credit
		Internal	External	
20-381-0601	Project Work and Course Viva Voce.	200	200	15
Total				15

LIST OF ELECTIVES

Elective I

20-381-0311 Android Application Development

20-381-0312 Web Application Design using PHP

20-381-0313 Network Security and Wireless Security

20-381-0314 Artificial Intelligence

20-381-0315 Security Threats and Vulnerabilities

Elective II

20-381-0321 BlockChain Technology

20-381-0322 Bioinformatics

20-381-0323 Internet of Things

20-381-0324 Real Time Systems

20-381-0325 Distributed and Cloud Computing

20-381-0326 Software project management/ Software testing

20-381-0327 Introduction to Cryptography

Elective III

20-381-0331 Big Data Analytics

20-381-0332 Natural Language Processing #

20-381-0333 Digital Image Processing

20-381-0334 Deep Learning

Elective IV

20-381-0341 Design Thinking

20-381-0342 Project Management

 # Syllabus to be approved

Principles of Programming

(2020)

Hour 1

Introduction-Computers, Algorithms, Flowchart, Structured programming, compilers, Operating System, Preprocessor, Linker, Running a program.

Hour 2

Programming domains. Language Evaluation, Programming paradigms- Imperative programming, Functional programming, Object oriented programming, Logic programming

Hour 3

Formal methods of describing syntax and semantics

Hour 4

Introduction to programming- Character Set, Identifiers and Keywords , Variables – Declaration of variables, initialization, Characters and character String, Data Type ,Qualifiers, typedef, Promotion and type casting, Constants, operators and expressions.

Hour 5

Basic Input –Output-Single character input output, string input output, general input output, types of characters in format string, scanf width specifier.

Hour 6

Control Structures –if, if else, multiway decision, compound statement, Loops – while, for, do while, Switch, Break, Continue, Go to and labels.

Hour 7

Functions–Introduction, main function, function parameters, return value, Recursion, Comparison of Iteration and recursion.

Hour 8

Arrays and strings-Introduction, Multi-dimensional arrays, strings, arrays of strings

Hour 9 &10

Pointers-Introduction, Definition and uses of Pointers Address Operator &, Pointer Variables, Dereferencing Pointers ,Void Pointers, Pointer Arithmetic

Hour 11 & 12

Structures and Union-Introduction, Declaring and using structures, structure initialization, structure within a structure, operations on structures, array of structures, pointers to structures, Unions, operations on union, difference between structures and union.

TEXT:

K.R .Venugopal, S.R Prasad,"Mastering C", 11th Reprint, Tata McGraw-Hill, 2011.

REFERENCES:

1. Les Hancock and Morris Krieger, 'The C Primer', McGraw-Hill, 1987

2. Yashavant Kanetkar , 'Let Us C', BPB Pulication. 6 th Ed. 2005

3. Byron Gottfried, 'Programming with C', 2 nd Ed. Schaim's ouline series, 2002.

4.Kernighan, Brain W and Ritchie, Dennis M, 'The C Programming Language'. 2 nd Ed. Prentice Hall, 2007.

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Foundation Course

(2020)

Hour 1

Introduction to number systems-Decimal Number Systems, Binary Number Systems,

Hexadecimal Number Systems, Octal Number Systems. Binary Arithmetic

Hour 2

Set theory- Sets and their representations, Types of sets, Operations on sets, Venn

diagrams, Applications of sets. Relation

Hour 3

Relations- Relations and digraphs, Properties of relations, Reflexive, Symmetric, and

Transitive relations, Equivalence relation.

Hour 4

Binary Operations –Properties of Binary operations, Groups, Rings and Fields.

Hour 5 & 6

Matrices and Determinants: Matrix, Types of matrices, Operations on matrices, Determinants,

Properties of determinants, Inverse of a matrix, Solution of a set of equations.

Hour 7

Permutation and combination

Hour 8 & 9

Probability and Statistics- Random Variable, Measures of central tendency and dispersion

Sample space and events, Probability of events, Distributions.

Hour 10

Differentiation: Limits and continuity, Derivatives of standard Functions, Rules for finding

derivatives; Different types of differentiation;

Hour 11

Integration: Integration of standard Functions, Rules of Integration, Formulas in integration, Definite integrals.

Hour 12

Differential equations: Degree and Order of Differential equations, first order Differential equations, Second order Differential equations

20-381-0101 DATA STRUCTURES USING C

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basic concepts of C such as variables, data types and control structures.	(Cognitive level : Understand)
CO2	Apply dynamic memory allocation concept to implement list, stack and queue.	(Cognitive level : Apply)
CO3	Explain the elementary Data structures such as List, Stack and Queue.	(Cognitive level : Understand)
CO4	Interpret the properties and operations performed on a binary tree and binary search tree.	(Cognitive level :Apply)
CO5	Apply heap concept to implement priority queue.	(Cognitive level : Apply)
CO6	Explain the different types of graph implementations such as edge list, adjacency list and adjacency matrix	(Cognitive level : Understand)
CO7	Discuss the collision resolution techniques separate chaining and open addressing	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											

CO2	2		2		2							
CO3	1											
CO4				2								
CO5	2			2								
CO6	1											
CO7	3											

UNIT I

Introduction to C programming: Character Set, Identifiers and Keywords, Variables – Constants- Operators and Expressions , Data Types- Basic data types -Array-String.

Control Structures: Branching and Looping: if-elseif-else, Multiway decision-Switch, Loops –while, for, do while. Break, Continue statements in loops and conditional statements.

UNIT II

Functions: Advantages of functions, main() function, function parameters, return value, passing arrays to functions, Recursion. Structure-Introduction, Declaring and using structures,structure initialization

Pointer: Introduction, Pointer Variables, Dereferencing Pointers ,Void Pointers-Dynamic Memory Allocation-Demonstration of malloc(), calloc(), realloc() and free() functions.

UNIT III

Elementary Data Structures : List,Stack, Queue-Array and Linked List Implementation.
Non Linear Data Structure: Trees -Binary Trees, Binary Tree traversal (In Order, Pre Order, Post Order)
Binary Search Tree : Searching an element in BST, Insertion and Removal of Elements

UNIT IV

Heaps: Properties, Representations (Array Based and Linked) Insertion and deletion of elements, Heap implementation of priority queue.

Graphs: Properties, Representations (Edge List, Adjacency list, Adjacency Matrix), Graph Traversals (Depth First and Breadth First Search), Directed Graph.

UNIT V

Dictionaries: Hash Tables, Hash Functions, Collision Handling Methods - Separate Chaining, Open Addressing - Linear & Quadratic Probing, Double Hash.

TEXT BOOKS:

1. K.R .Venugopal, S.R Prasad,"Mastering C", 11th Reprint, Tata McGraw-Hill, 2011.

2. Ellis Horowitz. SartajSahni and Anderson Freed, 'Fundamentals of Data Structures in C", 2nd Ed, Universities Press, 2008.

REFERENCES:

1. Kernighan, Brain W and Ritchie, Dennis M, 'The C Programming Language'. 2 nd Ed. Prentice Hall, 2007.
2. Byron Gottfried, 'Programming with C', 2 nd Ed. Schaum's outline series, 2002.
3. Aaron M.Tanenbaum, Moshe J.Augenstein, "Data Structures using C", Prentice Hall International Inc., Englewood Cliffs, NJ, 1986.
4. 2. Aaron M Tanenbaum, YedidyahLangsam, Moshe J Augenstein, "Data Structures using C", Prentice Hall International, Inc, 2009.

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20-381-0102 MATHEMATICAL FOUNDATIONS AND NUMERICAL TECHNIQUES

Course Outcomes

After completion of this course, students will be able to

CO1	Solve the consistent system of linear equations.	(Cognitive level : Apply)

CO2	Apply iterative methods (Gauss Jordan, Gauss Elimination and Jacobi) to solve systems of linear equations.	(Cognitive level : Apply)
CO3	Apply Propositional logic and First order logic to solve problems.	(Cognitive level : Apply)
CO4	Solve recurrence relations.	(Cognitive level : Apply)
CO5	Explain sets and operations on sets.	(Cognitive level : Understand)
CO6	Calculate mean and variance of a given probability distribution.	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3											
CO3	3	2	1	1	1							
CO4	3	1	2	1	1							
CO5	2											
CO6	3	3	1	2	1							

UNIT I Matrices, determinants, inverse of matrix. System of equations, Linear transformation - rank and nullity, Consistency and inconsistency of linear system of equations, rank nullity theorem , Echelon form of a matrix and Row reduced echelon form of matrix. Eigen values and Eigen vectors.

UNIT II Power method to find the dominant Eigen values, Numerical Linear Algebra: Gauss elimination method, Gauss Jordan Method, Jacobi Method for solving linear systems.

UNIT III Sets, Operations on sets, Venn Diagrams, Multi Sets, Binary Relations, Equivalence Relations, Ordering Relations, Operations on Relations, Partial Orders .

Statements and Notation, Connectives, Quantified Propositions, Logical Inferences, Methods of Proof of an Implication, First Order Logic and other Methods of Proof, Rules of Inference for Quantified Propositions, Proof by Mathematical Induction.

UNIT IV Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The Method of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relations

UNIT V Introduction to Probability, random variables - discrete and continuous, probability functions, density and distribution functions, mean and variance, special distributions (Binomial, Hyper geometric, Poisson, Uniform, exponential and normal).

Testing of Hypothesis, Null and alternative hypothesis, level of significance, one-tailed and two tailed tests, tests for small samples- T-test, Chi-square test.

TEXTBOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics And Its Applications", 7th Ed,McGrawHill, 2012.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition 2011.
3. Bernard Kolman, RobertBusby and Sharon Cutler Ross, "Discrete Mathematical Structures for Computer Science", 6 th Ed, PHI , 2013.
4. Walpole, R. E., Myers, R. H., Myers S L & Keying Ye, 'Probability and Statistics for Engineers and Scientists'. 8th ed, Pearson Education, 2007.

REFERENCES:

1. Eric Lehman, F. Thomson Leighton, Albert R. Meyer, "Mathematics for Computer Science", MIT 7th Ed, 2015
2. William Stein, "Elementary Number Theory: Primes, Congruences, and Secrets": A Computational Approach Springer, 2008.
3. Sipser, "Introduction to the Theory of Computation, CENGAGE Learning, 2014. 4. Ernest Davis, "Linear Algebra and Probability for Computer Science Applications ", 1st Edition, CRC Press 2012.
4. Tom M. Apostol, "Introduction to Analytic Number Theory", Springer, 1998.

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20-381-0103 DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION

Course Outcomes

After completion of this course, the students will be able to

CO1	Discuss the basic laws of Boolean Algebra.	(Cognitive level : Understand)
CO2	Explain the conversion of Boolean functions between Canonical forms.	(Cognitive level : Understand)
CO3	Apply K-Map to simplify Boolean functions.	(Cognitive level : Apply)
CO4	Classify different types of Mnemonic instructions	(Cognitive level : Understand)
CO5	Discuss Computer Architecture related concepts such as pipelining, memory hierarchy and memory technologies.	(Cognitive level : Understand)
CO6	Explain the steps involved in binary arithmetic operations such as addition,subtraction, multiplication and division.	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2											
CO3		3										
CO4		2										
CO5		1										
CO6	2	2	1									

UNIT I	Review of number systems: Binary,Octal,Hexadecimal,Boolean Algebra: Theorems and Properties,Sum Of Products, Product Of Sums and Canonical forms ,Digital Logic gates, K-Maps, Simplification of Boolean Functions using K-Maps Latches and flip-flops: SR, D, JK and T
UNIT II	Von-Neumann Architecture, Instruction set architecture: Arithmetic,logical,shift,and rotate operations. Instruction Set Architecture - Instructions and Instruction Sequencing , Addressing Modes, Subroutines, Condition Codes, Encoding of Machine Instructions
UNIT III	Input /Output Organization - Accessing I/O Devices, Interrupts,The Memory System - Semiconductor RAM Memories Read-only Memories, Memory Hierarchy,Cache Memories - Mapping Functions

UNIT IV	Computer Arithmetic - 1's, 2's complement representations , Addition and Subtraction of Signed Numbers, Multiplication of Unsigned Numbers , Multiplication of Signed Numbers, Integer Division
UNIT V	Basic Processing Unit - Some Fundamental Concepts , Instruction Execution, Hardware Components. Instruction Fetch and Execution Pipelining : Basic Concept, Pipeline Organization , Pipelining Issues Data Dependencies, Memory Delays , Branch Delays

TEXT BOOK

1. M. Morris Mano, "Digital Design", 6th Edition, Prentice Hall of India Pvt. Ltd.2018.
2. Computer organization And Embedded Systems, Hamacher, Vranesic, Zaky, Manjikian, 6Ed, McGraw-Hill , 2012

REFERENCES

1. Manish Saraswat, 'Computer Architecture And Organisation', 1st Ed. Vayu Education Of India, 2011.
2. Tanenbaum A.S, 'Structured Computer Organization'. 5/e, Prentice Hall of India, 2006.
3. Mano, M M, 'Computer System Architecture'. 3rd Ed. Prentice Hall of India, 2007.
4. Hayes, 'Computer Architecture and Organization', 2nd Ed. McGraw Hill, 1998.

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20-381-0104 DATABASE MANAGEMENT SYSTEMS

Course Outcomes

After completion of this course, students will be able to

CO1	Discuss the characteristics of database systems, database architecture and data models.	(Cognitive level : Understand)

CO2	Solve simple and moderately advanced database queries using SQL.	(Cognitive level :Apply)
CO3	Employ ER diagram as a data modelling technique to represent entity framework.	(Cognitive level : Apply)
CO4	Apply logical database design principles including functional dependencies and normalization to solve various database designs.	(Cognitive level : Apply)
CO5	Explain the concepts of a database transaction and related database facilities (concurrency control and deadlock handling).	(Cognitive level : Understand)
CO6	Describe the physical file structures and primary methods of organizing files of records on disk.	(Cognitive level : Understand)
CO7	Discuss the indexing techniques for files including tree based indexing and hash based indexing.	(Cognitive level : Understand)
CO8	Discuss the various types of databases including OODBMS, Distributed database.	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											

CO2		2	3									
CO3		2	3									
CO4			3									
CO5	2											
CO6	2											
CO7	2											
CO8	2											

UNIT I Introduction to File and Database systems- History- Advantages, disadvantages- Data views – Database Languages – DBA – Database Architecture – Data Models -Keys – Mapping Cardinalities.

UNIT II Relational Algebra and calculus – Query languages – SQL – Data definition – Queries in SQL – Updates – Views – Integrity and Security – triggers, cursor, functions, procedure – Embedded SQL – overview of QUEL, QBE.

UNIT III Design Phases – Pitfalls in Design – Attribute types –ER diagram – Database Design for Banking Enterprise – Functional Dependence – Normalization (1NF, 2NF, 3NF, BCNF, 4NF, 5NF).Transaction concept – state - Serializability – Recoverability- Concurrency Control –Locks- Two Phase locking – Deadlock handling – Transaction Management in Multidatabases.

UNIT IV Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing - Clustered Indexes, Primary and Secondary Indexes, Index data Structures - Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

UNIT V Object-Oriented Databases- OODBMS- rules – ORDBMS- Complex Data types –Distributed databases – characteristics, advantages, disadvantages, rules-
Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML Data – XML Document. Introduction to MongoDB , Overview of NoSQL.

TEXT BOOK

1.Avi Silberschatz, Henry F. Korth and S Sudarshan, 'Database System Concepts". 7th Ed., McGraw Hill International Edition, 2019.

REFERENCES

1. Philip J. Pratt, Joseph J Adamski, 'Database Management Systems', Cengage Learning, 2011.
2. RameezElmasri, Shamkant B. Navathe, 'Fundamentals of Database Systems', 7th Ed., Pearson Education, 2015.
3. Arun K Majumdar, Pritimoy Bhattacharyya, 'Database Management Systems', TMH, 2017
5. ISRD group, 'Introduction to Database Management Systems', TMH, 2008
6. Raghu Ramakrishnan, Johannes Gehrke 'Database Management Systems', McGraw Hill International Edition, **3rd** Edition

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20-381-0106 C PROGRAMMING LAB

Course Outcomes

After completion of this course, students will be able to

CO1	Design algorithms to solve mathematical and scientific problems.	(Cognitive level :Create)
CO2	Develop and test programs using control structures	(Cognitive level : Create)
CO3	Develop modular programs using functions	(Cognitive level : Create)
CO4	Develop Programs using pointers	(Cognitive level : Create)

CO5	Compare Structure and Union	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3									3
CO2			3									
CO3			3								2	2
CO4			3									2
CO5												2

Overview of Programming , Constants, variables ,data types, Operators and expressions, input and output operators. Decision-making , branching/Looping, Arrays, handling of character Strings. User-defined functions, Structures and unions, Pointers, file management , Dynamic memory allocations - malloc(), calloc(), realloc(), free()) , Preprocessor statements. Program through Command Line Arguments.

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20-381-0107 DBMS LAB

Course Outcomes

After completion of this course, students will be able to

CO1	Design a database schema for a given problem domain.	(Cognitive level :Create)

CO2	Employ SQL DDL/DML commands to create, secure, populate, maintain, and query a database.	(Cognitive level : Apply)
CO3	Create query using SQL commands as solutions to a broad range of query and data update problems.	(Cognitive level : Create)
CO4	Employ integrity constraints on a database design.	(Cognitive level : Apply)
CO5	Create stored functions, stored procedures, cursor, trigger using PL/SQL block.	(Cognitive level : Create)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3									2
CO2		2	3									
CO3	3		3									
CO4	2		3									2
CO5	2		3									

Familiarization of MySQL RDBMS, SQL- query-structure, DDL-create, alter, drop, rename and Truncate, DML-select, insert, update, delete.
Using the WHERE clause, using Logical Operators in the WHERE clause Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING clause, using aggregate functions combining tables using JOINS subqueries.
Set-operations, union, intersection and except, creating views. Using GRANT and REVOKE
PL/SQLEnvironment, block structure, variables, operators, data types, control structures, Cursors structures-Implicit and Explicit, Stored procedures, functions, Triggers- Data definition language triggers, Data manipulation triggers.

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20-381-0201 OBJECT ORIENTED PROGRAMMING

Course Outcomes

After completion of this course, students will be able to

CO1	Discuss the basic object oriented concepts such as class, object, properties and methods	(Cognitive level : Understand)
CO2	Give examples for user interactive Java programs	(Cognitive level : Understand)
CO3	Explain object oriented features such as constructors, inheritance, abstract classes, interfaces and exception handling	(Cognitive level : Understand)
CO4	Employ access specifiers to protect data and methods from being used by all	(Cognitive level : Apply)
CO5	Apply object oriented constructs of Java to build robust and interactive applications	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	1											
CO2	1											
CO3	1											
CO4	1		1									
CO5	1		2									

UNIT I

Introduction to object oriented concepts and an Overview of Java: Object and Class Basics, Java Program Structure, Primitive data types in Java, Creating and defining classes , methods, Creating and instantiating Objects, Accessing class members.

Basic Input and Output: Input using Buffered Reader class & Scanner class. Output using system.out.

UNIT II

Classes, Properties and Methods: Methods, Scope of variables - class scope and method scope, this operator, Constructors, Overloading - Constructor & Method overloading
Nested classes and Static class members
Arrays and Strings.

UNIT III

Inheritance: Creating child class, Method overriding, Final classes and methods in Java. Packages.
Access Control - Public, Protected and Private. Access control during inheritance.
Abstract classes and Interfaces. Multiple inheritance with interfaces.

UNIT IV

Object Cloning: Deep copy and shallow copy of objects
Exception Handling: Try catch blocks, throw, throws and finally, Creating custom exceptions

UNIT V	Lists: Array Lists and Linked Lists in Java, iterating over lists using the iterator object. Multi Threading: Creating threads - Extending Thread class, implementing runnable interface, Thread States, Thread synchronization.

TEXT BOOK

Java: The Complete Reference by Herbert Schildt, 11th Ed, 2018

REFERENCES

The Java Programming Language, Ken Arnold, David Holmes, James Gosling, Prakash Goteti, 3rd Edition, Pearson 2008

Object-Oriented Design & Patterns, Cay Horstmann, Second Edition, Wiley 2006

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20-381-0202 DESIGN AND ANALYSIS OF ALGORITHMS

Course Outcomes

After completion of this course, students will be able to

CO1	Analyse a given algorithm to express its time and space complexities in asymptotic notations.	(Cognitive level :Analyze)
CO2	Solve recurrence equations using substitution method, recursion tree method and masters theorem.	(Cognitive level : Apply)
CO3	Apply divide and conquer methodology to solve problems	(Cognitive level : Apply)
CO4	Apply dynamic programming paradigm to solve problems	(Cognitive level : Apply)

CO5	Apply greedy algorithm to solve problems	(Cognitive level : Apply)
CO6	Apply amortized analysis methods (aggregate analysis, accounting and potential method) on algorithms	(Cognitive level : Apply)
CO7	Describe backtracking paradigm and branch and bound technique	(Cognitive level : Understand)
CO8	Differentiate between P and NP classes of problems	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3										
CO2		3	3									
CO3	2		3									
CO4	2		3									

CO5	2		3									
CO6		2										
CO7	2											
CO8				2								

UNIT I	Introduction - Definition of Algorithm – time and space complexity- Asymptotic notations. Probabilistic Analysis and Randomized Algorithms- The hiring problem, Indicator random variables, Randomized algorithms. Recurrence Equations-substitution method -recursion tree method-masters theorem(proof not required).
UNIT II	Divide-and-conquer-maximum subarray problem, strassens's algorithm for matrix multiplication.AVL Trees – rotations, Red-Black Trees insertion and deletion. B-Trees – insertion and deletion operations. Heap sort -heaps, maintaining the heap property, building a heap, The heapsort algorithm, Analysis of heap sort.
UNIT III	Dynamic Programming-elements of dynamic programming, 0/1 Knapsack, Rod cutting, Longest common subsequence. Greedy Algorithms-The Control Abstraction- the Fractional Knapsack Problem, huffman codes. Amortized Analysis-aggregate method, the accounting method, the potential method.
UNIT IV	Back Tracking: -8-queens - Sum of subsets - Graph Coloring – Hamiltonian cycles Branch and Bound: Traveling Salesman Problem. Single source shortest paths- the bellman-ford algorithm. All pairs shortest path-The Floyd Warshall Algorithm.
UNIT V	Introduction to Complexity Theory :-Tractable and Intractable Problems- The P and NP Classes- Polynomial Time Reductions - The NP- Hard and NP-Complete Classes

TEXT BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms,3rd edition, The MIT Press, 2009.
2. A.V. Aho, J.E. Hopcroft, J.D. Ullmann, The design and analysis of Computer Algorithms, Addison Wesley, Boston., Pearson,1st edition 1974

REFERENCES

1. S.E.Goodman and S.T.Hedetniemi, , Introduction to the Design and Analysis of algorithms, Tata McGraw Hill Int. Edn, 1977, New Delhi.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2011.
3. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, 2nd edition 2008, Computer Science Press

20-381-0203 - FUNDAMENTALS OF SOFTWARE ENGINEERING

Course Outcomes:

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

CO1	Describe Software Development Models	**[Cognitive Level : Understand]**
CO2	Compare Life Cycle Models to use in a particular Context	**[Cognitive Level : Analyze]**
CO3	Apply different techniques for requirements gathering	**[Cognitive Level : Apply]**
CO4	Construct a Software Requirement Specification	**[Cognitive Level : Create]**
CO5	Apply UML Models during Requirement Analysis and Design Phase	**[Cognitive Level : Apply]**
CO6	Show to prepare Software Documentation	**[Cognitive Level : Apply]**
CO7	Describe good code	**[Cognitive Level : Understand]**

CO8	Evaluate Software Code and Output using Testing Techniques	**[Cognitive Level : Evaluate]**

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2										
CO3	2									3		2
CO4			3		2							2
CO5	3				3							1
CO6			3									2
CO7	2											2
CO8				3	3							

Unit I

Introduction – Evolution – from an art form to an engineering discipline, Software Development Projects, Exploratory style of Software Development, Notable changes in Software Development Practices, Computer Systems Engineering.

Unit II

Software Life Cycle Models – A few basic concepts, Waterfall model and its extensions, Agile Development Models, Spiral model, A comparison of different Life Cycle models.

Requirements analysis and specification – Requirements Gathering and Analysis, Software Requirements Specification.

Unit III

Software Design – Overview of Software Design, How to charactarise a good software design, Cohesion and coupling, Layered arrangement of modules, Approaches to Software Design. Software Maintenance – Characteristics of Software Maintenance, Software Reverse Engineering, Software maintenance process models, Estimation of maintenance cost.

Unit IV

Object Modelling using UML – Basic object Orientation concepts, Unified Modelling Language, UML diagrams, Use Case Model, Class Diagrams, Interaction Diagrams, Activity Diagram, State Chart diagram.

Unit V

Coding and Testing – Coding, code review, Software Documentation, Testing, Unit Testing, Black-Box testing, White-Box testing, Integration Testing, System Testing.

Books:

Text Book : Fundamentals of Software Engineering, Fifth Edition by Rajib Mall, PHI Learning Pvt. Ltd., February 2019.

References:

1. Software Engineering – a Practitioner's approach Sevent Edition by Roger S Presman, 7th edition, McGraw Hill. 2017.
2. **Software Engineering 10th Edition by Ian Sommerville, PEARSON INDIA, October 2018.**
3. Software Engineering A Precise Approach by Pankaj Jalote, 2010, WILEY INDIA

20-381-0204 DATA MINING AND MACHINE LEARNING

Course Outcomes

After completion of this course, students will be able to.

CO1	Explain the basics of Data mining and Machine Learning	(Cognitive level : Understand)
CO2	Describe data Reduction and transformation methods	(Cognitive level : Understand)
CO3	Solve problems related to probability distributions and Inferential Statistics.	(Cognitive level : Apply)
CO4	Describe association rule mining methods.	(Cognitive level : Understand))
CO5	Apply Apriori algorithm on a given dataset using python.	(Cognitive level : Apply)
CO6	Discuss the basics of classification and clustering methods.	(Cognitive level : Understand)
CO7	Compare the performance of the decision tree and Bayesian Classifier.	(Cognitive level : Analyze)
CO8	Apply k-means clustering on a given dataset using python.	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	2											
CO2	2											
CO3		2										
CO4	2											
CO5			3	3								
CO6	2											
CO7		3		3								
CO8			3	3								

UNIT I	Introduction to Data Mining and Machine Learning, Knowledge Discovery Process, Technologies for Data Mining, Application areas of Data Mining; Major issues in Data Mining; Various type of attributes and data values. Data Preprocessing: Data Cleaning – Missing Values, Noisy Data, Data Reduction – Overview , Wavelet Transforms, Principal Component Analysis, Parametric Data Reduction; Data Transformation and Discretization – Data Transformation Strategies Overview, Data transformation by Normalization, various methods of Discretization, Concept Hierarchy Generation for nominal data.
UNIT II	FOUNDATIONS OF LEARNING - Components of learning – learning versus design – characteristics of machine learning – learning models – types of learning – training versus testing – Features – error measures, Descriptive Statistics-Probability Distributions, Inferential Statistics-Inferential Statistics through hypothesis tests.
UNIT III	Mining Frequent Patterns, Associations, and correlations: Basic Concepts – Market Basket Analysis, Frequent Itemsets and Association Rules; Frequent Itemset. Mining Methods - The Apriori Algorithm, Generating Association Rules from Frequent Itemsets, Finding Frequent Itemsets without Candidate Generation, FP-Growth, FP-Tree.

UNIT IV	Classification - Basic Concepts, Decision tree induction, Bayes Classification, Rule Based Classification, Model evaluation and selection, Advanced Classification methods – Bayesian Belief Networks, Introduction to classification by Back propagation and Support Vector Machines.
UNIT V	Cluster Analysis: Introduction to Cluster Analysis, Overview of Clustering Methods, Distance Measures, Partitioning methods - k-Means, k-Medoids; Hierarchical methods - Agglomerative versus Divisive Clustering, BIRCH, Chameleon, Density based methods - DBSCAN, Grid based methods – STING; Evaluation of Clustering.

TEXT BOOKS

1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining - Concepts and Techniques" - Morgan Kaufmann Publishers, Third Edition, 2012.

2. T. M. Mitchell, "Machine Learning", McGraw Hill, 2017.

REFERENCES

1. Ian H. Witten, Eibe Frank, "Data Mining - Practical Machine Learning Tools and Techniques", Morgan Kaufmann Publishers, Third Edition, 2011.

2. Soman, Divakar and Ajay, "Data Mining – Theory and Practice", PHI, 2006.

3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", *Pearson* Addison Wesley, 2006.

4. Arun K Pujari, "Data Mining Techniques", Universities Press, 2001.

5. Margaret H Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education India, 2006.

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20-381-0205 INFORMATION SECURITY

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basic concepts of information security – Threats, Vulnerabilities and Controls.	(Cognitive level : Understand)
CO2	Solve the problems using conventional symmetric key algorithms.	(Cognitive level : Apply)
CO3	Apply Asymmetric key cryptography algorithm RSA to protect the information.	(Cognitive level : Apply)
CO4	Compare Security enabled in conventional and trusted operating systems.	(Cognitive level : Analyze)
CO5	Describe various security measures in database management systems.	(Cognitive level : Understand)
CO6	Discuss network threats and security techniques.	(Cognitive level : Understand)
CO7	Examine the working of firewalls in an institution network.	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2										

CO3		3										
CO4				2								
CO5	1											
CO6	2											
CO7		3		2								

UNIT I Introduction and Basic concepts: threats, vulnerabilities, controls; risk; confidentiality, integrity, availability; security policies, security mechanisms; assurance; prevention, detection, deterrence.

Basic cryptography - Basic cryptographic terms, Historical background, Symmetric crypto Systems - Conventional systems, Asymmetric crypto primitives –RSA.

UNIT II Program security - Malicious code: viruses, Trojan horses, worms , Program flaws: buffer overflows, time-of-check to time-of-use flaws, incomplete mediation of Defenses , Software development controls, Testing techniques.

UNIT III Security in conventional operating systems - Memory, time, file, object protection requirements and techniques Identification and authentication. Trusted operating systems.

UNIT IV Database management systems security - Database integrity , Database secrecy , Inference control , Multilevel databases.

UNIT V Network security - Network threats: eavesdropping, spoofing, modification, denial of service attacks, Introduction to network security techniques: firewalls, intrusion detection systems. Cyber crimes and control measures.

TEXT BOOK

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing", 5 th Ed, Prentice hall, 2015.

REFERENCES

1. Michael E. Whitman, 'Information Security: incident response and disaster

recovery', Cengage Learning, 2009

2. WM. Arthur Conklin, Gregory B. White, Chuck Cotheren, Dwayne Williams, Roger Lavis,"Principles of Computer Security", 4 th Ed,Mc Graw Hill 2016.

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20-381-0206 JAVA PROGRAMMING LAB

Course Outcomes

After completion of this course, students will be able to

CO1	Apply object oriented concepts such as classes, inheritance, polymorphism and interfaces in application programming	(Cognitive level : Apply)
CO2	Show how to use Collections in Java for creating applications which optimizes memory requirements	(Cognitive level : Apply)

CO3	Employ Exception Handling primitives to build robust Java applications	(Cognitive level : Apply)
CO4	Evaluate Java programs based on the degree of object orientedness, error handling incorporated, level of abstraction and user friendliness	(Cognitive level : Evaluate)
CO5	Develop interactive applications using GUI constructs and event handling methods	(Cognitive level : Create)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1								1	
CO2	1		1								1	
CO3	1		1								1	
CO4											1	
CO5	2		1								1	

Introduction to JAVA, Data Types , variables , arrays, Operators, Control statements.

Classes and objects, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

Inheritance, Overriding, Object class, Polymorphism, Dynamic binding, Instance of operator, Abstract class, Interfaces.

Exception handling with try-catch-finally, Collections (array lists and linked lists) in java, Multithreaded Programming.

Introduction to swing, Event handling , Event types, Mouse and key events, GUI Basics.

20-381-0207 DATA MINING LAB

Course Outcomes

After completion of this course, students will be able to apply various Data mining and to real world problems.

CO1	Apply data preprocessing techniques on Data set.	(Cognitive level :Apply)
CO2	Analyze the performance of classification algorithms on real datasets from society	(Cognitive level : Analyze)
CO3	Conclude patterns from the data set to demonstrate knowledge.	(Cognitive level : Evaluate)
CO4	Calculate frequent itemsets using Apriori and FP growth algorithm	(Cognitive level :Apply)
CO5	Apply K-means clustering to cluster data of a real dataset.	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1					3							3
CO2						3						
CO3							3					
CO4						3						
CO5						3						

Understand the data set, Apply data preprocessing and mining techniques to large data sets, Use data mining tools, Understand different Visualization techniques,Compare different classifiers.Demonstration of Association rule mining using apriori algorithm and FP Growth algorithm .Demonstration of clustering techniques.

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20-381-0301 DATA COMMUNICATION AND NETWORKS

Course Outcomes

After completion of this course, students will be able to

CO1	Explain Data Communication systems and its components.	(Cognitive level: Understand)
CO2	Describe the functionalities of different layers.	(Cognitive level: Understand)
CO3	Calculate CRC, Parity Bit and Checksum for error correction and detection.	(Cognitive level: Analyse)

CO4	Describe the protocols used for collision detection and avoidance in multiple access.	(Cognitive level: Understand)
CO5	Compare the performance of Distance Vector, Link State and Path Vector routing protocols	(Cognitive level: Analyse)
CO6	Classify IP addresses to Classful and Classless addresses.	(Cognitive level: Understand)
CO7	Describe the features and operations of protocols HTTP, FTP, SNMP, POP3,IMAP and DNS and SMTP etc.	(Cognitive level: Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**											
CO2	**2**											
CO3		**2**										
CO4	**1**											
CO5		**2**		**2**								
CO6		**1**		**1**								
CO7	**2**											

UNIT I Need for networking, Data Representation in n/w. Categories of Network, Protocols & Standards, Layered models, Reference Models – ISO/OSI Models, TCP/IP models, Connecting Devices used in Networks. Physical Layer: Analog and Digital Signals, Transmission Impairments, Data Rate, Baud Rate, Digital & Analog Transmission, Multiplexing, Guided and Unguided Transmission Media, Wireless Transmission, Communication Satellites. Connection Oriented & Connectionless Communication.

UNIT II Data Link Layer – Function of DLL, Types of Errors in transmission, Detection vs Correction of Errors, Retransmission, Framing, Protocols for Noisy & Noiseless Channels. Protocols for Multiple Access – ALOHA, CSMA, CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing.Channel Allocation Techniques – FDMA, TDMA, CDMA.Wired LAN – Ethernet & Wireless LAN – Bluetooth, Backbone Networks, Virtual LANs

UNIT III Network Layer – Need for network layer, Routing – Optimality Principle, Routing Algorithms – Unicast & Multicast. Addressing- Physical, Logical & Port addressing.IPv4 Addressing, Classful & Classless addressing, NAT, Subnetting.IPv6 addressing. Packet format – IPv4 & IPv6.Internet Protocol – Datagram. Fragmentation, Tunneling. Address Mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP.

UNIT IV Transport Layer – Functions of Transport Layer, Process to Process Delivery, UDP, TCP, Congestion Control Techniques. Quality of Service – Need & Techniques. Integrated and Differentiated Services.

UNIT V Application Layer – DNS – Resolver, Remote Login, E-Mail, Telnet, FTP, SMTP, SNMP, POP3, IMAP. WWW – Architecture, URL, HTTP, HTTPS.Mobile Networking – Structure, Cell Signal Encoding, Handing over, Generations of Wireless Communication, EDGE, LTE.

TEXT BOOK

1. Data Communications and Networking, Behrouz A. Forouzan, 5th Ed McGraw-Hill, 2013,

2. Fundamentals of mobile computing, Prasant kumar Pattnaik, Rajib Mall, Second Edition, PHI Learning Pvt. Ltd., 2015

REFERENCES

1. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, 5th Edition, Pearson Education, 2012
2. Peterson, Larry L, Computer networks,Elsevier 2003
3. White, Curt M, Data communications and networking, Cengage Learning India, 2010
4. Stojmenovic, Ivan, Handbook of wireless networks and mobile computing, Wiley, 2002

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20-381-0306 MINI PROJECT

Course Outcomes

After completion of the mini project students will be able to get hands on experience on designing solutions for real world problems.

CO1	Identify a problem by considering realistic constraints .	(Cognitive level :Remember)
CO2	Classify already available literature or existing systems for selected problems.	(Cognitive level : Understand)
CO3	Describe the requirements for the real world problem.	(Cognitive level : Understand)
CO4	Describe the basic concepts of software and hardware used for solving the problem.	(Cognitive level : Understand))
CO5	Design solution with Software Engineering practices and standards.	(Cognitive level : Create)
CO6	Evaluate the performance and document the outcome.	(Cognitive level :Evaluate)

CO7	Compare the performance of the stated solution with already existing literatures	(Cognitive level :Analyze)

Mapping of course outcomes with programme outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		3			2					
CO2		3		3								
CO3	2											
CO4					2	2						
CO5							2	2	2		2	2
CO6				3							2	
CO7	3									3	3	3

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20-381-0307 - TECHNICAL COMMUNICATION

LEARNING OBJECTIVES:

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

CO1	Explain communication at an organization level.	[Cognitive Level : Understand]
CO2	Explain different constructs in English Language for technical writing.	[Cognitive Level : Understand]
CO3	Examine common mistakes people make in writing technical documents.	[Cognitive Level : Analyze]
CO4	Discuss how vocabulary is built and use.	[Cognitive Level : Understand]
CO5	Compare a technical document, check if it is worded properly	[Cognitive Level : Analyze]
CO6	Apply reading and learning skills.	[Cognitive Level : Apply]
CO7	Interpret to initiate and run a conversation.	[Cognitive Level : Apply]
CO8	Interpret the skills to face interviews and presentation.	[Cognitive Level : Apply]

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2											2
CO3		2										
CO4	3											3
CO5		3										
CO6	3											
CO7			3						2	2		2
CO8			3						2	2		3

UNITI

English Language and Communication Skills: An Overview - Importance of Language and Communication, Four Essential Skills—LSRW, Communication—An Overview, Definition of Communication, Process of Communication, Features of Successful Professional Communication, Importance of Effective Professional Communication, Different Types of Communication, Communication Flow in an Organization - Formal Flow

of Communication, Informal Flow of Communication. Barriers to Communication. Role of Creative and Critical Thinking for Effective Communication, Role of Intercultural Communication, Verbal Communication, Non-verbal Communication, Tips for Improvement (TEN PAGES)

UNIT II

ESSENTIALS OF WRITING SKILLS - Common Errors in English - Steps for Identifying Errors, Some Major Types of Errors, Errors Related to Noun/Pronoun Agreement, Errors Related to Subject−Verb Concord, Errors Related to Preposition Usage, Errors Related to Usage of Articles, Errors Related to Misplaced Modifiers.

Vocabulary Building - Importance of Vocabulary, Word Formation, Roots. Learning through Roots, Prefixes and Suffixes, Synonyms, Antonyms, Overcoming Confusion in Choice of Words, Acronyms/Abbreviations (THIRTY FIVE PAGES)

UNIT III

LISTENING SKILLS - Listening Skills and Comprehension - Why do We Avoid Listening?Disadvantages of Poor Listening, Poor Listening vs Effective Listening, 4Advantages of Effective Listening, Types of Listening, Barriers to Effective Listening, Five Steps to Active Listening, Techniques for Effective Listening, Practising Listening Activities.

READING SKILLS - Effective Reading and Comprehension Skills- Need for Developing Efficient Reading Skills, Benefits of Effective Reading, Differences Between Efficient and Inefficient Readers, Four Basic Steps to Effective Reading, Getting Acquainted with Major Types of Questions. Tips to Improve Reading Comprehension Skills, Stumbling Blocks in Becoming an Effective Reader. (FIFTEEN PAGES)

UNIT IV

Conversations and Dialogues: Everyday Speaking Situations - Purpose of General Conversations, Self-expression and Interaction, Getting to Know the Other Person Better, Building Trust and Credibility, Advantages of Conversations, Features of a Good Conversation, Tips for Improving Conversations. Begin by Using Pleasantries, Listen More than You Speak, Reciprocate Warmly, Ask Open-ended Questions, Be Courteous and Polite, Resist the Urge to Dominate, Listen to Others Attentively, Use Appropriate Body Language, Be Specific and Use Vivid Language, Paraphrase the Speaker’s Words, Apply the Three Cs. Participating in Short Conversations, Making Requests, Seeking and Giving Advice, Agreeing and Disagreeing, Giving Instructions, Situational Dialogues, Definition. Tips for Writing Dialogues. Giving Characters Distinct Speech Patterns263

(SIXTEEN PAGES)

UNIT V

COMMUNICATION AT WORKPLACE - Job Interviews, Definition of Interview, Process of Job Interview, Stages in Job Interviews, Types of Interviews and Questions Related to Them, Desirable Qualities of Candidates, Preparation for Successful Job Interviews, Know the Company, Know Yourself, Review Common Interview Questions, Prepare Questions You Want to Ask the Interviewer, Using Proper Verbal and Non-verbal Cues, Exhibiting Confidence, Tips for Success.

Formal Presentations - Overcoming Nervousness, Factors that Make a Presentation Work, Researching the Topic Thoroughly, Choosing an Appropriate Pattern of Organization, Starting Innovatively, Stating Facts to Substantiate Main Ideas, Using Examples and Instances, Using Visual Aids Effectively, Being Witty and Humorous, Employing Effective Body Language, Maintaining Appropriate Space Distance, Employing Paralinguistic Features Effectively, Ending on an Emphatic Note, Using PowerPoint Slides Effectively, Making Effective Group Presentations. [TWENTY SIX PAGES]

Text Book :

English Language and Communication Skills for Engineers by Sanjay Kumar and Pushp Lata, Oxford University Press, 2018.

References :

Personality Development and Soft Skills Paperback by by Barun Mitra (Author) , Oxford Higher Education , 18 Apr 2016

Communication Skills Paperback - by Sanjay Kumar (Author), Pushp Lata (Author) – Oxford Higher Education, 2015

20-381-0401 PROJECT WORK

Course Outcomes

After completion of this course, students will be able to design solutions to complex real world problems utilising a systems approach.

CO1	Apply prior knowledge to designing solutions to open-ended computational problems while considering realistic constraints.	(Cognitive level : Apply)
CO2	Describe the literature or existing solutions to identify the gap	(Cognitive level : Understand)
CO3	Analyze Database, Network and Application Design methods.	(Cognitive level : Analyze)
CO4	Design solution for the problem and document the outcome	(Cognitive level : Create)
CO5	Evaluate the performance of the solution using testing and security tools	(Cognitive level : Evaluate)
CO6	Analyze professional issues, including ethical, legal and security issues, related to computing projects.	(Cognitive level : Analyze)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2		2		2	2		2	2		2
CO2		2	2	2		2	2				2	
CO3		2		2								
CO4			3	2				2		3		
CO5				3	3							3
CO6	3									3	3	3

20-381-0311 ANDROID APPLICATION PROGRAMMING

Course Outcomes

After completion of this course, students will be able to

CO1	Explain Android SDK, Basics of mobile application development and life cycle of an application.	(Cognitive level : Understand)
CO2	Describe Native Capabilities, Messaging, and Location based services.	(Cognitive level : Understand)
CO3	Create applications that work with databases to store data using Shared preferences and SQLite database.	(Cognitive level : Create)
CO4	Apply built in widgets and components in mobile app.	(Cognitive level : Apply)
CO5	Create GUI based applications.	(Cognitive level : Create)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		1									
CO2	2		2									
CO3					3							

CO4	2											
CO5					2							1

UNIT I Introduction to Android

Introduction to Android Architecture: Introduction, History, Features and Android Architecture. Application Environment and Tools, Android Studio, Android SDK, AVD. Application Components- Activity, Content providers, Broadcast receivers, Services. Intents- Explicit and Implicit Intents, Intent Filter, Manifest File. Debugging android application.

UNIT II User Interface Design

User Interface Design: Views &View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. Creating the user interface programmatically, Managing changes to screen orientation, Displaying notifications- Setting up notifications, Notification manager. Designing for Tablets – Working with tablets: Developing for different android platforms, Fragments, combining fragments into a multilane UI, Specialized Fragments

UNIT III Mobile Data Management

Shared Preferences – Saving and Loading User Preferences, Persisting Data to Files, Creating and using Databases, SQLite Databases. Content Providers - Using a Content Provider, Built in Content Provider - Browser, CallLog, Contacts, Media Store and Settings. Creating Your Own Content Providers -Uri, CRUD access.

UNIT IV Native Capabilities, Messaging, Location based services

Camera, Audio, Sensors and Bluetooth: Android Media API: Playing audio/video, Media recording. Sensors - how sensors work, listening to sensor readings. Bluetooth , Messaging – SMS Messaging, Broadcast Receiver, Sending Email . Maps & Location: Maps : Map - Based Activities, How to load maps, To finding map API key, GPS, Working with Location Manager, Working with Google Maps extensions, Location based Services. Location Updates, location-based services (LBS), Location Providers, Selecting a Location Provider, Finding Your Location.

UNIT V Threading, Services, Web services

Tasks & Processes: Tasks, Switching between Task, Process, Process lifecycle. Threads, Thread Life cycle, Worker Threads, Thread Handlers, Threads & Loopers and IPC.Services: Services and Notifications – bound/unbound services, Starting and stopping services, Android Interface Definition Language, Handler and Messenger, Passing objects over IPC, Scheduling of services. Web Services – Android Server Communication: communication protocols, interacting with server-side applications, develop clients for web services, Exchanging Data over the Internet data parsing using json and xml parsing. Integrating with 3rd party Apps using Web Services.

TEXTBOOK

1. Beginning Android Programming with Android Studio, 4ed, by J. F. DiMarzio, 2016

REFERENCES

1. Android Application Development Cookbook, by Wei-Meng Lee, John Wiley and Sons, 2013
2. Professional Android 4 Development by Reto Meier, John Wiley and Sons, 2012
3. Android in Action, Third Edition, by W. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, 2012

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Course Outcomes

After completion of this course, students will be able to

CO1	Explain HTML tags used for formatting static web contents	(Cognitive level : Understand)
CO2	Discuss how custom responses are given to users by dynamic websites according to the user specific inputs	(Cognitive level : Understand)
CO3	Employ CSS constructs to improve the look and feel of websites	(Cognitive level : Apply)
CO4	Explain how MySql database tables are accessed through PHP front end for insertion, retrieval and modification of data.	(Cognitive level : Understand)
CO5	Give examples of client-side scripts in JavaScript	(Cognitive level : Understand)
CO6	Apply the constructs of CSS and JavaScript and database technologies like XML and MySql to create user friendly websites and web based applications	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		1									
CO2	1		2									

CO3	1		1									
CO4	1		2									
CO5	1		1									
CO6	2		1									

UNIT I	Introduction HTML: General Structure of an HTML page, Familiarization of HTML input tags - textbox, textarea, password, checkboxes, radio buttons, drop-down lists, submit and button tags. Inserting Images and links Creation of dynamic pages using PHP: Introduction to general programming language features - variables, looping and branching structures, user defined functions, familiarization of arrays and associative arrays, Strings and string functions.
UNIT II	Fundamentals of page styling using CSS: Inline, Internal & External CSS Client side scripting using JavaScript. Embedding JavaScript in PHP programs.
UNIT III	Familiarization of object oriented features of PHP: Constructors, Method overloading using default arguments, Inheritance, Abstract classes, Interfaces, Exception handling. Sessions and Cookies in PHP
UNIT IV	Form data validation, File Uploading using FILE input tag, Time and Date function in PHP, Regular expressions.
UNIT V	Database interaction in object oriented style using Mysqli: Execution of Insert, Select and Update queries through PHP front end. Interaction with XML databases through PHP front end.

TEXT BOOK

1. Beginning PHP and MySql; From novice to professional, W. Jason Gilmore, Apress, 2010, Fourth Edition
2. Deitel and Deitel and Nieto, "Internet and World Wide Web – How to Program", Prentice Hall, 5th Edition, 2011.

REFERENCES

1. PHP6 and MySQL, Steve Suehring, Tim Converse and Joyce Park, Wiley India 2010, Second Edition
2. HTML4 Complete ,E.Stephen Mask, Janan Platt BPB Publications, First Edition 1998.

20-381-0313 NETWORK SECURITY AND WIRELESS SECURITY

Course Outcomes

After completion of this course, students will be able to

CO1	Describe the model for network security.	(Cognitive level : Understand)
CO2	Examine the working of email security protocols PGP and S/MIME.	(Cognitive level : Analyze)
CO3	Describe various security attacks possible in the wireless networked environment.	(Cognitive level : Understand)
CO4	Discuss wireless security protocols WAP, WEP and WPA..	(Cognitive level : Understand)
CO5	Compare the performance of WEP and WPA in terms of security.	(Cognitive level :Analyze)
CO6	Evaluate WEP Security protocol	(Cognitive level :Evaluate)
CO7	Give examples for Real time RFID applications.	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2						2						

CO3	**1**											
CO4	**3**											
CO5				**2**								
CO6							**2**					
CO7	**2**											

UNIT I Model for network Security : Electronic Mail Security- PEM, Pretty Good Privacy, S/MIME IP and Web Security, Secure Sockets and Transport Layer,

UNIT II Buffer Overflow, TCP Session Hijacking, ARP Attacks, Route Table Modification, UDP Hijacking, Man in the Middle attack.

UNIT III Wireless Application Protocol, How WAP works, Security status of WAP – Viruses, Authorization, Non Repudiation, Authentication, Secure Sessions. WAP Security Architecture, Marginal Security – Wireless access to the internet, Wireless middleware.

UNIT IV Block Ciphers and Stream Ciphers, RC4 Encryption. WEP Security, Cracking WEP, WPA.

UNIT V RFID – Application types, RFID System components – Tag, Reader, Middleware, Attaching RFID tags, Tracking the movements of items. Architecture Guide lines. Wireless Hacking Techniques, Wireless attacks, mobile Security, Securing Wi- Fi.

TEXT BOOKS

1. Tyler Wrightson, "Hacking exposed Wireless Network Security A Beginner's Guide ", 1st Edition, Tata Mc – Graw Hill, 2012.
2. Bill Glover, Himanshu Bhatt, "RFID Essentials", 2nd Edition, Oreilly, 2007.

REFERENCES

1. William Stallings ,"Cryptography and Network Security Principles and Practice ", Sixth Edition , Pearson, 2014.
2. Shiva Sukula, RFID essentials , innovations and beyond, ESS, 2012.

20-381-0314 APPLIED ARTIFICIAL INTELLIGENCE

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basic concepts of Artificial Intelligence	(Cognitive level : Understand)
CO2	Classify Propositional and predicate calculus	(Cognitive level : Understand)
CO3	Compare the performance of using heuristic techniques for a give problem	(Cognitive level : Understand)
CO4	Apply minimax and alpha beta pruning strategy in game playing	(Cognitive level :Apply)
CO5	Explain the concept of agents, behaviour and environment of Intelligent agents.	(Cognitive level : Understand)

CO6	Apply the Image processing and object recognition technique in the real time application	(Cognitive level : Apply)
CO7	Describe the basic concepts of Natural Language processing and Robotics	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2	1											
CO3	1											
CO4	2											
CO5	1											
CO6						2						
CO7						1						

UNIT I Introduction to artificial intelligence - Artificial Intelligence- Definitions, Programming Methodologies, Techniques, Intelligent Systems, Propositional calculus, Predicate Calculus, Rule-Based Knowledge Representation.

UNIT II Intelligent Agents – Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The structure of Agents. The Present and Future of AI- Agent Components, Agent Architectures.

UNIT III Heuristic search and state space search - Techniques for Heuristic Search, State Space Search-Strategies for State Space Search -Applications of Search Techniques in Game Playing- Minimax strategy and Alpha Beta Pruning, and Planning.

UNIT IV Perception –Image Formation, Early Image-Processing Operations, Object Recognition by Appearance, Object Recognition from Structural Information. Introduction to Recommender Systems -Case study: Real time application.

UNIT V Natural Language Processing- Language Models, Text Classification, Information Retrieval, Information Extraction. Robotics- Robot Hardware, Robotic Perception, Robotic Software Architecture.

TEXT BOOKS

1. **Stuart Russell, Peter Norvig: "Artificial Intelligence: A Modern Approach ", 3rd Ed,** Pearson, 2016.
2. Elaine Rich, Kevin Knight, B.Nair: "ARTIFICIAL INTELLIGENCE ", 3rd Ed, Mc Graw Hill, 2017.

REFERENCES

1. Charu C. Aggarwal. "*Recommender Systems*. The *Textbook",* Springer, 2016.
2. N.P.Padhy:Artificial Intelligence and Intelligent Systems, Oxford University Press, 2009.

20-381-0315 SECURITY THREATS AND VULNERABILITIES

Course Outcomes

After completion of this course, students will be able to

CO1	Describe the concept of security goals, challenges, attacks and mechanisms.	(Cognitive level : Understand)
CO2	Interpret the relation between the threat, vulnerability and security attacks to implement countermeasures.	(Cognitive level : Apply)
CO3	Examine the security implementations in the environment.	(Cognitive level : Analyze)
CO4	Give examples for authentication systems and protocols.	(Cognitive level : Understand)
CO5	Describe the security applications implemented in network, e-mail and Operating System.	(Cognitive level :Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**1**											
CO2		**3**										
CO3						**2**						
CO4		**2**										
CO5	**3**											

UNIT I	OSI Security architecture – Security Attacks, Services and Mechanisms. Model for network Security – Open, Restrictive and Closed Security models. Security Goals, Identifying potential risks to Network security Simplified DES, Simplified AES.
UNIT II	Threat, Types of Threat, Vulnerabilities, Controls and Counter measures, . Attacks examples – Reconnaissance attack, Access attacks, Masquerading, IP Spoofing, Denial of Service attack, Distributed Denial of Service, Salami Techniques, Logic Bomb, Botnets. Onion Routing.
UNIT III	Entity authentication – Password, Challenge/ Response, Zero Knowledge Protocol. Biometrics, Introduction to identity based Public Key Cryptography, Oblivious transfers. Legal and Ethical issues, Cybercrime and computer crime, Intellectual Property Management – Copyright, Patent and Trade Secret, Digital Right Management.
UNIT IV	Intruders, Hackers, Intrusion Techniques – Password Guessing, Password Capture. Intrusion Detection Systems- Types, Honeypots. Malicious Softwares - Virus and Types of Virus, Countermeasures, Worms, Trojan Horse , Trap door. Firewalls – Characteristics, Types – Packet filters, Application level gateways, Circuit level gateways, Baston host, Personal firewalls.
UNIT V	Email attacks – SPAM , Electronic Mail Security - PGP, S/MIME, Smart cards, SET, Clipper, ISO Authentication framework

TEXT BOOKS

1. William Stallings ,"Cryptography and Network Security Principles and Practice ", Sixth Edition , Pearson, 2014.

2. Behrouz A Forouzan, "Cryptography & Network Security , Second Edition, McGraw-Hill, 2007.

REFERENCE

Charles P Fleeger, Shari Lawerence P Fleeger, Jonathan Margulies, "Security in Computing" Fifth Edition, Prentice Hall, 2015.

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20-381-0321 BLOCKCHAIN TECHNOLOGY

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basic concepts of blockchain data structures.	(Cognitive level : Understand)
CO2	Write smart contract programs.	(Cognitive level : Apply)
CO3	Implement soft fork and hard fork mechanisms	(Cognitive level : Apply)
CO4	Compare features of various cryptocurrencies	(Cognitive level : Analyze)
CO5	Describe various Consensus and multiparty agreements	(Cognitive level : Understand)
CO6	Discuss the hyper ledger components	(Cognitive level : Understand)
CO7	Examine the Blockchain Concurrency and scalability over various network models	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	2											
CO2	2											
CO3				3								
CO4				2								
CO5	1											
CO6	2											
CO7		3										

UNIT I Introduction to Blockchain, Blockchain Data structure, Hash chain, distributed database, Index structure, Transactions, Asymmetric-Key Cryptography, Addresses and Address Derivation, Private Key Storage, Ledgers, Blocks, Chaining Blocks

UNIT II Consensus and multiparty agreements: protocols, Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Elapsed Time, Deposit based consensus, Proof of importance.

Federated consensus or federated Byzantine consensus, Reputation-based mechanisms, Practical Byzantine Fault Tolerance.

UNIT III Blockchain implementation. Forking-Soft Fork, Hard Forks. Smart contract programing. Blockchain Platforms – Cryptocurrencies - Bitcoin, Litecoin, Ethereum, Ripple.

UNIT IV Hyperledger, Ethereum. Decomposing the consensus process , Hyperledger fabric components , Chaincode Design and Implementation.

UNIT V Blockchain-Outside of Currencies. IPFS protocol and Blockchain. Blockchain Concurrency and scalability. Network models and timing assumptions.

TEXT BOOK

1. Andreas M Antonopoulos , "Mastering Bitcoin: Unlocking digital crypto currencies", ORELLY,2015.
2. Melanie, "Blockchain: Blueprint for new economy", ORELLY,2015.
3. https://www.ibm.com/blockchain/in-en/hyperledger.html.

REFERENCES

1. Don Tapscott, "Block chain and Crypto currency", 2016. Draft NISTIR 8202, Blockchain Technology Overview - NIST CSRC, 2018.
2. Imran Bashir, Mastering Blockchain, 2017.
3. Andreas M. Antonopoulos, Mastering Bitcoin - Programming the Open Blockchain, O'Reilly Media, Inc., 2017
2. Ethereum Programming, Alex Leverington, Packt Publishing Limited, 2017
3. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, Princeton University Press, 2016
4. The Science of the Blockchain, Roger Wattenhofer, CreateSpace Independent Publishing Platform, 2016

5. Melanie Swan, Blockchain - Blueprint for a new economy, O'Reilly Media, Inc., 2015.

6. Abhijit Das and VeniMadhavan C. E., Public-Key Cryptography: Theory and Practice: Theory and Practice, Pearson Education India, 2009.

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20-381-0322 BIOINFORMATICS

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the central dogma of molecular biology.	(Cognitive level : Understand)
CO2	Compare the different biological databases.	(Cognitive level : Analyze)
CO3	Apply the sequence alignment algorithms for any given sequences.	(Cognitive level : Apply)
CO4	Compare primary and secondary protein structure prediction methods.	(Cognitive level : Analyze)
CO5	Describe various needs and applications of molecular phylogenetics.	(Cognitive level : Understand)
CO6	Discuss the features of tree calibration tools.	(Cognitive level : Understand)
CO7	Examine the working of machine learning algorithms in computational biology.	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2											
CO3				3								
CO4				2								
CO5	1											
CO6	2											
CO7		3										2

UNIT I Bioinformatics and Computational Biology – Scope. Central Dogma of Molecular Biology. Nucleic Acid Structure and Function. Genetic Code. Gene Expression – Transcription, Translation, Microsatellites, Minisatellites, Tandem repeats, Inverted repeats, SNPs. Biological Databases – Primary DBs, Secondary DBs, Nucleic Acid DBs, Protein DBs. Basic file formats.

UNIT II Basic Gene Statistics – Base counts, word (n-mer), frequency. Sequence Alignment – Local/Global Alignment, Pairwise Sequence Alignment, Needleman-Wunsch Algorithm. Multiple Sequence Alignment. PAM Matrix, BLOSUM. Tools: CLUSTAL W, Muscle, Tcoffee, Dotplot.

UNIT III Molecular Phylogenetic –Need & applications, DNA Barcoding, Genetic Finger Printing. Dendrogram, Cladogram; Rooted/Unrooted tree; Distance Based tree construction – UPGMA, NJ algorithm. Character Based Methods – Maximum Parsimony. Validating – Jack Knifing, Bootstrapping. Tree calibration. Tools: Phylip, NJ Plot, CLUSTAL X

UNIT IV Protein Structure- Primary, Secondary – alpha helics, beta sheets & turns, Tertiary and Quaternary structures. Protein Folding, Ramachandran Plot. Homology Modelling. CADD – Introduction to Molecular Docking. HMM- Introduction, Forward algorithm, Viterbi algorithm, Applications in bioinformatics Protein Databases, Tools: Swiss PDB, Pymol

UNIT V Systems Biology – Introduction, Protein Interaction networks, Metabolic and Signaling networks, SBML. E-Cell, Synthetic Biology- Introduction & Applications. Machine Learning in Bioinformatics

TEXT BOOK

1. Lesk, Arthur, Introduction to genomics, Oxford University Press, 2017

REFERENCES

1. Bergeron, Bryan P, Bioinformatics Computing, Prentice Hall Professional, 2003
2. Neil James, Pavel A Pevnezer, An Introduction to Bioinformatics Algorithms, MIT Press, 1st ed, 2004
3. Gibas , Cynthia, Developing bioinformatics computer skills, O'reilly 2003

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20-381-0323 INTERNET OF THINGS

Course Outcomes

After completion of this course, students will be able to

CO1	Describe IoT and working of IoT	(Cognitive level : Understand)

CO2	Explain layered architecture of IoT.	(Cognitive level : Understand)
CO3	Employ IoT protocols for communication.	(Cognitive level : Apply)
CO4	Create applications using Arduino Programming.	(Cognitive level : Create)
CO5	Design use case for IoT Application.	(Cognitive level : Create)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	3											
CO3							2					
CO4	3											
CO5		3		3		3					2	

UNIT IIntroduction to IoT-Physical Design of IoT, Logical Design of IoT, IoT Levels, Deployment templates, IoT enabling technologies. Domain Specific IoTs - NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II Networking IoT and Communication protocols – Link Layer, Network Layer, Transport layer, Application Layer.Sensor Networks and Machine to Machine communication – Differences and Similarities between M2M and IoT, Software defined networking , Network function virtualization.

UNIT III M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol –Modbus– Zigbee Architecture – Network layer –LowPAN - CoAP – Security.

UNIT IV Building IoT - RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi-Board - Linux on Raspberry Pi- Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino. Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Implementation of IoT.

UNIT V Big data platform for the internet of things, - Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different IoT based applications. Fog Computing: A Platform for Internet of Things and Analytics

TEXT BOOK/REFERENCES

1. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley &Sons, 2013.
2. Cuno Pfister, “Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud”, Maker Media, 2011.
3. Pethuru Raj and Anupama C. Raman , “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press).
4. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", by (Universities Press)2015.

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20-381-0324 REAL TIME SYSTEMS

Course Outcomes

After completion of this course, students will be able to

CO1	Explain basic components and types of a real time system.	(Cognitive level : Understand)
CO2	Solve problems to demonstrate Real time	(Cognitive level : Apply)

	scheduling algorithms.	
CO3	Analyze tasks and highlight restrictions in scheduling periodic tasks.	(Cognitive level : Analyze)
CO4	Examine aperiodic jobs to accept the job.	(Cognitive level : Analyze)
CO5	Explain priority ceiling and priority inheritance protocol.	(Cognitive level : Understand)
CO6	Discuss Applications of IOT	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		3										
CO3				3								
CO4				3								
CO5	3											
CO6	2											

UNIT I	Real Time Systems – Introduction, PID control concept, basic components - sensors, embedded processors, actuators, open and closed loop system, Example of embedded applications. Hard and Soft real time systems
UNIT II	Real Time Scheduler – Components, optimality and feasibility constraints for hard and soft real time systems. Task, Periodic, Aperiodic, Sporadic tasks. Taskgraph, DAG's and schematics to model tasks using graphs, commonly used approaches for Real Time Scheduling.
UNIT III	Clock driven scheduling, Frame size constraints, cyclic executives, Slack Stealing approach. Priority driven Scheduling – Static and Dynamic – Laxity BasedApproach. Deferrable server, Bandwidth Preserving server, Acceptance test.
UNIT IV	Resources and Resources access control, Resource control using task graphs,Priority ceiling and priority inheritance protocols.
UNIT V	Introduction to IoT – Physical and logical design of IoT, IoT enabled technologies examples and Raspberry Pi.

TEXT BOOKS

1. Liu, Jane W.S., Real Time Systems, Pearson Education, 2000

2. Laplante, Phillip A., Real-Time Systems Design and Analysis, Wiley, 3rd Ed., 2006.

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, Internet Of Things A hands on Approach, 2015

2. Jared Hendrix, Raspberry Pi: Essential guide on starting your own raspberry pi3

projects with ingenious tips and tricks, 2016.

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20-381-0325 DISTRIBUTED AND CLOUD COMPUTING

Course Outcomes

After completion of this course, students will be able to

CO1	Discuss the features of different distributed and cloud computing technologies such as cluster computers, coordinated computers, peer-to-peer systems and parallel and distributed computing models (Understand)	(Cognitive level : Understand)
CO2	Explain the features of virtualization middleware such as VMM and Hypervisor	(Cognitive level : Apply)
CO3	Describe full virtualization and para virtualization (Understand)	(Cognitive level : Analyze)
CO4	Discuss different aspects of cloud security including security defence strategies, distributed intrusion detection, and cloud security software (Understand)	(Cognitive level : Analyze)
CO5	Explain the nature and types of services provided by Amazon Web Services and Microsoft Azure (Understand)	(Cognitive level : Understand)
CO6	Apply the knowledge on AWS and Microsoft Azure to set up simple cloud based applications and services (Apply)	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											

CO2		3										
CO3				3								
CO4				3								
CO5	3											
CO6	2											

UNIT I Distributed Systems Models and Enabling Technologies: Scalable Computing – Technologies for Network-Based Systems – System Models for Distributed and Cloud Computing – Clusters of Cooperative Computers, Peer-to-Peer Network Families, Cloud Computing over the Internet. Software Environments for Distributed and Clouds – Trends toward Distributed Operating Systems, Parallel and Distributed Programming Models.

UNIT II Virtualization: Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization- VMM Design Requirements and Providers, Virtualization Support at the OS Level, Middleware Support for Virtualization- Virtualization Structures, Tools and Mechanisms- Hypervisor and Xen Architecture, Binary Translation with Full Virtualization, Para-Virtualization with Compiler Support- Virtual Clusters and Resource management- Virtualization for Data-Center Automation- Cloud OS for Virtualized Data Centers, Trust Management in Virtualized Data Centers

UNIT III	Cloud Platform Architecture over Virtualized Data Centers: Cloud Computing and Service Models- Architectural Design of Compute and Storage Clouds- Inter- cloud Resource Management- Resource Provisioning and Platform Deployment, Virtual Machine Creation and Management, Cloud security and resource management- Cloud Security Defense Strategies. Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques. Public Cloud Platforms: GAE, AWS, and Azure
UNIT IV	Service-Oriented Architectures for Distributed Computing: Services and Service- Oriented Architecture- Message-Oriented Middleware-Workflow in Service- Oriented Architectures - Workflow Architecture and Specification, Workflow Execution Engine
UNIT V	Cloud Programming and Software Environments :Features of Cloud and Grid Platforms – Grid Service Protocol Stack, Open Grid Services Architecture ,Grid Data Access Models, Resource Brokering with Grid bus- Parallel and Distributed Paradigms – MapReduce, Iterative MapReduce,Hadoop Library from Apache, Support of Google App Engine – Amazon AWS and Microsoft Azure

TEXT BOOKS

1. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things – Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra – Morgan Kauffmann, 2011.

2. Mastering Cloud Computing – Rajkumar Buyya, Christian Vecchiola and S.Thamarai Selvi – Tata McGraw Hill Education, 2013

3. George Coulouris, Jean Dollimore and Tim Kindberg , Distributed Systems: Concepts and Design, Fifth Edition , Pearson Education, 2011

REFERENCES

1. Enterprise Cloud Computing : Technology, Architecture, Applications - Shroff, Gautam - Cambridge University Press, 2013.

2. 2. Cloud Computing – A Sreenivasan and J. Suresh – Pearson, Chennai,2014. 3. Cloud Computing: A Practical Approach – Anthony Velte, Toby J Velte and Robert Elsenpeter - McGraw Hill Education (India) Private Limited, 2009

20-381-0326 SOFTWARE TESTING

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basic concepts of software testing.	(Cognitive level : Understand)
CO2	Employ different software testing evaluation techniques.	(Cognitive level : Apply)
CO3	Discuss the types of software testing.	(Cognitive level : Understand)
CO4	Describe software testing frameworks.	(Cognitive level : Understand)
CO5	Evaluate different testing tools.	(Cognitive level :Evaluate)
CO6	Apply the testing tool on the given test cases.	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2										
CO3	2											
CO4	2											

CO5											2	
CO6					3							

UNIT I **A Perspective on Testing**– Software Testing Life Cycle - (STLC),Quality Attributes, Types and Levels of Testing—Acceptance Testing, Overview of Testing Techniques-black box testing-boundary value analysis- Robust bva ,Worst-Case bva, robust worst case bva- Equivalent class partitioning-Decision table based testing -Cause effect graph. White-Box Testing-code based testing - Statement Coverage—Branch Coverage—Condition Coverage-Data Flow Coverage, path testing-metric-Manual versus Automated Testing, Static versus Dynamic Testing

UNIT II **Transforming Requirements to Testable Test Cases**- Introduction, Software Requirements as the Basis of Testing, Requirement Quality Factors, Process for Creating Test Cases from Good Requirements, Transforming Use Cases to Test Cases, Ad Hoc Testing, Exploratory Testing

UNIT III **Emerging specialized areas in testing:** Nonfunctional Testing - Performance Testing, Stress Testing, Performance Monitoring, Knowledge Acquisition Process, Test Development, Performance Deliverables, Security Testing, Types of Security Testing, Usability Testing, Goals of Usability Testing, Compliance Testing

UNIT IV **Test Process and Automation Assessment**: Test Automation Framework Basic Features of an Automation Framework, Standard Automation Frame works- Data driven Framework, Modular Framework- Keyword Driven Framework -Hybrid framework.

UNIT V **Automated Tools for Testing**: Tool Selection and Implementation- Test Data/Test Case Generation - vendor testing tools – open source testing tools -Introduction of Object Oriented Testing –Life Cycle Based Testing Overview and Perspective, Introduction of Automation Tools- selenium- QTP.

TEXT BOOKS

1. Software Testing – A Craftsman's Approach, Fourth Edition, Paul C Jorgenson, CRC Press,2013.
2. Software Testing and Continuous Quality Improvement Third Edition, William E Lewis, Auerbach Publications, 2009.

REFERENCES

1. Foundations of Software Testing, Second Edition, Aditya P Mathur, Pearson,2013.
2. Glenford J.Myers," The Art of Software Testing" John Wesley & Sons, 3edn. 2012.
3. Boris Beizer, "Software Testing Technologies" 1st edition Dreamtech 2000.

20-381-0327 INTRODUCTION TO CRYPTOGRAPHY

Course Outcomes

After completion of this course, students will be able to

CO1	Solve the problems using Classical Cryptography.	(Cognitive level : Apply)
CO2	Compare Feistel and Non Feistel ciphers.	(Cognitive level : Analyze)
CO3	Describe five modes of operations.	(Cognitive level : Understand)
CO4	Describe hash algorithms, Digital Signatures and key distribution algorithms	(Cognitive level : Understand)
CO5	Evaluate the use of hash functions.	(Cognitive level : Evaluate)
CO6	Apply public key cryptosystems – RSA, Elgamal and ECC for confidentiality.	(Cognitive level : Apply)
CO7	Describe X.509 certification standard.	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2										
CO3	2											
CO4	2											
CO5			3									
CO6		3										
CO7		3										

UNIT I Classical cryptography: Shift cipher, Substitution cipher, Affine cipher, Vigenere cipher, Hill cipher, Permutation cipher, Stream ciphers, LFSR, Cryptanalysis of Vigenere cipher and LFSR.

UNIT II Block ciphers: Feistel cipher, Data Encryption Standard, Multiple encryption, 3-DES, Substitution Permutation networks, Advanced Encryption Standard and Modes of operation.

UNIT III Hash functions: Hash functions and data integrity, Secure Hash Algorithm, Message Authentication Code, Nested MAC, HMAC, CBC-MAC.

UNIT IV Public Key Cryptosystems: Integer factorization problem, Discrete logarithm problem, RSA cryptosystem, Attacks on RSA, Diffie-Hellman Key agreement scheme, ElGamal cryptosystem, Elliptic curve cryptography.

UNIT V Signature schemes:RSA signature, ElGamal signature, Digital Signature Algorithm, ECDSA. Certificates - X.509 certification standard.

TEXTBOOKS

1. Behrouz A Forouzan, Cryptography and Network Security, Tata Mc Graw Hill, 2005.
2. Cryptography: Theory and Practice, (Third Edition), Douglas R. Stinson.
3. William Stalings, Cryptography and Network Security, Principles and Practices. 6th Ed., Pearson Education, 2014.

References:

1. Handbook of Applied Cryptography, (Second Edition), Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone.
2. Introduction to Modern Cryptography, (Second Edition), Jonathan Katz, Yehuda Lindell.
3. Understanding Cryptography: A Textbook for Students and Practitioners, (2010 Edition),Christof Paar, Jan Pelzl.
4. Introduction to Cryptography with Coding Theory, (Second Edition),Wade Trappe, Lawrence C. Washington.
5. Network Security and Cryptography, Bernard Menezes.

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20-381-0331 BIG DATA ANALYTICS

Course Outcomes

After completion of this course, students will be able to

CO1	Explain the basics characteristics of Big Data.	(Cognitive level : Understand)

CO2	Solve the problems using MapReduce programming paradigm.	(Cognitive level : Apply)
CO3	Apply spark libraries for solving distributed applications.	(Cognitive level : Apply)
CO4	Compare distributed and parallel computing.	(Cognitive level : Analyze)
CO5	Describe various YARN schedulers.	(Cognitive level : Understand)
CO6	Discuss the features of NoSql data bases.	(Cognitive level : Understand)
CO7	Examine the impact of Mlib libraries on large datasets	(Cognitive level : Analyze)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	2											
CO3				3								
CO4				2								
CO5	1											

CO6	2											
CO7		3										

UNIT I Introduction to Big Data: Big Data – Introduction, Structuring Big Data, Elements of Big data, Big data analytics, Big data applications. Big Data in business context, Technologies for handling big data – Distributed and Parallel computing for Big Data, Data Models, Computing Models, Introducing Hadoop – HDFS and MapReduce.

UNIT II Hadoop Ecosystem: Hadoop EcoSystem, Hadoop Distributed file system, HDFS architecture, MapReduce framework, Techniques to Optimize MapReduce, Uses of MapReduce, Processing Data with MapReduce, MapReduce execution and Implemention, YARN Architecture, Advantages of YARN, Working of YARN, YARN Schedulers, Configurations, Commands, Containers.

UNIT III Apache Spark: Spark Architecture, Resilient Distributed Datasets (RDD) – Persistance and Cashing , In-memory distributed processing using Apache Spark, Components of the Spark unified stack, Spark SQL, Spark Streaming, Spark GraphX, Spark MLLib

UNIT IV NoSQL Databases: Types NoSQL databases, Introducing HBase, Hive and Pig, Role of HBase in Big data processing, HBase Architecture, Hive Architecture and Data Model, HiveQL, SQL vs HQL, Pig Architecture and Data Model, Pig Latin

UNIT V Analytics: Machine Learning on Large Datasets using Spark MLLib, Building visualizations using Big Data, Case Studies on applications of Big Data Analytics

TEXT BOOKS

1. Authored by DT Editorial Services , "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization WileyIndia, 2016.
2. Mike Frampton, "Mastering Apache Spark", Packt Publishing, 2015

REFERENCES

1. Borislublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, 2015.
2. Chris Eaton,Dirkderooset al. , "Understanding Big data ", McGraw Hill, 2012.
3. Sima Acharya, Subhashini Chellappan, BIG Data and Analytics , Willey
4. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.
5. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packet Publishing 2013.
6. Kulkarni, Parag, Joshi, Sarang, Brown, Meta S. Big Data Analytics, PHI 2016
7. Andy Konwinski, Holden Karau, Matei Zaharia, and Patrick Wendell, "Learning Spark: Lightning-Fast Big Data Analysis", O Reilly, 2015.

20-381-0333 DIGITAL IMAGE PROCESSING

Course Outcomes

After completion of this course, students will be able to

CO1	Discuss digital image processing.	(Cognitive level : Understand)
CO2	Employ spatial filtering and frequency domain filtering to images.	(Cognitive level : Apply)
CO3	Discuss about noise model and inverse filtering, weiner filtering, least-square filtering and geometric mean filtering	(Cognitive level : Understand)
CO4	Discuss morphological image processing	(Cognitive level : Understand)
CO5	Apply basic morphological algorithm erosion and dilation, opening and closing to images.	(Cognitive level : Apply)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	1											
CO2						2						
CO3	2			2								
CO4	2											
CO5							2					

UNIT I Introduction-Digital Image Fundamentals: elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, some basic relationship between pixels. Intensity Transformations: Basics of intensity transformations, some basic intensity transformation functions, histogram processing.

UNIT II Filtering-Spatial Filtering: fundamentals of spatial filtering, smoothing and sharpening filters. Frequency domain Filtering: Background, preliminary concepts, sampling, Fourier transforms and DFT, 2-D DFT and properties, frequency domain filtering, low pass filters, high pass filters, implementation.

UNIT III Image restoration and Reconstruction- Noise models, restoration in the presence of noise, linear-positive invariant degradations, inverse filtering, Wiener filtering, constrained least square filtering, geometric mean filter.

UNIT IV Image Compression-fundamentals, basic compression methods. Morphological Image Processing: preliminaries, erosion and dilation, opening and closing, basic morphological algorithms.

UNIT V Image Segmentation-fundamentals, point, line and edge detection, thresholding, region based segmentation, use of motion in segmentation.

TEXT BOOK

1. Digital Image Processing, by Rafael C. Gonzalez & Richard E. Woods, 3rd edition, PHI 2008

REFERENCE

1. Fundamentals of Digital Image Processing, by Anil K. Jain, Prentice Hall, 1995. 2. Digital Image Processing, by William K. Pratt, John Wiley & Sons Inc., 3rd edition, 2001.

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20-381-0334 DEEP LEARNING

Course Outcomes

After completion of this course, students will be able to

CO1	Discuss performance characteristics of Deep Neural Networks under various situations.	(Cognitive level : Understand)
CO2	Examine appropriate optimization functions when a deep neural network is used for decision making applications.	(Cognitive level : Analyze)
CO3	Apply the concept of backpropagation and regularization to optimize the learning parameters of a deep neural network	(Cognitive level : Apply)
CO4	Apply various deep learning architectures to solve real life problems	(Cognitive level : Apply)
CO5	Conclude the situations where autoencoders can be used as a generative model.	(Cognitive level : Evaluate)

CO6	Explain the importance of gradient computations where autoencoders can be used as a generative model.	(Cognitive level : Understand)
CO7	Describe recent developments and applications in the area of DNNs like varionational Auto Encoders , GANs etc	(Cognitive level : Understand)

Mapping of course outcomes with programme outcomes - **Low=1, medium=2, High=3**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2		2										
CO3				3	2							
CO4		2										
CO5				2								
CO6	2											
CO7	3											

UNIT I

Basics-Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Threshold logic, Linear Perceptron, Multilayer Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training. Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural network

UNIT II Deep Feed forward Networks- Gradient Descent, hidden units, Back propagation, Regularization for deep learning, Optimization for training deep models- Empirical Risk Minimization.

UNIT III Convolutional Neural Networks:- LeNet, AlexNet. Recurrent Neural Networks: Back propagation through time, Bidirectional RNNs, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs

UNIT IV Autoencoder- Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

UNIT V Recent trends: Variational Auto encoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning Applications: Computer Vision, NLP, Speech.

TEXT BOOK

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.
2. Yuxi (Hayden), Liu and Savansh Mehta, "Hands -on Deep Learning Architectures with Python", Packt, 2019.

REFERENCES

1. Sudharsan Ravichandiran,"Hands -on Deep Learning Algorithms with Python",Packt, 2019.
2. Sandro Skansi, "Introduction to Deep Learning from Logical calculus to Artificial Intelligence", Springer , 2018.
3. Nikhil Ketkar, Deep Learning with Python- A Hands on Introduction,Apress, 2017.
4. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
5. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

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20-381-0341 DESIGN THINKING

Course Outcomes

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

CO1	Explain different stages of thinking	[Cognitive Level : Understand]
CO2	Examine a sample project	[Cognitive Level : Analyze]
CO3	Discuss steps to collect background information about the product	[Cognitive Level : Understand]
CO4	Examine processes of collecting ideas	[Cognitive Level : Analyze]
CO5	Describe different idea refinement techniques	[Cognitive Level : Understand]
CO6	Analyze prototype and implementation details	[Cognitive Level : Analyze]
CO7	Develop a Prototype	[Cognitive Level : Create]
CO8	Develop a live Case implementation of Design Thinking process	[Cognitive Level : Create]

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		2		2								
CO3	3											
CO4		2										
CO5	3											
CO6				3								
CO7			3									
CO8			3						2			

Unit I

Stages of thinking – The design process, stages 1 to 7, Example project.

Unit II

Research – Identifying drivers, Information Gathering, Target Groups, Samples and feedback,

Unit III

Idea Generation – Basic Design directions, Themes of Thinking, Inspiration and References, Brainstorming, Value, Inclusion, Sketching, Presenting Ideas.

Unit IV

Refinement – Thinking in Images, Thinking in Signs, Appropriation, Humour, Personification, Visual Metaphors, Modification, Thinking in words, Words and Language, Type "faces", Thinking in shapes, Thinking in proportions, Thinking in colour.

Unit V

Prototyping – Developing Designs, Types of Prototype, Vocabulary.

Implementation – Format, Materials, Finishing, Media, Scale, Series/Continuity.

Live Case Implementation of the Design Thinking Process.

Text Book:

1.Design Thinking The act or practice of using your mind to consider design by Gavin Ambrose and Paul Harris (pdf version)

Production by AVA Book Production Pte. Ltd., Singapore

Reference :

1.Design thinking handbook by Eli Woolery (pdf version)

Complete Design Thinking Guide for Successful Professionals by Daniel Ling, Createspace Independent Pub (2015)

20-381-0342 - PROJECT MANAGEMENT

Course Outcomes

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

CO1	Explain a Project	[Cognitive Level : Understand]
CO2	Construct a Work Breakdown Structure	[Cognitive Level : Create]
CO3	Create a Project Plan using Activity on Node Networks	[Cognitive Level : Create]
CO4	Describe preparing a resource schedule.	[Cognitive Level : Understand]
CO5	Discuss Project Cost Baseline using the resource schedule	[Cognitive Level : Understand]
CO6	Explain managing inter-organizational and customer relations	[Cognitive Level : Understand]
CO7	Describe winding up a project	[Cognitive Level : Understand]
CO8	Examine SCRUM	[Cognitive Level : Analyze]

Mapping of course outcomes with programme outcomes - Low=1, medium=2, High=3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1											
CO2			2									
CO3			3									
CO4	3											
CO5	2										2	1
CO6	2											
CO7	3											
CO8		3							3	3	3	3

Unit I

Modern Project Management – What is a Project, current drivers of Project Management, Project Governance, Project Management Today : a socio-technical approach. Organization strategy and project selection – the strategic management process – an overview.

Defining the Project – Defining the Project scope, Employing a project scope checklist, establishing project priorities, creating the Work Breakdown Structure, Major grouping found in a WBS, How WBS helps the Project Manager, A simple WBS Development.

Unit II

Developing a project plan – Developing the project network, from work package to network, constructing a project network, activity on node network fundamentals, Network computation process, using the forward and backward pass information, level of details for activities, practical considerations, extended network techniques to come closer to reality.

Unit III

Scheduling Resources and Costs – Overview of the resource scheduling problem,types of resource constraints,classifiation of a scheduling problem,resource allocation methods,computer demonstration of resource-constrained scheduling,splitting Activities,benefits of scheduling resources,assigning project work,multiproject resource schedules,using the resource schedule to develop a project cost baseline.

Unit IV

Outsourcing: Managing interorganizational relations-Outsourcing project work, Best Practices in Outsourcing Project Work, The Art of Negotiating, A note on managing customer relations.

Unit V

Project Closure – Types of Project Closure, Wrap up closure activities, creating the final report, post-implementation evaluation, Retrospectives.

An Introduction to Agile Project Management – Traditional versus Agile methods, Agile PM, Agile PM in action : SCRUM, Applying Agile PM to large projects, Limitations and concerns.

Text Book :

1.Projet Management The Managerial Process by Clifford F Gray, Erk W Larson, Gautam V Desai, 6th edition, McGraw Hill Education (India)Pvt. Ltd., Edition 2014

References :

1.Project Management (Essential Managers) by Peter Hobbs, DK Publishers, 2009

2.Project Management by K Nagarajan New Age International Publishers, 2017