GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

Approved by AICTE, Accredited by NBA & NAAC 'A' Grade, Recognized under 2(f) and 12(b) of UGC, Permanently Affiliated to JNTUK, Kakinada

NH-16, Chaitanya Knowledge City, Rajahmundry – 533296. E.G.Dt., - AP.

DEPARTMENT OF COMPUTER APPLICATIONS

3 YEARS MCA COURSE STRUCTURE

(2017-18)

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..I.. Year   **..I..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1.	17300101	Computer Programming	2	1	-	3	40	60	100
2.	17300102	Digital Logic Design	3	1	-	4	40	60	100
3.	17300103	Discrete Mathematical Structures and Graph Theory	3	1	-	4	40	60	100
4.	17300104	Human Resource Management	4	-	-	4	40	60	100
5.	17300105	Accounting and Financial Management	3	1	-	4	40	60	100
6.	17300111	English Communication Lab	-	-	3	2	50	50	100
7.	17300112	Computer Programming Lab	-	-	3	2	50	50	100
8.	17300113	Digital Logic Design Lab	-	-	3	2	50	50	100
		Total	15	4	9	25	350	450	800

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..I.. Year   **..II..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1.	17300201	Data Structures	3	1	-	4	40	60	100
2.	17300202	Computer Organization	4	-	-	4	40	60	100
3.	17300203	OOPS Through Java	3	1	-	4	40	60	100
4.	17300204	Organizational Structures and Personal Management	4	-	-	4	40	60	100
5.	17300205	Intellectual Property Rights & Professional Ethics	4	-	-	4	40	60	100
6.	17300211	Data Structures Lab	-	-	3	2	50	50	100
7.	17300212	OOPS Through Java Lab	-	-	3	2	50	50	100
8.	17300213	IT Workshop	-	-	3	2	50	50	100
		Total	18	2	9	26	350	450	800

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..II.. Year   **..III..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1.	17300301	Probability and Statistics with R	3	1	-	4	40	60	100
2.	17300302	Data Base Management Systems	3	1	-	4	40	60	100
3.	17300303	Operations Research	3	1	-	4	40	60	100
4.	17300304	Computer Networks	4	-	-	4	40	60	100
5.	17300305	Design & Analysis of Algorithms	3	1	-	4	40	60	100
6.	17300311	Probability and Statistics with R Lab	-	-	3	2	50	50	100
7.	17300312	Data Base Management Systems Lab	-	-	3	2	50	50	100
8.	17300313	Python Programming Lab	-	-	3	2	50	50	100
		Total	16	4	9	26	350	450	800

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..II.. Year   **..IV..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1.	17300401	Operating Systems	3	1	-	4	40	60	100
2.	17300402	Web Technologies	3	1	-	4	40	60	100
3.	17300403	Software Engineering	4	-	-	4	40	60	100
4.	17300404	Cryptography and Network Security	4	-	-	4	40	60	100
5.	17300461(A,B,C)	Elective - 1	4	-	-	4	40	60	100
6.	17300411	Operating Systems Lab	-	-	3	2	50	50	100
7.	17300412	Web Technologies Lab	-	-	3	2	50	50	100
8.	17300421	Mini Project.	-	-	2	2	50	-	50
		Total	18	2	8	26	350	400	750

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

LIST OF ELECTIVES

Department Elective 1:

        A) Human Computer Interaction (17300461A)

        B) Cloud Computing (17300461B)

        C) Mobile Computing (17300461C)

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..III.. Year   **..V..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1.	17300501	Data Warehousing and Data Mining	4	-	-	4	40	60	100
2.	17300502	OOAD through UML	4	-	-	4	40	60	100
3.	17300503	Computer Graphics and Multimedia Systems	4	-	-	4	40	60	100
4.	17300562(A,B,C)	Elective – 2	4	-	-	4	40	60	100
5.	17300563(A,B,C)	Elective – 3	4	-	-	4	40	60	100
6.	17300511	Data Warehousing and Data Mining Lab	-	-	3	2	50	50	100
7.	17300512	OOAD through UML Lab	-	-	3	2	50	50	100
8.	17300513	Computer Graphics and Multimedia Systems Lab	-	-	3	2	50	50	100
		Total	20	0	9	26	350	450	800

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

LIST OF ELECTIVES

Department Elective 2:

       A) Software Project Management(17300562A)

       B) Data Science (17300562B)

       C) Mobile Application Development (17300562C)

       D) Machine Learning (17300562D)

Department Elective 3:

       A) Software Testing Methodologies (17300563A)

       B) Artificial Intelligence (17300563B)

       C) E-Commerce (17300563C)

GODAVARI INSTITUTE OF ENGINEERING AND TECHNOLOGY (A),RAJAHMUNDRY

COURSE STRUCTURE (GR-17)

MASTER OF COMPUTER APPLICATIONS

..III.. Year **..VI..Semester**

S. No.	Subject Code	Subject Title	Periods per week			C	Scheme of Examination Maximum Marks		
			L	T	P		Int.	Ext.	Total
1	17300601	Big Data Analytics	4	-	-	4	40	60	100
2	17300611	Big Data Analytics Lab	-	-	3	2	50	50	100
3	17300681	Seminar	-	-	3	2	50	-	50
4	17300641	Dissertation	-	-	20	12	-	150	150
		Total	4	0	26	20	140	260	400

L- LECTURE   T-TUTORIAL   P – PRACTICAL   C – CREDITS   Int. – INTERNAL   Ext. - EXTERNAL

SZ-Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300101 Computer Programming**	2	1	0	3
Teaching	Total Contact Hours 64				
Prerequisite (s)	Problem Solving				

Course Objective(s):
1. To impart adequate knowledge on the need of programming languages and problem solving techniques.
2. To develop programming skills using the fundamentals and basics of C Language.
3. To enable effective usage of arrays, structures, functions, pointers and to implement the memory management concepts.

Unit - I

Objective: Notion of an algorithm and computational procedure, editing and executing programs. (**CO1, CO2, CO3**)

Introduction:
Computer systems, Hardware and Software Concepts

Problem Solving:
Algorithm / Pseudo code, flowchart, program development steps, Computer languages: machine, symbolic and high level languages, Creating and Running Programs: Writing, Editing (vi/emacs editor), Compiling (gcc), Linking and Executing in under Linux.

Basics of C:
Structure of a C program, identifiers, basic data types and sizes. Constants, Variables, Arithmetic ,relational and logical operators, increment and decrement operators, conditional operator, assignment operator, expressions, type conversions, Conditional Expressions, precedence and order of evaluation, Sample Programs.

Unit - II

Objective: Understanding branching, iteration and data representation using arrays.(**CO4,CO6**)

Selection – making decision: two way selection:
If-else, null else, nested if, examples, Multi way selection: switch, else-if, examples**.**

Iterative:
Loops- while, do-while and for statements, break, continue, initialization and updating, event and counter controlled loops, looping applications: Summation, powers, smallest and largest.

Arrays:
Arrays- concepts, declaration, definition, accessing elements, storing elements, Strings and String Manipulations, 1-D arrays, 2-D arrays and character arrays, string manipulations, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix**.**

Strings:
Concepts, c strings.

Unit - III
Objective: Understanding Modular programming and recursive solution formulation. (**CO5**)

Functions- modular programming:
Functions, basics, parameter passing, storage classes extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for Fibonacci series, Tower of Hanoi; header files, C Preprocessor, example C programs, Passing 1-D arrays, 2-D arrays to functions.

Unit - IV
Objective: Understanding pointers and dynamic memory allocation. (**CO1, CO6**)

Pointers:
Pointers- concepts, initialization of pointer variables, pointers and function arguments, passing by address- dangling memory, address arithmetic, character pointers and functions, pointers to pointers, pointers and multi-dimensional arrays, dynamic memory management functions, command line arguments

Unit -V
Objective: Understanding miscellaneous aspects of C. (**CO5, CO6**)

Enumerated, structure and union types:
Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, type def, bit-fields, program applications

Bit-wise operators:
Logical, shift, rotation, masks**.**

File handling: Input and output- concept of a file, text files and binary files, Formatted I/O, File I/O operations, example programs.

Course Outcomes:

After successful completion of the course, a successful student will be able to-

   CO1: Write clear, elementary C programs, understand algorithmic thinking and apply it to

Programming.

CO2: Apply for problem-solving techniques.

CO3: Code with C arithmetic, increment, decrement, assignment, relational, equality and logical operators.

CO4: Code C control structures (if, if/else, switch, while, do/while, for) and use built-in data types.

CO5: Use standard library functions and write user-defined function definitions.

CO6: Manipulate arrays and Pass arrays to functions and pointers and also using files.

Text Books:
1. Computer Programming in C,V.Rajaraman,Prentice Hall
2. Programming in ANSI C,E.Balaguruswamy,Tata Mc.Graw Hill

References:
1. C Programming, A Problem Solving Approach, Forouzan, Gilberg and Prasad, CENGAGE
2. Programming with C, Bichkar, Universities Press
3. Programming in C, Reema Thareja, OXFORD
4. C by Example, Noel Kalicharan, Cambridge

Web Resources:

1. https://www.eskimo.com/~scs/cclass/notes/top.html
2. https://www.tutorialspoint.com/cprogramming/cprogramming_tutorial.pdf
3. www.cprogramming.com/tutorial/c/lesson1.html

COURSE CODE		17300101 Computer Programming									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓	✓								
	CO2	✓									
	CO3	✓									
	CO4						✓			✓	
	CO5					✓					
	CO6		✓			✓					
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
	✓										
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300102 Digital Logic Design**	3	1	0	4
Teaching	**Total Contact Hours 64**				
Prerequisite (s)	**Logical Thinking & Analytics**				

Course Objective(s):
1. To familiarize the student with fundamental principles of digital design.
2. Coverage of classical hardware design for both combinational and sequential logic circuits.
3. To acquire the basic knowledge of digital logic levels and applications of knowledge to understand digital electronic circuits.
4. Prepare students to perform the analysis and design of various digital electronic circuits.

Unit - I
Objective: To discuss basic number systems codes and logical gates.(**CO1**)

Digital Systems:
Binary Numbers, Octal, Hexadecimal and other base numbers, Number base conversions, complements, signed binary numbers, Floating point number representation, binary codes, error detecting and correcting codes, digital logic gates(AND, NAND,OR,NOR, Ex-OR, Ex-NOR), Boolean algebra , basic theorems and properties, Boolean functions, canonical and standard forms.

Unit - II
Objective: To discuss the Boolean algebra and minimization logic.(**CO3**)

Gate –Level Minimization and combination circuits, The K-Maps Methods, Three Variable, Four Variable, Five Variable , sum of products and product of sums Simplification, Don't care conditions , NAND and NOR implementation and other two level implementation.

Unit - III
Objective: To discuss the design of combinational circuits.(**CO5,CO2**)

Combinational Circuits (CC):
Design Procedure, Combinational circuit for different code converters and other problems, Binary Adder, subtractor, Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Demultiplexers.

Unit - IV
Objective: To discuss the design of Synchronous Sequential Circuits.(**CO5,CO6**)

Synchronous Sequential Circuits:
Latches, Flip-flops, analysis of clocked sequential circuits, design of counters, Up-down counters, Ripple counters, Registers, Shift registers, Synchronous Counters.

Asynchronous Sequential Circuits: Reduction of state and follow tables, Role free Conditions.

Unit - V
Objective: To discuss the basics of various memory.(**CO4,CO6**)

Memory:
Random Access Memory, Types of ROM, Memory decoding, address and data bus, Sequential Memory, Cache Memory, Programmable Logic Arrays, Memory Hierarchy in terms of capacity and access time.

Course Outcomes:
After successful completion of the course, a successful student will be able to-

    CO1. Design Combinational sequential circuits.
    CO2. They should be in a position to continue with computer organization.
    CO3. To recognize Logic level models, including Boolean algebra, finite state machines, Arithmetic circuits and hardware description languages.
    CO4. Describe Logic gates, memory, including CMOS gates, flip-flops, arrays.
    CO5. Design tools, both manual and computerized, for design, optimization, and test of logic circuits.
    CO6. Describe the design criteria, including area, speed, power consumption, and testability.

Text books:

    1. Digital Design- M. Morris Mano and Michael D.Ciletti, 4th Edition, Pearson Education.

References:

    1. Switching and Finite Automata Theory , Zvi Kohavi, Tata McGraw Hill.
    2. Switching and Logic Design, C.V.S. Rao, Pearson Education.
    3. Digital Principles and Design, Donald D.Givone, Tata McGraw Hill, Edition.
    4. Fundamentals of Digital Logic & Micro Computer Design , Rafiquzzaman, 5th Edition John Wiley.

 Web Resources:

    1. http://www.alljntuworld.in/download/digital-logic-design-dld-materials-notes/
    2. http://www.scoopworld.in/2015/04/digital-logic-designdld-jntu-2-1-cse.html
    3. https://www.smartzworld.com/notes/digital-logic-design-dld/

COURSE CODE		17300102 Digital Logic Design									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓									
	CO2			✓							
	CO3		✓								
	CO4			✓							
	CO5			✓	✓						
	CO6			✓	✓						
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300103 Discrete Mathematical Structures and Graph Theory**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Elementary Algebra And Arithmetic.				

Course Objective(s):

1. Simplify and evaluate basic logic statements including compound statements, implications, inverses, converses, and contra positives using truth tables and the properties of logic.
2. Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
3. Apply the operations of sets and use Venn diagrams to solve applied problems;
4. Solve problems using the principle of inclusion-exclusion. Determine the domain and
5. Range of a discrete or non-discrete function, graph functions, Identify one-to-one functions, perform the composition of functions, find and/or graph the inverse of a function, and apply the properties of functions to application problems.
6. List the terms in a sequence, write a sequence in closed form. Sequence, compute the product of a finite sequence, and express sequences in terms of recursive or non-recursive forms.

Unit -I
Objective: To Discuss Mathematical logic and Predicate calculus.(**CO1**)

Mathematical Logic:
Statements and notations, Connectives, Well formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus, Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving.

Predicate Calculus:
Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus.

Unit -II
Objective: To gain knowledge about Set theory & relations and Functions.(**CO2**)

Set Theory Relations:
Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram.

Functions:
Composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon hole Principles and its application.

Algebraic Structures:
Algebraic systems, Examples and general properties, Semi groups and monoids , groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

Unit -III
Objective: To Discuss Elementary Combinatorics usage .(**CO3**)

Elementary Combinatorics:
Basis of counting, Enumeration of Combinations & Permutations ,Enumerating of Combinations &Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion– Exclusion.

Unit -IV
Objective: To Discuss recurrence relations usage for solving recursive problems.(**CO4**)

Recurrence Relations:
Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, The method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

Unit -V
Objective: To Discuss Graph Theory and it's applications.(**CO5**)

Graph Theory:
Representation of Graph, Spanning Trees, BFS, DFS, Kruskal's Algorithm, Binary trees, Planar Graphs, Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Course Outcomes:
After successful completion of the course, a successful student will be able to-

   CO1: Have knowledge of the concepts needed to test the logic of a program.
   CO2: Identify mathematical structures on various levels.
   CO3: Be aware of a class of functions which transform a finite set into
         another finite set which relates to input output functions in computer
         science.
   CO4: Be aware of the counting principles
   CO5: Be exposed to concepts and properties of algebraic structures such
         as semi groups, monoids and groups.
Text Books:

   1. Discrete Mathematical Structures with Applications to Computer Science, J.P Trembley, R.Manohar, TMH
   2. Discrete Mathematics for Computer Scientists & Mathematicians, J.L.Mott, A.Kandel, T.P.Baker, PHI

References:

   1. Elements of Discrete Mathematics, C L Liu and D P Mohanpatra, TMH

2. Discrete Mathematics, Schaum's Outlines, Lipschutz and Lipson,TMH.
3. Discrete Mathematical Structures, Kolman, Busby and Ross, 6th ed., PHI, 2009.
4. Discrete Mathematics, Johnsonbaugh, 6th ed., Pearson, 2005.
5. Discrete Mathematics, Malik, Sen, 6th ed.,Cengage Learning,2004.
6. Discrete Mathematics for Computer Science, Bogart, Stein and Drysdale, Springer, 2005.
7. Discrete Mathematics and Combinatorics, Sengadir, Pearson, 2009.
8. Discrete and Combinatorial Mathematics, Grimaldi and Ramana, 5th ed., Pearson.2006.
9. Discrete Mathematics, JK Sharma, 2nd ed., Macmillan, 2005.

Web Resources:
1. http://forum.jntuworld.com/showthread.php?6366-Mathematical-Foundations- of-Computer-Science--%28MFCS%29-Notes-Material
2. http://jkdirectory.blogspot.in/2010/11/mfcs.html
3. http://cs.bme.hu/fcs/graphtheory.pdf
4. http://math.tut.fi/~ruohonen/GT_English.pdf

COURSE CODE17300103 Discrete Mathematical Structures and Graph Theory											
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓				✓		✓			
	CO2				✓					✓	
	CO3						✓		✓		
	CO4	✓	✓								
	CO5				✓				✓		✓
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
					✓						
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300104 Human Resource Management**	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	There are no specific prerequisites for this course				

Course Objective(s):
1. To know the social and historical context of the development of these practices.
2. Develop a wide range of professional skills.
3. Become familiar with various approaches to the management of HR adopted by various companies.

Unit-I:
Objective: To Explain the importance of human resources and their effective management in organizations. (**CO1,CO2**)

Introduction of HRM:
Introduction to HRM ,Line Managers, HR Duties ,New Approaches to Organizing HR ,Globalization & Competition Trends ,Technological Trends ,Trends in Nature of Work ,Workforce and Demographic Trends ,Economic Challenges ,HRM in India ,High Performance Work Systems, Labor Legislation in India, Equal Employment Opportunity 1990-1991 ,HR Score Card developed by TVRLS India.

Unit-II:
Objective: To Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs. (**CO2,CO4**)

Recruitment and Placement:
Basics of Job Analysis, Methods for Collecting Job Analysis Information \,Job Descriptions, Job Satisfaction, Job Enlargement, Job Enrichment, Job Rotation, HRP, Recruitment & Selection Process, Planning & Forecasting, Sources of Recruitment, Recruitment of Diverse Work Force, Employee Testing & Selection, Basic types of Interviews, Errors in Interviews, Translating Strategy into HR-Policies & Practices.

Unit-III:
Objective: To Describe the meanings of terminology and tools used in managing employees effectively. (**CO1**, **CO3**)

Performance Appraisal and Training & Development of Employees, Concept of Performance, Management Appraisal, Techniques for Performance Appraisal, Career Management, Employer Life Cycle, Career Management & Talent Management, Analyzing Training needs & Designing the program ,Implementing different training program, Implementing Management Development Programs, Evaluating the Training Programs.

Unit-IV:
Objective: To Analyze the key issues related to administering the human elements such as motivation, compensation, appraisal, career planning, diversity, ethics, and training.(**CO2**,**CO4**)

Compensation, Basic Factors in Determining pay structure, Establishing pay rates, Pricing Managerial and Professional Jobs, Special Topics in Compensation, Benefits, Insurance, Retirement Benefits, Personal Services & Family friendly benefits, Salient features of Workmen Compensation Act & Minimum Wages Act.

Unit-V:
Objective: To Record governmental regulations affecting employees and employers.(**CO4**,**CO5**)

Employee Relation, Labor Movement, Collective Bargaining Process ,Grievances, Managing Dismissals, Employee Safety and Health , Occupational Safety Law, Work Place Health Hazards Problems & Remedies, Salient features of Industrial Disputes Acts 1947, Factories Act, Mines Act.

Course Outcomes:
After successful completion of the course, a successful student will be able to-

CO1. Describe what human resource management is and how human resource management relates to effective and successful organizations.
CO2. Articulate the critical issues and challenges involved in contemporary human resource management.
CO3. Discriminate between different types of human resource strategies, models, theories and approaches.
CO4. Develop plans relating to central HR issues.
CO5. Highlight particular issues that determine the success or failure of human resource management practices.

Text books:

1. "Human Resource Management", Gary Dessler, 12th Edition, Pearson-2012.

References:

1. Human Resource Management-A South Asian Perspective, Robert L Mathis , Manas Ranjan Tripathy and John H Jackson, Cengage Learning2012.
2. Personnel Management, C.B. Mamoria and V.S.P.Rao ,HPH, 2012.
3. Human Resource Management, Text and Cases, K. Aswathappa, TMH, 2011.
4. Human Resource Management, Dipak Kumar Bhattacharyya, Excel Books, 2012.
5. Human Resource Management, R.Wayne Mondy, Pearson, 2009.

Web Resources:
1. http://libguides.murdoch.edu.au/c.php?g=246205&p=1639782
2. https://www.safaribooksonline.com/library/view/human-resource.../chapter004.xhtml

3. https://rphrm.curtin.edu.au/authors/biblio.html
4. www.amazon.in/Human-Resource-Management-V-Rao/dp/8174468951

COURSE CODE		17300104 Human Resource Management									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1			✓					✓		
	CO2	✓				✓	✓				
	CO3				✓			✓			
	CO4		✓							✓	
	CO5			✓				✓			
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
							✓				
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300105 Accounting and Financial Management**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	There are no specific prerequisites for this course				

Course Objective(s):

1. Define and use the terminology of financial accounting.
2. Define and apply the principles of financial reporting, including an understanding of the role of professional judgment.
3. Preparing records of business transactions.
4. Prepare and analyze financial statements.

Unit -I
Objective: To gain knowledge about Accounting principles, Preparation of trail balance and Final accounts.(**CO1,CO3**)

Accounting Generally Accepted Accounting Principles (GAAP) & Accounting standards, Characteristics and limitations of single entry system, double entry system of accounting, introduction of basis books of accounts, ledgers.

Preparation of trail balance , Final accounts , company final accounts , Users of Accounting Information, Role of Accountant in modern Organizations.

Unit -II
Objective: To Understand financial management, Ratio analysis and Fund flow analysis.(**CO2,CO3**)

Financial Management, meaning and scope, role, objectives of time value of money, over vitalization, under capitalization, profit maximization, wealth maximization, EPS maximization.
Ration Analysis - advantages - limitations - Fund flow analysis, meaning, importance, preparation and interpretation of Funds flow and cash flow statements, statements of changes in working capital.

Unit -III
Objective: To Understand Costing, Marginal costing and Break ,Even analysis.(**CO1,CO3**)

Costing , nature and importance and basic principles. Elements of cost , Absorption costing Vs. Marginal costing , Financial accounting vs. cost accounting vs. management accounting.

Marginal Costing and Break , Even Analysis:
Nature, scope and importance, practical applications of marginal costing, limitation and importance of cost , volume, profit analysis, short run decisions.

Unit -IV
Objective: To gain knowledge about standard costing and budgeting variance and budget.(**CO2,CO4**)

Standard Costing and Budgeting:
Nature, scope and computation and analysis , materials variance, labor variance and sales variance , cash budget, sales - budget, flexible Budgets, master budgets.

Unit -V
Objective: To Understand computerized accounting system.(**CO1,CO3**,**CO5**)

Introduction to Computerized Accounting System:
Coding logic and codes, master files, transaction files, introduction documents used for data collection, processing of different files and Outputs obtained.

Course Outcomes:
After successful completion of the course, a successful student will be able to-

   CO1: Solve ethical issues related to the accounting profession.

   CO2: Prepare financial statements in accordance with Generally Accepted Accounts

   CO3: Develop Financial accounting methods on the financial statements.

   CO4: Build the audit process from the engagement planning stage through completion

           of the audit, as well as the rendering of an audit opinion via the various report options.

   CO5: Recognize current auditing standards and acceptable practices, as well as the impact of

           audit risk on the engagement.

Text Books:

1. Accounting for Managers, P. Vijaya Kumar, Himalaya Publications.

References:

1. Accounting for Management, P.Vijaya Kumar. TMH.
2. Financial Accounting, S.N Maheswari and S.K. Maheswari, Vikas.
3. Financial Accounting, A. Mukherjee and M. Heneef, TMH.
4. Basic Financial Accounting for Management, Ambaresh Gupta, Pearson.
5. Accounts and Finance for Non accounts, Chatterjee, D.K. Himalaya.
6. Financial Analysis and Accounting, P. Premchand Babu and M. Madan Mohan, Himalaya.

7. Essential of Financial Accounting, Ashish, K and Ballacharya, PHI.
8. Guide to Financial Management, John Tannent, Viva.

Web Resources:
1. http://archive.mu.ac.in/myweb_test/MCA%20study%20material/M.C.A.%20(Sem%20%20II)%20Accounting%20and%20Financial%20Management.pdf
2. http://www.slideshare.net/BabasabPatil/financial-and-management-accounting-notes-mba
3. http://education.svtuition.org/2011/08/financial-management-notes.html
4. http://www.icai.org/post.html?post_id=6081
5. http://www.ziddu.com/downloadlink/1456128/MEFA_Most_Important_Questions.doc

COURSE CODE		17300105 Accounting and Financial Management									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓						✓			
	CO2		✓								
	CO3					✓				✓	
	CO4				✓						✓
	CO5						✓				
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
							✓				
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300111 English Communication Lab**	0	0	3	2
Teaching	Total Contact Hours 48				
Prerequisite (s)	Understanding of English Language				

Course Objective(s): *The language lab focuses computer-aided multi-media instruction and Language acquisition to achieve the following targets:*

1. Introduce the students to a variety of self-instructional, learner-friendly modes of language learning.
2. Cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
3. To learn better pronunciation through stress on word accent, intonation and rhythm.
4. To use language effectively for facing interviews, group discussions, public speaking.

English Language Laboratory Practice

1. Introduction to Phonetics.
2. Introduction to Vowels and Consonants and associated Phonetic symbols.
3. Introduction to Accent, Intonation and Rhythm.
4. Situational Dialogues/Role Play
5. Debate
6. Public Speaking.
7. Group Discussions
8. Facing Interviews
9. Resume preparation
10. e- Correspondence

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MODULE	TOPICS/SUB-TOPICS	L A B
1.	INTRODUCTION TOPHONETICS -Vowels, -Consonants, -Diphthongs INTRODUCTION TO STRESS & INTONATION- Articulation, -Respiration, -Phonation(**CO1**)	3
2.	GROUP DISCUSSIONS FACING INTERVIEWS(**CO3**)	4
3	SITUATIONAL/DIALOGUE/ ROLE PLAY RESUME PREPARATION(**CO2**)	2
4	PUBLIC SPEAKING, DEBATE(**CO2**)	2
5	GRE,TOEFL,GMAT MODELS, e-CORRESPONDENCE(**CO3**)	3

Course Outcomes:

After successful completion of the course, a successful student will be able to-

CO1. Recognize the nuances of English language through audio-visual experience
and group Activities.

CO2. Neutralize of accent for intelligibility.

CO3. Improve Speaking skills with clarity and confidence which in turn enhances their
Employability skills.

Suggested Software for Lab classes:

1. Clarity Pronunciation Power
2. Mastering English in Vocabulary, Grammar, Spellings, Composition
3. Learning to Speak English - 4 CDs
4. Microsoft Encarta

Reference Books:

1. The Human Touch: personal Skills for Professional Success , Debra Paul.
2. The Definitive Book of body Language , Allan Pease and Barbara Pease.
3. How to Face Interviews , Clive Fletcher.
4. The 7 Habits of Highly Effective People , Stephen Covey
5. The Google Resume: How to Prepare for Career and Land a Job at Apple, Microsoft.
6. Good English, by G.H Vallins
7. Better English, G.H Vallins
8. Best English, G.H. Vallins
9. How to talk to anyone:92 little tricks for big success in Relationships by Leli
Lowndes.

COURSE CODE		17300111 English Communication Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1			✓	✓		✓			✓	
	CO2	✓				✓					✓
	CO3		✓					✓	✓		
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
							✓				
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300112 Computer Programming Lab	0	0	4	2
Teaching	Total Contact Hours 48				
Prerequisite (s)	Numerical Exploration, Expression Evaluation ,Advanced Control Flow				

Course Objective(s):
1. Know concepts in problem solving.
2. To do programming in C language.
3. To write diversified solutions using C language.

Recommended Systems/Software Requirements:
Intel based desktop PC, A N S I C Compiler with Supporting Editors, IDE's such as Turbo C

List of experiments:

1. Write a C Program to calculate the area of triangle using the formula
   area = (s (s-a) (s-b)(s-c))1/2 , where s= (a+ b +c)/2 (**CO4**)
2. Write a C program to find the largest of three numbers using ternary operator. (**CO1**)
3. Write a C Program to swap two numbers without using a temporary variable. (**CO1**)
4. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2''s complement of 11100 is 00100. Write a C program to find the 2''s complement of a binary number. (**CO3**).
5. Write a C program to find the roots of a quadratic equation. (**CO1**)
6. Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement(**CO3**).
7. Write a C program to find the sum of individual digits of a positive integer and find the reverse of the given number. (**CO2**)
8. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. (**CO1**)
9. Write a C program to generate the first n terms of the sequence Use the summing series method to compute the value of sin(x),cos(x) and e ^{x} (**CO1**)
10. Write a C program to generate all the prime numbers between 1 and n, where n is a value Supplied by the user.(**CO1**)
11. Write a C Program to print the multiplication table of a given number n up to a given value, where n is entered by the user. (**CO2**)

12. Write a C Program to enter a decimal number, and calculate and display the binary equivalent of that number. **(CO1)**
13. Write a C Program to check whether the given number is Armstrong number or not. **(CO1)**
14. Write a C program to interchange the largest and smallest numbers in the array. (**CO1**)
15. Write a C program to implement a linear search. **(CO2)**
16. Write a C program to implement binary search.(**CO2)**
17. Write a C function to find both the largest and smallest number of an array of integers. (**CO5**)
18. Write C programs illustrating call by value and call by reference concepts.(**CO3**)
19. To insert a sub-string into given main string from a given position. (**CO2**)
20. To delete n Characters from a given position in a given string. **(CO1)**
21. To replace a character of string either from beginning or ending or at a specified location. **(CO1)**
    a. Write a C program that uses functions for Reading a complex number using Structure (**CO6**)
    b. Write a C program that uses functions for Writing a complex number using Structure (**CO6**)
    c. Write a C program that uses functions for Addition and Multiplication of two complex numbers (**CO6**)
22. Write C Programs for the following string operations without using the built in functions(**CO5**)
    a. to concatenate two strings
    b. to append a string to another string
    c. to compare two strings.
23. Write C Programs for the following string operations without using the built in functions(**CO5**)
    a. to find t he length of a string
    b. to find whether a given string is palindrome or not
24. Write C programs that use both recursive and non recursive functions for the following(**CO5**)
    a. To find the factorial of a given integer.
    b. To find the GCD of two given integers.
    c. To find Fibonacci sequence.
25. Write C Program to reverse a string using pointers. (**CO1**)
26. Write a C program to compare two arrays using pointers.(**CO1**)
27. Write a C Program consisting of pointer based function to exchange value of two integers using passing by address. (**CO1**)
28. Write a C Program to swap two numbers using pointers. (**CO3**)
29. Examples which explore the use of structures, union and other user defined variables. (**CO6**)

30. Write a C program which copies one file to another. (**CO7**)
31. Write a C program to count the number of Characters and number of lines in a file. (**CO1**)
32. Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments. (**CO7**)

Course Outcomes:
After successful completion of the course, a successful student will be able to-

CO1: Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming
CO2: Acquire knowledge about the basic concept of writing a program.
CO3: Recognize constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
CO4: Use of conditional expressions and looping statements to solve problems Associated with conditions and repetitions.
CO5: Use functions involving the idea of modularity.
CO6: Construct structures and unions through which derived data types can be formed
CO7: Implement file handling for permanent storage of data or record.

References:

1. C programming and Data Structures, P. Padmanabham, Third Edition, BS Publications
2. Data Structures: A pseudo code approach with C, second edition R.F. Gilberg and B.A. Forouzan
3. Programming in C, P.Dey and M. Ghosh, Oxford Univ.Press.

COURSE CODE		17300112 Computer Programming Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1				✓						
	CO2	✓									
	CO3	✓									
	CO4		✓								
	CO5			✓							
	CO6		✓								
	CO7				✓						
Category	Programming		Core		Mathematices Based		Non Computer Based			Latest Technology		
	✓											
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300113 Digital Logic Design Lab	0	0	3	2
Teaching	Total Contact Hours 48				
Prerequisite (s)	Electric circuit analysis techniques; circuit components; electronic components.				

Course Objective(s):
1. Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolean algebra
2. Design simple digital systems based on these digital abstractions, using the "digital paradigm" including discrete sampled information.

Recommended Systems Requirements:

1. Digital IC Trainer kit
2. Ic 7400,7402,7404,7408,7432,7486
3. IC 7495, 7474,7476,7490

List of experiments:

1. Boolean algebra: Theorems and logical guides, verification of truth tables. (**CO1**)

2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.(**CO1**)

3. Realization of Boolean expressions; Using (i) AND , OR-NOT Gates (ii) NAND Gates (iii) NOR Gates. (**CO1**)

4. Latches Flip , Flops: RS, JK, T, D, Master ,Slave FF, Edge , Triggered Flip , Flops. (**CO1**)

5. Counters: Binary Counter, Synchronous/Asynchronous Binary Counter, Ripple Counter, Decade Counter, Up/Down Counter. (**CO1**)

6. Modulo Counter: Modulo - 5, Modulo , 10. (**CO2**)

7. Design and verify the 4-bit synchronous counter. (**CO3**)

8. Design and verify the 4-bit asynchronous counter. (**CO3**)

9. To design and verify operation of half adder and full adder. (**CO3**)

10. To design and verify operation of half subtract or. (**CO3**)

11. To design & verify the operation of magnitude comparator. (**CO3**)

12. Adders / Sub tractors: Half Adder, Full Adder, 1 's and 2's complement addition. (**CO3**)

13. Multiplexers/ Data Selector: 2- input and 8- input, De multiplexers, Logic Function Generator. (**CO2**)

14. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC74150 and IC 74154. (**CO3**)

15. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops(**CO3**)

16. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147. (**CO3**)

17. Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters. (**CO3**)

18. Design and implementation of 3-bit synchronous up/down counter. (**CO3**)

19. Design of experiments 3, 6, 7 and 9 using Verilog Hardware Description Language (Verilog   HDL). (**CO3**)

20. Implementation of SISO, SIPO, PISO and PIPO shift registers using flipflops (**CO5**)

21. Construct BCD adders and Comparators. (**CO2**)

22. Design Registers: Basic Shift Register (SR), SI/SO SR, SI/PO SR, PI/SO SR, PI/PO SR. (**CO3**)

23. Design Johnson Counter, Sequence Generator, Parity Generators/ Checkers. (**CO1**)

24. Construct code converters : Decimal ,to-Binary, Binary , to , Decimal, Decimal , to- Hexa

25. Decimal, BCD- to ,Decimal, Binary , to- gray, gray- to ,Binary. (**CO4**)

26. Buffers / Derivers: Open; collector Buffers. (**CO4**)

27. Verify Gates: CMOS / NMOS/TTL , Basic Operational Characteristics and parameters. (**CO4**)

Course Outcomes:

After successful completion of the course, a successful student will be able to-

CO1. Describe the architecture of modern computer.
CO2. Analyze the Performance of a computer using performance equation
CO3. Calculate the effective address of an operand by addressing modes
CO4.Understand how a computer performs arithmetic operation of positive and
    negative numbers.
CO5. Understand how cache mapping occurs in computer and can solve
    various problems related to this Secondary storage organization and problem
    solving.

References:

1. Digital Fundamentals, Floyd & Jain, Pearson, 2005.
2. Digital Logic and Computer Organization, Rajaraman, and Radhakrishnan, PHI, 2006

COURSE CODE		17300113 Digital Logic Design Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓		✓							
	CO2				✓					✓	
	CO3					✓					✓
	CO4	✓					✓				
	CO5									✓	
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300201 Data Structures**	3	1	0	4
Teaching	Total contact hours - 64				
Prerequisite (s)	Knowledge of C programming				

Course Objective(s):
1. To understand the concepts of data structure
2. To choose the appropriate data structure for a specified application**.**

Unit – I
Objective: To Overview of the basic concepts of data structure ,complexities of algorithms and types of data structures. **(CO1, CO2)**

Basic concepts - Algorithm Specification - Introduction, Recursive algorithms, Data Abstraction Performance analysis - time complexity and space complexity, Asymptotic Notation - Big O, Omega and Theta notations, introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists- Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion. Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

Unit – II
Objective: To Introduce the stack and queue data structure ,operations and applications. **(CO1, CO3)**

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

Unit – III
Objective:. To Introduce the tree and graph data structure ,operations and applications. **(CO1, CO2)**

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, Threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap. Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.

Unit – IV
Objective: To Introduce the various searching and sorting techniques. **(CO1, CO2)**

Searching- Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions,Overflow Handling.
Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

Unit – V
Objective: To Introduce the Advanced concepts in trees. **(CO2, CO3)**

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees- Definition and Examples, Insertion into an AVL Tree ,B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees (Elementary treatment-only Definitions and Examples), Comparison of Search Trees.Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

Course Outcomes
After successful completion of the course, a successful student will be able to-
   CO1: Learn how to use data structure concepts for realistic problems.
   CO2: Ability to identify appropriate data structure for solving computing problems in
         respective language
   CO3: Ability to solve problems independently and think critically.

Text Books:
   1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson-Freed, Universities Press.
   2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.

Reference books:

   1. Data structures: A Pseudocode Approach with C, 2nd edition, R.F.Gilberg And B.A.Forouzan, Cengage Learning.
   2. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
   3. Data Structures using C, A.M.Tanenbaum,Y. Langsam, M.J.Augenstein, Pearson.
   4. Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.Tondo and B.Leung,Pearson.
   5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, CareerMonk Publications.
   6. Data Structures using C, R.Thareja, Oxford University Press.
   7. Data Structures, S.Lipscutz,Schaum's Outlines, TMH.
   8. Data structures using C, A.K.Sharma, 2nd edition, Pearson..
   9. Data Structures using C &C++, R.Shukla, Wiley India.
   10. Classic Data Structures, D.Samanta, 2nd edition, PHI.
   11. Advanced Data structures, Peter Brass, Cambridge.

Web Resources:
       1.http://nptelonlinecourses.iitm.ac.in/
       2 https://www.quora.com/What-are-some-good-websites-to-learn-data-structures
       3 https://www.peterindia.net/DataStructureandAlgorithms
       4 https://www.tutorialspoint.com/data_structures_algorithms/

COURSE CODE		17300201 Data Structures								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓	✓				✓				✓
	CO2			✓	✓	✓				✓	
	CO3			✓				✓	✓		
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
	✓										
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300202 Computer Organization**	4	0	0	4
Teaching	Total contact hours - 64				
Prerequisite (s)	Basic Knowledge of electronic circuits and Gates , digital computers				

Course Objective(s):
1. To analyze the system performance, how Computer Systems work & its basic principles
2. Examine the operation of the major building blocks of a computer system
3. To study the basic organization of digital computers (CPU, memory, I/O, software).

Unit – I
Objective: To have a thorough understanding of the basic structure and operation of a digital computer. **(CO1, CO5)**

Digital Logic Circuits: Digital Computers, Logic Gates, Boolean algebra, Map Simplification, Combinational Circuits, Flip-flops, Sequential Circuits. Digital Components: Integrated Circuits, Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, Memory Unit.

Unit – II
Objective: To discuss in detail Data types , micro operations and Computer Organization Design**(CO1, CO3)**

Data Representation: Data types, Complements, Fixed-point Representation, Floating-point representation, other binary codes, Error detection Codes. Register Transfer and Micro operations: Register transfer language, Register transfer, Bus & memory Transfers, Arithmetic micro operations, logic micro operations, Shift micro operations, Arithmetic Logic Shift Unit Basic Computer Organization and Design: Instruction Codes, Computer registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-output Interrupt

Unit – III
Objective:. To study the Micro programmed control and CPU **(CO2, CO4)**

Micro programmed Control: Control memory, Address Sequencing, Micro program Example, Design of control Unit. Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control

Unit – IV
Objective: To discuss in detail the operation of the arithmetic unit including the floating-point addition, subtraction, multiplication & division. **(CO1, CO5)**

Computer Arithmetic: Introduction, Addition and subtraction, Multiplication algorithm, Floating point arithmetic operations, Decimal Arithmetic unit, Decimal Arithmetic operations.

Unit – V
Objective: To study the hierarchical memory system including cache memories **(CO1, CO2)**

To study the different ways of communicating with I/O devices and standard I/O interfaces.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory

Course Outcomes
After successful completion of the course, a successful student will be able to-

CO1: To apply the knowledge of performance metrics to find the performance of systems.
CO2: To create an assembly language program for a microprocessor system.
CO3: To design a hardware component for an embedded system
CO4: To deal with different types of computers
CO5: To identify high performance architecture design

Text Books:
1. M. Morris Mano ,Computer System Architecture,3rdEdition, Pearson Education (2008).

Reference books
1 V. Rajaraman, T. Radha Krishnan Computer Organization and Architecture PHI
2 Behrooz Parhami Computer Architecture Oxford (2007)
3 ISRD group Computer Organization ace series, TMH (2007)
4 William Stallings Computer Organization and Architecture – Designing for Performance Pearson Education (2005)

Web Resources:
1. https://pdfs.semanticscholar.org/30a2/02b45d404e51531267a3e7362892f5036e3e.pd
2. https://www.quora.com/What-are-the-best-websites-and-videos-to-learn-computer-arc
3. https://www.quora.com/What-is-the-best-way-to-learn-computer-organization-and-arc
4.   www.nu.edu.sa/c/document_library/get_file?...computer+organisation

COURSE CODE		17300202 Computer organisation								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓					✓				
	CO2		✓	✓							✓
	CO3				✓				✓		
	CO4					✓					
	CO5			✓				✓			
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300203 OOPS Through Java**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge of basic programming concepts				

Course Objective(s):

1. To impart knowledge on basic Object Oriented Programming.
2. Understanding data abstraction using problem representation.
3. To teach the basic concepts and techniques which form the object oriented programming paradigm.

Unit-I

Objective: To describe basic concepts of Object Oriented Programming, java data types, classes and objects. **(CO1,CO2)**

Basics of Object Oriented Programming (OOP):

Need for OO paradigm , A way of viewing world - Agents, responsibility, messages, methods, classes and instances, class hierarchies(Inheritance), method binding, overriding and exceptions, summary of oop concepts, coping with complexity , abstraction mechanisms.

Java Basics:

Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects - concepts of classes, objects, constructor methods, access control, this keyword, garbage .handling.

Unit-II

Objective: To implement object oriented constructs such as various class hierarchies, interfaces and exception handling.**(CO2,CO3)**

Inheritance:

Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes**.**

Packages and Interfaces:

Defining, Creating and Accessing a package, Understanding Class path ,Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.

Unit , III

Objective: To gain knowledge of throwing on exception and catching it.**(CO2,CO3)**

Exception handling and multithreading:

Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

Unit , IV

Objective: To be able to build dynamic user interface using event handling and to designing the user interface using the UI components. **(CO5,CO6)**

Event Handling:

Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy, user interface components-labels, button, canvas, scrollbars, text components, check box, check box groups, choices, list panes- scroll pane, dialogs, menu bar , graphics, layout manager-layout manager types- boarder, grid, flow, card and grid bag.

Unit , V

Objective: To know about the creation of applets & using it and application oriented knowledge on swings. **(CO5,CO7)**

Applets:

Concepts of Applets, differences between applets and applications, lifecycle of an applet, types of applets, creating applets, passing parameters to applets.

Swings:

Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Course Outcomes:

After successful completion of the course, a successful student will be able to -

CO1: Understand of the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs.

CO2: Develop object oriented constructs such as various class hierarchies, interfaces & exception handling .

CO3: Able to implement, compile, test and run Java programs comprising more than one class, to address a particular software problem.

CO4: Demonstrate the ability to use simple data structures like arrays in a Java program.

CO5: Make use of members of classes found in the Java API

CO6: Develop various types of selection constructs in a Java program.

CO7: Know about the creation of applets & using it and application oriented knowledge on swings.

Text Book:

1. Java-The complete reference - 7/e, Herbert schildt, TMH.

References:

1. JAVA: How to program, 8/e, Dietal and Dietal, PHI.
2. Introduction of programming with JAVA, S.Dean, TMH.
3. Introduction to Java programming, 6/e, Y.Daniel Liang, Pearson.
4. Core Java 2, Vol 1(Vol 2) Fundamentals (Advanced), 7/e, Cay.S.Horstmann, Gary Cornell, Pearson.
5. Big Java2, 3/e, Cay.S. Horstmann, Wiley.
6. Object Oriented Programming through Java, P.Radha Krishna, University Press.

Web Resources:

1. http://ebook-dl.com/item/java_programming_seventh_edition_joyce_farrell/
2. http://introcs.cs.princeton.edu/java/10elements/
3. http://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html
4. http://www.horstmann.com/bigjava2.html
5. https://www.edx.org/course/introduction-programming-java-part-1-uc3mx-it-1-1x

Course code		**17300203 OOPS Through Java**									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓									
	CO2			✓	✓						
	CO3	✓	✓	✓	✓						
	CO4		✓					✓	✓		✓
	CO5	✓	✓	✓							
	CO6				✓	✓					
	CO7		✓				✓				

Category	**Programming**	**Core**	**Mathematics Based**	**Non Computer Based**	**Latest Technology**
	✓				

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300204 Organizational Structures and Personnel Management**	4	0	0	4
Teaching	Total contact hours - 64				
Prerequisite (s)	Basics about organization				

Course Objective(s):
1. To provide the students with an in depth understanding of organizations.
2. To understand various levels of management and to describe the various skills that are necessary for successful managers.
3. To develop the nature and scope of management.
4. To know the difference between management and administration.

Unit – I
Objective: To identify the planning and importance of management **(CO1, CO5)**

Introduction to Management: Concepts, nature and definitions of management, management and administration, principles of management -functions of management planning, organizing, directing and controlling –importance of management.

Unit – II
Objective: To explore the basic theories of Personnel Management and its functions. **(CO1, CO4)**

Classical Theories of Organization: Functional approach –division of labor, levels of authority, span of Control, authority& responsibility, efficiency of management. Concept of organization Structure-Formal and Informal organization, difficulties due to informal organization-group Behavior-Committee motivation and theories of motivation.

Unit – III
Objective:. To identify Manpower management effectively describes the processes of planning and directing the application, development, and utilization of human resources in employment **(CO2, CO4)**

Manpower planning: Uses benefits problems and limitations, manpower inventory, manpower forecasting, job description, recruitment, Job specification and job selection, interviewing techniques, transfers, promotion and its policies. Training and development : Objectives and policies planning, organizing the training department, training manager and his job, on and off the job training, techniques, career planning, objectives of performance appraisal

Unit – IV
Objective: To obtain and practice effective written and oral business communications skills. **(CO1, CO3)**

Communication : Importance of communication, inter personnel communication barriers of communication, communication in organizations, using communication skills to manage conflicts. Impact of informational technology and fostering effective communication

Unit – V
Objective: To learn business levels and strategic management (**CO1, CO3, CO5)**

Strategic management: Objectives, importance policies, concept of core competence capability of organizational learning, strategic levels and planning, business level strategy and functional level, phases of planning,SWOT, develop strategies and prepare strategic plan

Course Outcomes
  After successful completion of the course, a successful student will be able to-

CO1: Understand the importance of organizational structure and design on internal organizational.
CO2: Understand the relationships between organization structure and the behavior of those who work in them or otherwise interact with them.
CO3: Recognize the managerial implications of organization design and change and how these are informed by the relevant theories.
CO4: Appreciate the impact of advanced technologies on the strategy and structure of organizations and how to address the changes implied by the adoption of these technologies.
CO5: Understand the Personnel Functions like position of the personnel department in the organization

Text Books:

1. L.M.Prasad, Principles and Practice of Management, Sultan Chand & Sons.
2. A.R.Aryasri, Organizational Structure and Personnel Management, TMH, 2009

Reference books:
1. Organization Structure and Personnel Management, 2/e, Subbarao.P, HPH.
2. Personnel and Human Resource Management, Recenzo, Robins,PHI.
3. Management process and Organizational Behaviour, Karampal,I.k.Int.
4. Human Resource Management Jyothi, Oxford.
5. Organizations and Management, Agarwal, TMH.
6. Fundamentals of HRM, David A. Decenzo and Stephen R. Robins,Wiley India.

Web Resources:

1. https://www.slideshare.net/WelingkarDLP/hrm-i-personnel-mgmtchap2
2. https://www.slideshare.net/Williardq/personnel-managemen
3. https://management-chandrasekhar.blogspot.com/2011/.../personnel-management.htm
4. www.yourarticlelibrary.com/personnel-management/organization-structure
5. www.managementstudyguide.com/personnel-management.htm

COURSE CODE		17300204 Organizational Structures and Personal Management									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓				✓		✓			
	CO2								✓		
	CO3		✓				✓				✓
	CO4				✓					✓	
	CO5			✓							✓

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
				✓	

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300205 Intellectual Property Rights & Professional Ethics**	4	0	0	4
Teaching	Total contact hours - 64				
Prerequisite (s)	Basics about law and marketing				

Course Objective(s):

1 To appreciate the concept of Intellectual Property and recognize different kinds of Intellectual Property
2 To appreciate the rationale behind IP and underlying premises,
3 To know the position of IP under the Constitution of India,
4 To understand the concepts of Ethics in work environment.
5 To understand the threats in computing environment and the in traceries of accessibility

Unit – I
Objective: To introduce the concepts of intellectual property law basics and various types of trademarks. **(CO1, CO3, CO4)**

Intellectual property law basics:
Types of Intellectual property – agencies responsible for Intellectual property registration.

Introduction to law of trademarks:
Purpose and function, types of trademarks, acquisition of trademark rights, trademark selection and searching, trademark registration process.

Unit – II
Objective: To know the concept of IPR and the relevant Law and its practical application. **(CO1, CO4)**
Introduction to patent law – patent requirements – ownership-patents application process-patent infringement –patent litigation –International patent law-double patenting-patent searching-invention developers and promoters.

Unit – III
Objective: To know the copyright ownership and their disputes. **(CO3, CO4)**

Copyright ownership, transfer and duration-right to prepare derivative works- rights of distribution –rights of perform the work publicity copyright formalities and registrations – limitations –copyright disputes and international copyright law.

Unit – IV
Objective: To summarize the laws for prosecuting computer attacks and risk assessment. **(CO1, CO2, CO5)**

Computer and Internet Crime:
Types of exploits, types of perpetrators, federal laws for prosecuting computer attacks, implementing trustworthy computing, Risk assessment, establishing security policy, educating employees and contract workers, prevention, detection, response.

Unit – V
Objective: To know about the importance of software quality, social networking and ethical issues. **(CO5)**

Software Development:
Importance of software quality, software product liability, software development process, capability maturity model integration, key issues in software development, development of safety critical system, quality management standards.

Social Networking –Ethical issues:
Cyber bullying- cyber stalking –online virtual world- crime in virtual world

Course Outcomes
After successful completion of the course, a successful student will be able to-
    CO1: Understand intellectual property rights and trademarks
    CO2: Model in different views in patent law and international patent law
    CO3: Identify and analyze intellectual property rights and law of trademarks
    CO4: Identify the infringement of different laws basing on ownership,
          transfers , duration, registration and searching
    CO5: Know about the importance of software quality, social networking and ethical
          Issues .

Text Books:
1.   Intellectual Property- Deborah E.Bouchoux- Cengage learning, New Delhi.
2.   Ethics in Information technology - George W.Reynolds-4/e,Cengage Learning

Reference books:
1. Intellectual Property Rights Unleashing the Knowledge Economy, Prabuddha Ganguli, Tata McGraw Hill, New Delhi, 2001.
2. Ethical, legal and professional issues in computing, Penny Duquenoy, Simon Jonesand Barry G Blundell ,Middlesex University Press, 2008.
3. Intellectual Property Rights: In the WTO and Developing Countries, Jayasree Watal,Oxford University Press.
4. Intellectual Property Rights and Copyright, V.Sarkar , ESS publications.

Web Resources:

1. http://www.cengagebrain.com.au/content/9781285243863.pdf
2. http://www.abebooks.co.uk/book-search/title/intellectual-property-for-paralegals-the-law-of-trademarks-copyrights-patents-and-trade-secrets/author/bouchoux-deborah-e/
3. http://capitadiscovery.co.uk/brookes/items/1194118
4. http://trove.nla.gov.au/work/34006945?q&versionId=41863400

COURSE CODE		17300205 Intellectual Property Rights & Professional Ethics									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓					✓				
	CO2								✓		✓
	CO3		✓			✓				✓	
	CO4									✓	
	CO5			✓							

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
				✓	

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300211 DATA STRUCTURES LAB**			3	2
Teaching	Total contact hours - 48				
Prerequisite (s)	Knowledge of C programming				

Course Objective(s):

1 To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables

2 To write and execute write programs in C to implement various sorting and searching methods**.**

Recommended Systems/Software Requirements:

- Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 64 MB RAM and 100 MB free disk space.
- C compiler.

1. Write a C program that uses functions to perform the following: (CO1,CO3)
     a. Create a stack of integers.
     b. Delete a given integer from the above .
     c. Display the contents of the above .
2. Write a C program that uses functions to perform the following: (CO1,CO3)
     a. Create a queue of integers.
     b. Delete a given integer from the above .
     c. Display the contents of the above .
3. Write a C program that uses functions to perform the following: (CO1,CO3)
     a. Create a singly linked list of integers.
     b. Delete a given integer from the above linked list.
     c. Display the contents of the above list after deletion.
4. Write a C program that uses functions to perform the following: (CO1,CO3)
     a. Create a doubly linked list of integers.
     b. Delete a given integer from the above doubly linked list.
     c. Display the contents of the above list after deletion.
5. Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array (CO1,CO3)
6. Write a C program that uses stack operations for implementing Tower of Hanoi Problem (CO1,CO3)
7. Write a C program that uses stack operations for evaluating a postfix expression (CO1,CO3)
8. Write C programs to implement a double ended queue ADT using array . . (CO1,CO3)
9. Write C programs to implement a double ended queue ADT using doubly linked list . (CO1,CO3)
10. Write C programs to implement Linear Search . (CO3)
11. Write C programs to implement Binary Search . (CO3)
12. Create a binary search tree of characters. (CO1,CO3)
13. Traverse the above Binary search tree recursively in Postorder. (CO1,CO3)
14. Traverse the above Binary search tree recursively in Inorder. (CO1,CO3)

15. Traverse the above Binary search tree recursively in Preorder. (CO1,CO3)
16. Create a binary search tree of integers. (CO1,CO3)
17. Traverse the above Binary search tree non recursively in Inorder. (CO1,CO3)
18. Traverse the above Binary search tree non- recursively in Postorder. (CO1,CO3)
19. Traverse the above Binary search tree non recursively in Preorder. (CO1,CO3)
20. Write C program for implementing Bubble sort to arrange a list Of integers in Ascending order : (CO1,CO2)
21. Write C program for implementing Insertion sort to arrange a list Of integers in Ascending order : (CO1,CO2)
22. Write C program for implementing Merge sort to arrange a list Of integers in Ascending order : (CO1,CO2)
23. Write C program for implementing Quick sort to arrange a list Of integers in Ascending order : (CO1,CO2)
24. Write C program for implementing Heap sort to arrange a list Of integers in Ascending order : (CO1,CO2)
25. Write C program for implementing Radix sort to arrange a list Of integers in Ascending order : (CO1,CO2)
26. Write C program for implementing Selection sort to arrange a list Of integers in Ascending order : (CO1,CO2)
27. Write a C program to Implement a B-tree. (CO1,CO3)
28. Write a C program to Implement an AVL tree. (CO1,CO3)
29. Write a C program to implement all the functions of a dictionary (ADT) using hashing. (CO1,CO3)
30. Write a C program for implementing Knuth-Morris- Pratt pattern matching. Algorithm (CO1,CO3)
31. Write C programs for implementing the following graph traversal algorithms: Depth first traversal (CO1,CO3)
32. Write C programs for implementing the following graph traversal algorithms: Breadth first traversal (CO1,CO3)

Course Outcomes:

After successful completion of the course, a successful student will be able to-
   CO1: Identify the appropriate data structure for given problem.
   CO2: Design and analyze the time and space complexity of algorithm
         or program.
   CO3: Effectively use different data structures for solving real application
         problems.

Text books:

1. C and Data Structures, Third Edition, P.Padmanabham, BS Publications.
2. C and Data Structures, Prof. P.S.Deshpande and Prof. O.G. Kakde, Dreamtech Press.
3. Data structures using C, A.K.Sharma, 2nd edition, Pearson.
4. Data Structures using C, R.Thareja, Oxford University Press.
5. C and Data Structures, N.B.Venkateswarlu and E.V.Prasad,S.Chand.
6. C Programming and Data Structures, P.Radha Krishna, Hi-Tech Publishers.

COURSE CODE		17300211 DATA STRUCTURES LAB								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓			✓		✓			
	CO2			✓			✓		✓		
	CO3	✓			✓					✓	✓
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
	✓										
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300212 OOPS Through Java Lab**	0	0	3	2
Teaching	**Total Contact Hours 48**				
Prerequisite (s)	**Knowledge of fundamental programming concepts**				

Course Objective(s):
1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc
2. Defining classes, invoking methods, using class libraries.
3. Use applets and swings to create and run simple Java programs .

Recommended Systems/Software Requirements:
Intel based desktop PC, J D K 1 . 5 o r m o r e

List of Programs:

1. The Fibonacci sequence is defined by the following rule. The first two values in the sequence are 1, 1. Every subsequent value is the sum of the two values preceding it. Write a Java Program (WAJP) that uses both recursive and non-recursive functions to print the *nth* value of the Fibonacci sequence.**(CO1)**
2. WAJP that prints all real solutions to the quadratic equation $aX^2+bX+c=0$. Read in a, b,c and use the quadratic formula. If the discriminate b^2-4ac is negative, display a message stating that there are no real solution. **(CO1)**
3. WAJP to demonstrate wrapper classes, and to fix the precision.**(CO7)**
4. WAJP that prompts the user for an integer and then prints out all the prime numbers up to that Integer. .**(CO1)**
5. WAJP that checks whether a given string is a palindrome or not. Ex: MALAYALAM is a palindrome.**(CO2)**
6. WAJP for sorting a given list of names in ascending order. **(CO3)**
7. WAJP to check the compatibility for multiplication, if compatible multiply two matrices and find its transpose. .**(CO1)**
8. WAJP that illustrates how runtime polymorphism is achieved.**(CO5)**
9. WAJP to create and demonstrate packages. .**(CO5)**
10. WAJP, using String Tokenizer class, which reads a line of integers and then displays each integer and the sum of all integers. .**(CO1)**
11. WAJP that reads on file name from the user then displays information about whether the file exists, whether the file is readable/writable, the type of file and the length of the file in bytes and display the content of the using File Input Stream class. .**(CO7)**
12. WAJP that displays the number of characters, lines and words in a text/text file. .**(CO1)**
13. WAJP that reads a file and displays the file on the serene, with a line number before each line **(CO1)**
14. Write an Applet that displays the content of a file. **(CO6)**
15. Write a program using applets for passing parameters.**(CO6)**
16. WAJP that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the + - x / %operations. Add a text field to display the result.**(CO1)**

17. WAJP for handling mouse events.**(CO6)**
18. WAJP demonstrating the life cycle of a thread.**(CO6)**
19. WAJP that correctly implements Producer-Consumer problem using the concept of Inter Thread Communication.**(CO6)**
20. WAJP that lets users create Pie charts. Design your own user interface (with Swings & AWT).**(CO7)**
21. WAJP that allows user to draw lines, rectangles and ovals.**(CO1)**
22. WAJP to generate a set of random numbers between two numbers x1 and x2, and x1>0. .**(CO1)**
23. WAJP to create an abstract class named Shape, that contains an empty method named number Of Sides ().Provide three classes named Trapezoid, Triangle and Hexagon, such that each one of the classes contains only the method number Of Sides (), that contains the number of sides in the given geometrical figure.**(CO5)**
24. WAJP to implement a Queue, using user defined Exception Handling (also make use of throw, throws).**(CO6)**
25. WAJP that creates 3 threads by extending Thread class. First thread displays "Good Morning" every 1 sec, the second thread displays "Hello" every 2 seconds and the third displays "Welcome" every 3 seconds. (Repeat the same by implementing Runnable) .**(CO6)**
26. Create an inheritance hierarchy of Rodent, Mouse, Gerbil, Hamster etc. In the base class provide methods that are common to all Rodents and override these in the derived classes to perform different behaviors, depending on the specific type of Rodent. Create an array of Rodent, fill it with different specific types of Rodents and call your base class methods. **(CO1)**
27. WAJP to create and add 3 scroll bars to the window and handle the event appropriately. **(CO7)**
28. WAJP on key event handling. **(CO7)**
29. WAJP which uses flow layout.**(CO1)**
30. WAJP which uses grid layout .**(CO1)**

Course outcomes:
After successful completion of the course, a successful student will be able to -

CO1: Write, compiling and execute basic Java program.
CO2: Know the use of data types and variables, decision control structures: if, nested if ,etc.
CO3: Understand the use loop control structures: do, while, for etc.
CO4: Create classes and objects and use them in their program.
CO5: Know the use of oop's concept i.e data abstraction, data hiding, encapsulation, Inheritance and polymorphism.
CO6: Create and use threads, handle exceptions and write applets.
CO7: Develop programs to create interfaces ,inner classes and wrapper classes.

Course code		17300212 OOPS Through Java Lab									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓							✓		
	CO2		✓								
	CO3		✓				✓				
	CO4			✓							
	CO5				✓			✓			
	CO6			✓						✓	
	CO7				✓						✓

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
	✓				

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300213 IT Workshop**	0	0	3	2
Teaching	**Total Contact Hours 48**				
Prerequisite (s)	**Basic knowledge about computer hardware and software**				

Course Objectives:
1. An ability to use current techniques, skills, and tools necessary for computing practice.
2. To impart basic computer usage and maintenance skills.
3. It concentrates more on hands -on experience rather theoretical classes.
4. It enables to make the best use of Microsoft Office Suite in their day-today requirements and make use of it to improve the standards in the educational environment.

Recommended Systems Requirements:
Intel processor, 64-bit processor with SSE2 instruction set, OS: Windows 7

List of programs:

Hardware and Networking:

1. Dismantling of a Personal Computer (PC)(CO1,CO2)
2. Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives disk drives etc. (CO1,CO2)
3. Assembling of PC. (CO1,CO2)
4. Installation of Operating System (Any one) and Device drivers. (CO1,CO2)
5. Boot-up sequence. (CO1,CO2)
6. Installation of application software (at least one) basic troubleshooting and maintenance. (CO1,CO2)
7. Identification of network components: LAN card, wireless card, switch, hub, router. (CO1,CO2)
8. Different types of network cables (straight cables, crossover cables, rollover cables) (CO1,CO2)
9. Basic networking and crimping. (CO1,CO2)

MS Office:

MS-Word

10. Create a project certificate, Features to be covered:-Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
11. Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check and Track Changes.

12. Create a Newsletter. Features to be covered:-Table of content. Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs.

13. Create a Feed Back Form:-Features to be covered: Forms, Text Fields, Inserting objects and Mail Merge in Word.

14. Create a Scheduler:-Features to be covered: - Gridlines, Format Cells, Summation, auto fill, Formatting Text.

15. Prepare a your personal resume in word document.

16. Design a farewell (to seniors) invitation in Ms.Word.

MS-Excel

17. Calculate GPA-Features to be covered-Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count Function.

18. Performance Analysis-Features to be covered:-split cells, freeze panes, group and outline, sorting, Boolean and logical operators, Conditional formatting.

19. Update Manager Designation to Sr.Manager in EMP table.Delete employee Smith from EMP table.

20. Make a document containing a table displaying MBA I sem Time Table.

21. Design a work sheet for purchase made by a customer at a shop and calculate the total amount he need to pay.

22. Design a worksheet for calculating total marks and percentage of students.

23. Draw a column chart for showing production of crops in different years.

24. Draw a line chart for showing temperature in different months.

25. Draw a pie chart for showing pass percentage of students.

26. Create a table that containing the details about students and related fields. Also performing the operations insert, update, delete on the table.

MS-Power Point

27. Create a power point presentation consists of slide layouts inserting text, formatting text,bullets and numbering of five slides with following information: Slide 1 – contents, Slide 2 –Name, Slide 3 –Address, Slide 4 –Hobbies, Slide 5 –Friends. (CO5)

28. Create a power point presentation consisting of hyperlinks, inserting images, clip art, audio, video objects of 4 slides with the following information: Slide 1:-Name of your

college in bold letters. Slide 2:-Address of your college in bold letters. Slide 3:-List of all available courses, Slide 4:-Extra co-curricular activities. And apply the transaction effects and set the time three seconds for each slide and view it in slide show.

29. Create a power Point presentation on business by using master layouts and see the presentation in different views. (CO5)

Course Outcomes:

After successful completion of the course, a successful student will be able to-

1. To know the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers.
2. Understand the hardware and software level trouble shooting process, tips and tricks.
3. Masters in working PC to disassemble and assemble to working condition and install Windows and Linux on the same PC.
4. Having awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks.
5. Design in crafting professional word documents; excel spread sheets and power point presentations using the Microsoft suite of office tools and Latex.

Reference Books:
1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. PC Hardware and A +Handbook –Kate J. Chase PHI(Microsoft)
3. Latex Companion –Leslie Lamport, PHI/Pearson
4. "Introduction to Computers with MS-Office 2000", Alexis Leon and Mathews Leon, Leon Tech world.

COURSE CODE		17300213 IT Workshop								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓		✓							
	CO2				✓				✓	✓	
	CO3		✓			✓					✓
	CO4	✓					✓				
	CO5							✓		✓	
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300301 Probability and Statistics with R**	3	1	0	4
Teaching	Total contact hours - 64				
Prerequisite (s)	Knowledge of Basic Sciences and Calculations				

Course Objective(s):
1. Usage of R programming with Statistical Applications.
2. Generate charts, graphs, and other data representations using R

Unit - I:
Objective: To have a thorough understanding of R Programming concepts **(CO1, CO3)**

Discrete probability distributions and Introduction to R Descriptive Statistics , Random variables , Discrete random variable , Expectation , Binomial, Poisson distributions. Introduction to R software , Vectors , Matrices , Arrays , Lists , Data frames , Basic arithmetic operations in R , Importing and exporting files in R.

Unit - II:
Objective: To describe use of different types of distributions and R commands for them. **(CO1, CO2)**

Continuous Probability distribution and Computing with R Continuous random variable , Normal distribution , Properties , Gamma distribution , Weibul distribution. R commands for computing probability distributions.

Unit - III:
Objective: To define Sampling using R**(CO3, CO4)**

Sampling Theory and Test of Hypothesis Sampling , Central limit theorem (without proof) , Sampling distribution of means , point estimation , interval estimation Construction of confidence intervals using R.

Unit - IV:
Objective: To differentiate types of Errors and tests using R**(CO3)**

Test of Significance Introduction to test of Hypothesis , Type-I Error , Type-II Error , One tail and Two tail tests concerning single mean and two means , single proportion , two proportions. R programming for Z-test, t-test and F-test and Chi square test.

Unit - V:
Objective: To apply ANOVA, Correlation and Regression **(CO5)**
Analysis of Variance ANOVA for one way classification , ANOVA for two way classification. R programming , ANOVA for one way classification , ANOVA for two way classification.
Correlation and regression :Simple correlation and regression , Regression by the method of least squares , Rank correlation , Multiple linear regression R programming for correlation and regression.

Course Outcomes

After successful completion of the course, a successful student will be able to-

    CO1: Use of R programming for Statistical applications.
    CO2: Understand the different data structures in R.
    CO3: Use Sampling and find errors using R.
    CO4: Acquaint with Graphics and Charts through R Programming,
    CO5: Use ANOVA classification.

Text books:
1. R for Everyone by Lander, Pearson.
2. The Art of R Programming, Norman Matloff, Cengage Learning.

Reference books:
1. R Cookbook, Paul Teetor, O'reilly.
2. R in Action, Rob Kabacoff, Manning
3. Learning Base R, Lawrence Leemis,Lightning Source
4. An Introduction to R for Quantitative Economics: Graphing, Simulating and Computing. Springer, 2015
5. Using R for Numerical Analysis in Science and Engineering, Chapman and Hall, CRC Press

Web Resources:
1. http://www.ziddu.com/download/15701672/PSNotes.rar.html
2. http://www.mediafire.com/?z217j9hnp3m2n8s
3. http://forum.jntuworld.com/showthread.php?17173-Probability-amp-Statistics
4. http://www.ziddu.com/download/1463908/probability.pdf.html
5. http://nptelonlinecourses.iitm.ac.in
6. http://forum.jntuworld.com/showthread.php?18027-Probability-and-Statistics-

COURSE CODE		17300301 Probability and Statistics with R									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓	✓							✓	
	CO2	✓	✓	✓			✓			✓	✓
	CO3	✓	✓			✓			✓	✓	
	CO4			✓	✓			✓		✓	
	CO5	✓		✓						✓	
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
					✓						
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300302 Data Base Management Systems**	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge of data and its storage				

Course Objective:

1. Understand the theories and techniques in developing database applications.
2. Build databases using enterprise DBMS products such as Oracle or SQL Server.
3. Be familiar with managing database systems
4. Understand new developments and trends in databases.

Unit – I
Objective: To know about the database system applications, data models, Database design and ER Diagrams. **(CO1,CO2)**

Data base System Applications, data base system Vs file system, View of Data, Data Abstraction, Instances and Schemas, data Models , the ER Model, Relational Model, Other Models, Database Languages , DDL , DML , database Access for applications Programs , data base Users and Administrator , Transaction Management , data base System Structure , Storage Manager ,the Query Processor , History of Data base Systems.

Data base design and ER diagrams , Beyond ER Design Entities, Attributes and Entity sets , Relationships and Relationship sets , Additional features of ER Model , Concept Design with the ER Model ,Conceptual Design for Large enterprises.

Unit – II
Objective: To construct relational model and relational algebra. **(CO4,CO5)**

Relational Model:
Introduction to the Relational Model , Integrity Constraint Over relations , Enforcing Integrity constraints ,Querying relational data , Logical data base Design , Introduction to Views , Destroying /altering Tables and Views

Relational Algebra and Calculus:
Relational Algebra , Selection and projection set operations , renaming , Joins , Division ,Examples of Algebra overviews , Relational calculus , Tupple relational Calculus , Domain relational calculus , Expressive Power of Algebra and calculus.

Unit – III
Objective: To Acquire the knowledge of query evaluation and designing of database applications using normalization.**(CO5,CO6,CO7)**

Form of Basic SQL Query , Examples of Basic SQL Queries , Introduction to Nested Queries , Correlated Nested Queries Set ,Comparison Operators , Aggregative Operators , NULL values , Comparison using Null values , Logical connectivity's , AND,OR and NOR , Impact on SQL Constructs , Outer Joins , Disallowing NULL values , Complex Integrity Constraints in SQL Triggers and Active Data bases. Schema refinement , Problems Caused by redundancy , Decompositions , Problem related to decomposition , reasoning about FDS

, FIRST, SECOND, THIRD Normal forms , BCNF , Lossless join Decomposition , Dependency preserving Decomposition , Schema refinement in Data base Design , Multi valued Dependencies , forth Normal Form - fifth Normal Form-Inclusion dependencies.

Unit – IV
Objective: To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.**(CO8,CO10)**

Overview of Transaction Management:
ACID Properties , Transactions and Schedules , Concurrent Execution of transaction ,Lock Based Concurrency Control , Performance Locking , Transaction Support in SQL , Introduction to Crash recovery.

Concurrency Control:
Serializability, and recoverability , Introduction to Lock Management , Lock Conversions , Dealing with Deadlocks , Specialized Locking Techniques , Concurrency without Locking.

Crash recovery:
Introduction to ARIES , the Log ,Other Recovery related Structures , the Write-Ahead Log Protocol , Check pointing , recovering from a System Crash ,Media recovery , Other approaches and Interaction with Concurrency control.

Unit – V
 Objective: To gain the knowledge on indexing structures.**(CO9,CO10)**

Overview of Storage and Indexing:
Data on External Storage , File Organization and Indexing , Cluster Indexes, Primary and Secondary Indexes , Index data Structures , Hash Based Indexing , Tree base Indexing , Comparison of File Organizations .

Overview of Query Evaluation:
Tree Structured Indexing: Intuitions for tree Indexes , Indexed Sequential Access Methods (ISAM) , B+ Trees: A Dynamic Index Structure. Hash Based Indexing: Static Hashing , Extendable hashing , Linear Hashing , Extendable vs. Linear hashing .Storing data in disks and file .The memory hierarchy , Redundant arrays of independent disks.

Course Outcomes:
After successful completion of the course, a successful student will be able to –

   CO1: Master the basics of SQL and construct queries using SQL.
   CO2: Analyze the difference between traditional file system and DBMS.
   CO3: Work with different data base languages.
   CO4: Draw various data models for data base.
   CO5: Be familiar with the relational database theory,and be able to write relational algebra expressions for queries.
   CO6: Design schema and normalize data.
   CO7: Understand how query are being processed and executed.
   CO8: Deal with online transactions and control concurrency.
   CO9: Work with indexing and sorting in disk files.
  CO10: Understand types of data base failures and recovery.

Text Books:
1. Data base Management Systems- 3/e, Raghurama Krishnan and Johannes Gehrke-TMH.
2. Data base System Concepts- 6/e, Silberschatz, Korth- TMH

References:
1. Data base Management System, 5/e, Elmasri Navathe, Pearson
2. Introduction to Database Systems, 8/e, C.J.Date, Pearson
3. Data base Systems design, Implementation, and Management, 5/e, Rob, Coronel and Thomson
4. Database Management System, Connolly Begg, Pearson
5. Database Management systems, Garcia-Molina, Ullman and Widom, Pearson
6. Database Management Systems, Majumdar and Bhattacharyya, TMH.
7. Database System Concepts, Peter Rob and Coronel, Cengage.

Web Resources:

1. https://drive.google.com/file/d/0B-LkLATpEg9N3F6NHBqWld6czg/edit?pli=1
2. http://www.cse.hcmut.edu.vn/~ttqnguyet/CSDL/EbookDB.pdf
3. https://books.google.co.in/books?id=pk5GAQAAIAAJ&redir_esc=y
4. http://www.britannica.com/technology/database-management-system

Course code	17300302 Data Base Management Systems									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes CO1	✓				✓					
CO2			✓							
CO3		✓					✓			
CO4				✓	✓					
CO5	✓						✓			✓
CO6		✓							✓	
CO7		✓	✓	✓						
CO8							✓	✓		
CO9			✓			✓				
CO10								✓		✓
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**	
			✓							
Mode of Evaluation :Written Examination										

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300303 Operations Research**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge of basic Mathematics				

Course Objective:
1. Apply mathematics and science in the solution of societal problems.
2. Design and conduct experiments.
3. Understand, analyze and interpret data.

Unit -I:
Objective: Able to formulate a real-world problem as a mathematical programming model.**(CO1,CO2)**

Development: Definition, Characteristics and Phrases, scientific method. Types of models, general methods for solving, operations research modes.
Allocation: introduction linear programming formulation, graphical solution, simplex methods, artificial variable technique, duality principle.

Unit- II:
Objective: Solve specialized linear programming problems like the transportation and assignment problems. **(CO1,CO2)**

Transportation problem: Formulation, optimal solution, unbalanced transportation, assignment problem: formulation , optimal solution, variations problem, degeneracy i.e. non square MXN) matrix, restrictions sequencing: Introduction, optimal solution for processing each of n jobs through three machines, travelling salesman problem(i.e.) shortest acyclic route models.

Unit - III:
Objective: Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.**(CO3,CO5)**

Replacement: Introduction, replacement of items that deteriorate when money value is not counted and counted, and replacement of items that fail completely (i.e.) group replacements.
Waiting lines: Introduction, single channel, Poisson arrivals, exponential service time infinite population and unrestricted queue.

Unit -VI:
Objective: Learn optimality conditions for Inventory and Production models and corresponding solution methodologies**.(CO4,CO5)**

Inventory: Introduction, single item, deterministic models, production is instantaneous or at a constant rate , shortages are allowed or not allowed and with drawls from stock is continuous, purchase inventory model with one price break ,shortages are not allowed , instantaneous production demand production or purchase cost is relevant, stochastic models, simple problems.

Unit -V:
Objective: Understand how to model and solve problems using dynamic programming. **(CO6,CO7)**

Model a dynamic system as a queuing model and compute important performance measures. Theory of Games: Introduction , minmax(maximum),criterion and optimal strategy solution of games with saddle points, rectangular without saddle points. Dynamic programming: Introduction, Bellman's Principle of optimality, solutions for simple problems.Project Management: PERT and CPM , difference between PERT and CPM, PERT/CPM network components and precedence relations, Time Estimates for activities

Course Outcomes:
After successful completion of the course, a successful student will be able to -

CO1: Be proficienct with tools from optimization, probability, statistics and simulation.

CO2: Understand engineering economic analysis, including fundamental applications.

CO3: Develop tools in industry and the public sector.

CO4: Facilitate mathematical and computational modeling of real decision-making problems.

CO5: Use modeling tools and computational tools.

CO6: Develop analytic skills to evaluate the problems.

CO7: Facilitate with the design, implementation, and analysis of computational experiments.

Text Books:
1. Operations Research, S.D.Sharma, Ramnath and Kedarnath Co, Meerut.
2. Operations Research: An Introduction, 8/e, Taha, Pearson.

References:
1. Operations Research, P.K.Gupta and D.S. Hira, S.Chand & Company Ltd
2. Operations Research, R.D.Asrhedkar and R.V.Kulkarni, Dhanpat rai & Co.
3. Operations Research, Problems & sollutons, 3/e, JKSharma, Macmillan.
4. Operations Research, 8/e, Hillier, Liberman, TMH.
5. Operations Research, 2/e, R.Panneerselvam, PHI.

Web Resources:

1. http://libguides.gatech.edu/operations_research
2. http:// Parallelism and Locality on Scalable Parallel Machines
3. http://Global Optimization Methods in Geophysical Inversion
4. http://Nonlinear & Global Optimization; Computational Chemistry

Course code	**17300303 Operations Research**									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10
Course outcomes — CO1	✓	✓								✓
Course outcomes — CO2	✓				✓		✓			
Course outcomes — CO3						✓				
Course outcomes — CO4	✓				✓			✓		
Course outcomes — CO5										✓
Course outcomes — CO6			✓	✓						
Course outcomes — CO7						✓				✓

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
			✓		

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300304 Computer Networks**	4	-	-	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	**Fundamentals of computers**				

Course Objective*:*
1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize with the basic taxonomy and terminology of the computer networking area.
3. Introduce to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. To gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Unit -I:
Objective: Know   the basic concepts of computer networks and various reference models.**(CO1, CO3)**

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

Physical Layer: Guided transmission media, wireless transmission media.

Data Link Layer - design issues, CRC codes, Elementary Data Link Layer Protocols, sliding window prorocol

Unit- II:
Objective: To know the functioning of network layer and various routing algorithms.**(CO2,CO4)**

Channel allocation methods:
TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision Free protocols ,IEEE standard 802 for LANS , Ethernet, Token Bus, Token ring, Bridges.

Network layer Routing Algorithms:
Shortest path, Flooding, Flow based Distance vector, Link state, Hierarchical, Broadcast routing, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Choke packets and Load shedding.

Unit- III
Objective: Recognize the different internetworking devices and their functions. Explain the role of protocols in networking.**(CO4,CO5)**

Internet Working :
Tunneling, internetworking, Fragmentation, network layer in the internet , IP protocols, IP address, Subnets, Internet control protocols, OSPF, BGP, Internet multicasting, Mobile IP. Network layer in the ATM Networks , cell formats, connection setup, routing and switching,

service categories, and quality of service, ATM LANs.

Unit -IV:
Objective: Analyze the services and features of the Transport layer **(CO7)**

The Transport Layer:
Elements of transport protocols , addressing, establishing a connection, releasing connection, flow control and buffering and crash recovery, end to end protocols : UDP, reliable Byte Stream (TCP) end to end format, segment format, connection establishment and termination, sliding window revisited, adaptive retransmission, TCP extension, Remote Procedure Call , BLAST, CHAN, SELECT, DCE.

Unit- V:
Objective: Analyze the features and operations of various application layer protocols such as HTTP, DNS and SMTP**(CO6,CO7)**

Application Layer:
Network Security, Cryptographic Algorithms: DES, RSA. Security Mechanisms : Authentication Protocols, Firewalls .Name service (DNS) Domains Hierarchy, Name servers. Traditional Applications : SMTP, MIME, World Wide Web : HTTP, Network Management : SNMP

Course Outcomes:
After successful completion of the course, a successful student will be able to –

CO1: Independently understand basic computer network technology.
CO2: Identify the different types of network topologies and protocols.
CO3: Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of eachlayer.
CO4: Identify the different types of network devices and their functions within a network
CO5: Understand and building the skills of subnetting and routing mechanisms.
CO6: Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.
CO7: Be familiar with wireless networking concepts,

Text Books:

1. Computer Networks Andrew.S. Tanenbaum, 4/e, Pearson
2. Data and computer communications, stallings, 8/e, PHI

References:
1. Data communications and networking Forouzan, 4/e, TMH
2. Computer Networks , A System Approach , Peterson and Bruce Davie, 2/e, Harcourt Asia
3. Computer communications and networking technologies, Gallo, Hancock,Cengage
4. An Engineering approach to computer networking, Keshav ,Pearson
5. Communication networks, 2/e , Leon-Garcia, TMH
6. Computer networks, Anuranjan Misra, ACME Learning
7. Computer networks, C R Sarma, Jaico.
8. Understanding data communications, Held, 7/e , Pearson

Web Resources:

1. https://www.ischool.utexas.edu/~i380kpd/reference_models.doc
2. https://en.wikipedia.org/wiki/Networking_hardware
3. https://en.wikipedia.org/wiki/Transport_layer

Course code		17300304 Computer Networks									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓								
	CO2			✓		✓					✓
	CO3		✓		✓				✓		
	CO4					✓					✓
	CO5	✓			✓			✓			
	CO6						✓			✓	
	CO7		✓								✓
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300305 Design & Analysis of Algorithms**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge of Algorithm Design and Data structures				

Course Objective:
1. Design algorithms and to appreciate the impact of algorithm design in practice.
2. Understand how the worst-case time complexity of an algorithm is defined,.
3. Know how asymptotic notation is used to provide a rough classification of algorithms**.**

Unit -I:
Objective: To understand how the worst-case time complexity of an algorithm is defined, how asymptotic notation is used to provide a rough classification of algorithms.

Basic Concepts of Algorithms:
Introduction , Notion of Algorithm , Fundamentals of Algorithmic Solving , Important Problem types , Fundamentals of the Analysis Framework, Asymptotic Notations and Basic Efficiency Classes. **(CO1,CO2)**

Mathematical Aspects and Analysis of Algorithms:
Mathematical Analysis of Non-recursive Algorithm,- Mathematical Analysis of Recursive Algorithm. (Performance Analysis, Space Complexity and Time Complexity. Disjoint Set, Disjoint Set Operation, Union and find algorithm).

Unit - II
Objective: To study paradigms and approaches used to analyze sorting algorithms and to appreciate the impact of algorithm design in practice**.(CO6)**

Analysis of Sorting and Searching Algorithms:
Brute Force , Selection Sort And Bubble Sort , Sequential Search And Brute,Force String Matching , Divide And Conquer, Merge Sort , Quick Sort , Binary Search , Binary Tree, Traversal and Related Properties , Decrease and Conquer , Insertion Sort , Depth First Search and Breadth First Search.

Unit - III
Objective: Synthesize dynamic-programming algorithms, and analyze them**.(CO4,CO6)**

Algorithmic Techniques:
Transform and conquer , Presorting , Balanced Search trees , AVL Trees , Heaps and Heap sort , Dynamic Programming , Matrix Chain Multiplication ,0/1 Knapsack Problem, Travelling Salesman Problem ,Warshall's and Floyd's Algorithm, Optimal Binary Search trees , Greedy Techniques, Prim's Algorithm , Kruskal's Algorithm , Dijkstra's Algorithm, Huffman trees.

Unit - IV
Objective: To introduce the backtracking and branch and bound algorithms**.(CO5,CO3)**

Algorithm Design Methods : Backtracking , n-Queen's Problem , Hamiltonian Circuit problem , Subset-Sum problem , Branch and bound , Assignment problem , Knapsack problem , Traveling salesman problem.

Unit - V
Objective: Know the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems**.(CO3,CO5)**

Branch and Bound:
LC Branch and Bound solution, FIFO Branch and Bound solution.

NP-Hard and NP-Complete problems:
Basic concepts, non deterministic algorithms, NP - Hard and NP Complete classes, Cook's theorem.

Course Outcomes:
After successful completion of the course, a successful student will be able to –

Argue the correctness of algorithms using inductive proofs and invariants.
Analyze worst-case running times of algorithms using asymptotic analysis.
Describe the greedy paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize greedy algorithms, and analyze them.
Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them

CO1: Able to analyze and design algorithms and to appreciate the impact of algorithm design in practice.
CO2: Understand how the best,worst optimum case time complexity of an algorithm is defined,
CO3: Know how a number of algorithms exists for fundamental problems in computer science and engineering work and compare with one another.
CO4: Know how asymptotic notation is used to provide a rough classification of algorithms,
CO5: Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
CO6: Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.

Text Books:
1. The Design and Analysis of Computer Algorithms - A.V.Aho, J.E. Hop croft and J.D.Ullman- Pearson Education Asia, 2003.
2. Introduction to Algorithms -T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein-PHI Pvt. Ltd., 2001

References:
1. Computer Algorithms - Introduction to Design and Analysis- Sara Baase and Allen Van Gelder, Pearson Education Asia, 2003.
2. Introduction to the Design and Analysis of Algorithm- Anany Levitin, Pearson Education Asia, 2003.

Web Resources:
1. https://books.google.co.in/books?id=FKcCHr9NxjYC&pg=PA47&lpg=PA47&dq =1.%09The+Design+and+Analy
2. ftp://doc.nit.ac.ir/cee/jazayeri/Algorithms/Books/Design%20&%20Analysis%20of %20Algorithm.pdf
3. https://books.google.co.in/books/about/Design_Analysis_Of_Algorithms.html?id= FKcCHr9NxjYC
4. http://cc.ee.ntu.edu.tw/~ywchang/Courses/PD/EDA_Chapter4.pdf

Course code		17300305 Design & Analysis of Algorithms									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓				✓				
	CO2	✓			✓						
	CO3			✓				✓			
	CO4					✓				✓	
	CO5				✓						✓
	CO6				✓				✓		
		Programming	**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
Category			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300311 Probability and Statistics with R Lab**			3	2
Teaching	Total contact hours - 48				
Prerequisite (s)	Knowledge of Basic Sciences and Calculations				

Course Objective(s):
1. To write and execute programs in R and to solve various data types for dealing practical problems using such as Mathematical Functions and statistical problems.,
2. To write and execute programs in R to analyze and implement various solutions for data related problems.

Recommended Systems/Software Requirements:

- Intel based desktop PC with minimum of 166 MHZ or faster processor with at least 68 MB RAM and An installation takes up to 150MB of disk space.
- Binary version of R.

1. Program to fit binomial distribution (CO1)
2. Program to fit Poisson distribution. (CO1)
3. Calculating the probabilities in normal distribution. (CO1)
4. Programs showing mean , median , mode in normal distribution. (CO2)
5. Program to fit normal distribution for a given data. (CO2)
6. Program for the sampling distribution of mean and verifying the concepts of unbiasness of sample mean. (CO2)
7. Program for the sampling distribution of variance. (CO2)
8. Program for confidence interval of Population mean and Population properties. (CO1)
9. Programs for the following tests of significance one sample Z-test for testing mean and proportions. (CO3)
10. Program for Two sample Z- test for testing 2 means and proportions. (CO3)
11. Program for small sample test t – test for One sample problem (CO3)
12. Program for small sample test t – test for Two sample problem (CO3)
13. Program for small sample test paired t- test (CO3)
14. Program for small sample test f-test (CO3)
15. Program for small sample test chi – Square test (X^2) (CO3)
16. Program for fitting of straight line by least square method (CO1)
17. Program for fitting of straight line by second degree curve (CO1)

18. Program for fitting of straight line by Exponential curve (CO1)

19. Program for fitting of straight line by Power curve(CO1)

20. Program for calculation of Linear correlation(CO2)

21. Program for calculation of Linear regression(CO2)

22. Program for calculation of Rank correlation(CO2)

23. Program for calculation of Multiple regression (CO2)

24. Program for the preparation of control charts X - charts (CO3)

25. Program for the preparation of control charts R – charts (CO3)

26. Program for the preparation of control charts P & NP – charts (CO3)

27. Program for the preparation of control charts C – charts (CO3)

Course outcomes:

After successful completion of the course, a successful student will be able to-

CO1: Applying concepts of data inputting and basic statistics in R
CO2: Implementing statistical modeling in R
CO3: Implemening various functions and programming in R

Text books:

1. R for Everyone: Advanced Analytics and Graphics , Jared P.Lander (2014),Pearson
2**.** Beginning R: The Statistical Programming Language , Dr. Mark Gardener (2013),Wiley

COURSE CODE		17300311 Probability and Statistics with R Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓					✓			✓	
	CO2	✓	✓			✓					
	CO3	✓	✓					✓			
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
					✓						
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300312 Database Management Systems Lab**	0	0	3	2
Teaching	Total Contact Hours 48				
Prerequisite (s)	Knowledge of database systems				

Course Objective*:*
1. The primary objective of the course is to learn systematic database design approaches covering conceptual design, logical design and an overview of physical design.
2. To present the concepts and techniques relating to query processing by SQL engines.
3. Learning the concepts and techniques relating to ODBC and its implementation.
4. Understand the issues and techniques relating to concurrencr and recovery in multiuser database environment.

List of Programs

SQL

Week 1:
DDL Commands: **(CO4,CO1)**
 a. Table Creation : EMP(eid-PK, ename, dob, desg, salary, dno-FK)
                         DEPT(dno-PK,dname, location)
                         PRODUCT(pno-PK, pname, dom, price)
                         STUDENT(pin-PK, name, dob, prg)
                         ACCOUNT(accno-PK,name,balance)
 b. Command : Alter :
- Adding Constraints to the Table like not null,check,default etc.
- Changing size and type of a column
- Removing a column from the table
 c. Command : Truncate
 d. Command : Drop
 e. Command : Rename

Week 2:
DML commands: (Tables of week 1) **(CO2)**
 a. Queries on Insert Command (Inserting Records in all 5 tables)
- Inserting single rows with values
- Inserting multiple rows by using '&'
- Inserting values in some columns
 b. Queries on Update Command
- Updating all records
- Updating some records based on condition
 c. Queries on Delete Command
- Deleting all records
- Deleting records based on condition

Week 3:
DRL Command: (Tables of week 1) **(CO2)**
   a. Listing Records
   b. Listing Records using operators like AND,OR,BETWEEN,LIKE etc
   c. Listing Records using Order By Clause
   d. Listing Records using Group By Clause

Week 4:
DRL Command: (Tables of week 1) **(CO6)**
   a. Listing Records using Nested Statements
   b. Listing Records using Aggregate Functions-count,sum,max etc.
   c. Listing Records using built-in functions – length,power,trim etc.

 Week 5: **(CO3)**
   a. Creation of View V1 for EMP Table
   b. Insertion using View V1
   c. Deletion using View V1
   d. Updation using View V1
   e. Retrieval using View V1

Week 6: **(CO1)**
TCL and DCL Commands:
   a. Creating a User
   b. Granting Permissions to the User
   c. Revoking Permissions of the User
   d. Saving a Transaction
   e. Creating Savepoints
   f. Undo a Transaction

Week 7:
Implement the Bank Database and execute the given queries/updates(CO1,CO2,CO3)

Bank Database Schema:

       account(account_number, branch_name, balance)
       branch (branch_name, branch_city, assets)
       customer (customer_name customer_street, customer_city)
       loan (loan_number, branch_name, amount)
       depositor((customer_name, account_number)
       borrower(customer_name, loan_number)

Queries/Updations on Bank Database

Retrieving records from a table:

   a. List all branch names and their assests
   b. List all accounts of Brooklyn branch
   c. List all loans with amount > 1000.
   d. List all accounts of Perryridge branch with balance < 1000.
   e. List Numbers of accounts with balances between 700 and 900

Updating records from a table:

      a.   Change the assests of Perryridge branch to 340000000.

      b.   Transfer the accounts and loans of Perryridge branch to Downtown branch.

      c.   Transfer Rs. 100 from account A-101 to A-215.

Deleting records from a table:

      a.   Delete the branch Perryridge.

      b.   Waive off all the loans with amount < 1000.

      c.   Delete the accounts and loans of Downtown branch.

Week 8: (Table of Week 6 to be used) (CO1,CO2,CO3)

Modifying the structure of tables:

      a. Add a column phoneNo to customer table.

      b. Change the size of the branch_city to varchar(20).

      c. Drop the column phoneNo from customer table.

Retrieving records from multiple tables

      a. For all customers who have a loan from the bank, find their names, loan numbers, and loan amount.

      b. Find the customer names, loan numbers, and loan amounts, for all loans at the Perryridge branch.

Rename and Tuple Variables(Use as in select and from)

      a. For all customers who have a loan from the bank, find their names and loan numbers with the attribute loan_number replaced by loan_id.

      b. Find the names of all branches that have assets greater than atleast one branch located in Brooklyn.

String Operations (Use %, _, LIKE)

      a. Find the names of all customers whose street address includes the substring 'Main'.

Ordering the display of Tuples(Use ORDER BY ASC DESC)

      a. List loan data, ordered by decreasing amounts, then increasing loan numbers.

PL/SQL

Week 9: (CO5)

1. PL/SQL Program To Add Two Numbers
2. PL/SQL Program for Prime Number
3. PL/SQL Program to Find Factorial of a Number
4. PL/SQL Program to Print Table of a Number
5. PL/SQL Program for Reverse of a Number

Week 10:

6. PL/SQL code block to calculate the area of the circle for a value of radius varying from 3 to 7. Store the radius and the corresponding values of calculated area in a table Area.(CO5)

7. PL/SQL block of code for inverting a number 5639 or 9365. **(CO5)**
8. PL/SQL block which displays area for a given radius. If no data found then display an error message.**(CO5)**

Week 11:

9. PL/SQL block of code to achieve the following: if the price of Product 'p00001' is less than 4000, then change the price to 4000. The Price changes to be recorded in a separate table along with Product no and the date on which the price was last changed. (Table: PRODUCT). **(CO1,CO5)**

10. PL/SQL block that will display the name, department and salary of the first 10 employees getting the highest salary(Table –EMP,DEPT) **(CO5)**

Week 12:

11. PL/SQL block that will display the name, department of all employees using Cursor. (Table –EMP,DEPT) **(CO5)**

12. Create a package to include the following: **(CO5)**
    a. A named procedure to list the employee names of given department .(Table : EMP,DEPT)
    b. A function which returns the max salary for the given department .(Table : EMP,DEPT)

Week 13: **(CO5)**
13. PL/SQL code for retrieving records based on single fields from STUDENT Table.
14. PL/SQL code for retrieiving records based on full rows from STUDENT Table

Week 14: **(CO5)**
15. PL/SQL code for creating a high function that finds the employee with highest salary from EMP Table.
16. PL/SQL code for creating procedure that finds the largest among three given values

Week 15:

17. PL/SQL code for creating function to join name and designation from the EMP Table. **(CO5)**
18. PL/SQL block of code that lists the highest salary drawn by an employee in each of the departments. It should make use of a function dept_highest which return the highest salary drawn by an employee for the given department .(Table : EMP,DEPT) **(CO5)**

Week 16:
19. Write a row trigger to convert names entered by user to uppercase for EMP Table.**(CO4)**
20. Write a row trigger to insert the existing values of the salary table into a new table when the salary in EMP table is updated .**(CO4)**

Course Outcomes:

After successful completion of the course, a successful student will be able to -

      CO1: Understand SQL Fundamentals.
      CO2: Perform table operations.
      CO3: Work with objects in databases.
      CO4: Develop Table ,View, Log & Triggers.
      CO5: Use PL/SQL for working with data
      CO6: Develop Embedded and Nested Queries.

Course code		17300312 Database Management Systems Lab									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓							✓		
	CO2		✓				✓				
	CO3		✓				✓				
	CO4			✓							
	CO5				✓			✓			
	CO6			✓						✓	
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
			✓								
Mode of Evaluation :Written Examination											

| Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300313 Python Programming Lab**	0	0	3	2
Teaching	Total Contact Hours -48				
Prerequisite (s)	Knowledge of general programming concepts				

Course Objective*:*
1. To understand how to use Python Programming concepts
2. To understand the development of applications using Python.

Requirements: Python 2.7/3 for Windows,Editor :Notepad

List of Programs:

1. Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them. **(CO1)**
2. Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers. **(CO1)**
3. Write a Python program to print the calendar of a given month and year. **(CO1)**
4. Write a Python program to calculate number of days between two dates. **(CO1)**
5. Write a Python program to get the volume of a sphere with radius 6. **(CO1)**
6. Write a Python program to test whether a number is within 100 of 1000 or 2000. **(CO2)**
7. Write a Python program to calculate the sum of three given numbers, if the values are equal then return thrice of their sum. **(CO1)**
8. Write a Python program to get a new string from a given string where "Is" has been added to the front. If the given string already begins with "Is" then return the string unchanged. **(CO1)**
9. Write a Python program to count the number 4 in a given list. **(CO2)**
10. Write a Python program to test whether a parsed letter is a vowel or not. **(CO2)**
11. Write a Python program to create a histogram from a given list of integers.   **(CO3)**

12. Write a Python program that will accept the base and height of a triangle and compute the area. **(CO1)**
13. Write a Python program to solve (x + y) * (x + y). **(CO1)**
14. Write a Python program to compute the distance between the points (x1, y1) and (x2, y2). **(CO1)**
15. Write a Python program to convert height (in feet and inches) to centimeters. **(CO1)**
16. Write a Python program to calculate the hypotenuse of a right angled triangle. **(CO1)**
17. Write a Python program to sort files by date. **(CO5)**
18. Write a Python program to get a directory listing, sorted by creation date. **(CO5)**
19. Write a Python program to calculate midpoints of a line. **(CO1)**
20. Write a Python program to get numbers divisible by fifteen from a list using an anonymous function. **(CO4)**

21. Write a Python program to check if lowercase letters exist in a string. **(CO1)**
22. Write a Python program to add leading zeroes to a string. **(CO1)**
23. Write a program that counts a number's factors and determines whether the number is prime. **(CO2)**
24. Write a Python program to convert an array to an ordinary list with the same items. **(CO5)**
25. Write a Python program to sort a list alphabetically in a dictionary. **(CO5)**
26. Write a Python program for counting sort. **(CO5)**
27. Write a Python program for sequential search. **(CO5)**
28. Write a Python program for binary search. **(CO5)**
29. Write a program that draws the following figure: **(CO3)**
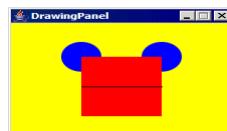
30. Write a program that draws the following figure: **(CO3)**
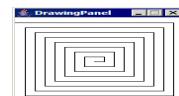
Course Outcomes:

CO1: Design, create, build, and debug Python applications.
CO2: Write and apply decision and loop structures for different applications.
CO3: Write GUI based code for applications.
CO4: Write and apply procedures, sub-procedures, and functions to create manageable code.
CO5: Create one and two dimensional arrays for sorting, calculating, and displaying of data.

COURSE CODE		17300313 Python Programming Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓		✓		✓			✓	✓
	CO2	✓							✓		
	CO3	✓		✓			✓				
	CO4		✓			✓					
	CO5	✓				✓					
Category	Programming		Core		Mathematices Based		Non Computer Based		Latest Technology		
	✓										
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300401 Operating Systems**	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge about Process ,processors and I/O Devices.				

Course Objective:
1. Understand the services provided by and the design of an operating system.
2. Understand the structure and organization of the file system.
3. Develop a process is and how processes are synchronized and scheduled.
4. To know different approaches to memory management.
5. Use system calls for managing processes, memory and the file system.
6. Understand the data structures and algorithms used to implement an OS.

Unit -I
Objective: Provide an overview of computer architecture and organization, with emphasis on topics related to operating system design.**(CO1,CO2)**

Introduction to Operating Systems:
OS structure and strategies, Evolution of operating systems-simple, batch, Multi programmed, time shared, personal computer, parallel, distributed systems, real time systems. Operating-system Services, Operating-system Interface, System calls, Types of System calls, System programs, Operating-system Design and Implementation.

Unit- II
Objective: Present a detailed analysis of processes, multithreading. Provides a discussion of various approaches to process scheduling. **(CO2, CO4)**

Process Management:
Processes: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication, Examples of IPC Systems, Communication in Client-Server systems Threads: Overview, Multithreading Models.

CPU Scheduling:
Basic concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling.

Process Synchronization:
Background, the Critical- section problem, Peterson's solution, Synchronization Hardware, Semaphores, Classic problems of Synchronization, Monitors, Atomic Transactions.

Unit- III:
Objective: Provide a comprehensive survey of techniques for memory management, including virtual memory. **(CO3, CO4)**

Memory management:
Main memory: Swapping, Contiguous memory Allocation, Paging, Structure of the Page table, Segmentation

Virtual memory:

Background, Demand paging, copy-on-Write, Page Replacement, Allocation of frames, Thrashing, Memory-Mapped Files.

Unit -IV
Objective: Master the concepts of file system interface and implementation, disk management. **(CO2, CO4)**

File-system Interface:
Concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection. File-system Implementation: File-system Structure, Implementation, Directory Implementation, Allocation Methods, Free- Space Management, Efficiency and Performance, Recovery, Log-Structured File systems,NFS.

Device Management:
Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap Space Management, RAID structure. Stable storage Implementation. I/O System: I/O hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O request to hardware operation, STREAMS.

Unit -V
Objective: Apply protection and security mechanisms. (**CO2, CO5**)

Deadlocks:
Deadlocks: Necessary conditions, resource allocation graph, methods for handling deadlocks, preventions, avoidance, detection and recovery.

Protection:
Goals of Protection, Principles of protection, Domain of Protection.

Security:
The Security Problem, Program Threads, System and Network Threats, Cryptography as a security tool, User Authentication, Firewall to protect systems and Networks.

Course Outcomes:
After successful completion of the course, a successful student will be able to-

CO1 : Understand the difference between different types of modern operating
systems, virtual machines and their structure of implementation and applications.
CO2 : Understand the concepts of deadlock in operating systems and how they can
be managed / avoided and implement them in multiprogramming system.
CO3 : Understand the design and management concepts along with issues and
challenges of main memory, virtual memory and file system.
CO4: Relate master system resources sharing among the users
CO5: Master issues related to file system interface and implementation,Disk management

Textbook:
1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating System Concepts, Wiley India, 2006.

References:
1. Operating systems,6/E,William Stallings, PHI/Pearson.
2. Operating systems 3/e,Dietal and Dietal,Pearson.

3. An introduction to Operating systems, Concepts and practice, Pramod Chandra P.Bhat,PHI

4. Operating systems, Haldar and Aravind, Pearson.
5. Operating systems, PAL Choudhury, PHI.
6. Operating systems: Design and Implementation, 3/e, Tanenbaum, Woodhull.

Web Resources:
1. https://www.quora.com/What-is-the-best-book-on-operating-systems
2. https://en.wikipedia.org/wiki/Memory_management_
3. www.tutorialspoint.com/operating_system/os_memory_management.
4. www.personal.kent.edu/~rmuhamma/OpSystems/.../cpuScheduling.htm
5. https://www.andrew.cmu.edu/course/15-440-sp09/.../ln/lecture3.html

Course code	**17300403 Operating Systems**									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes CO1		✓							✓	
Course outcomes CO2	✓			✓			✓			
Course outcomes CO3						✓				
Course outcomes CO4	✓				✓			✓		
Course outcomes CO5										✓

Category	**Programming**	**Core**		**Mathematics Based**	**Non Computer Based**	**Latest Technology**	
		✓					

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300402 Web Technologies**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge about Java Programming				

Course Objective(s):
1. To impart knowledge about various web technologies.
2. Develop web pages using like JavaScript, HTML, XML and DHTML.
3. Carry out server side programming with Java Servlets and JSP.
4. Study about database connectivity using JDBC

Unit –I
Objective: To know the concepts of HTML and JavaScript and its usage in developing web pages.**(CO1)**

Review of HTML4
Common tags, HTML Tables and formatting internal linking, Complex HTML   forms. Introduction to Scripting Languages: Java Scripts, Control structures, functions, arrays and objects, DHTML, CSS, event model, filters and transitions.

Unit - II
Objective: To understand XML and its usage in storing data for Web Programming**. (CO1, CO2)**

XML
Working with XML, Document type definition, XML Schemas, Document Object Model, XSLT, DOM and SAX.

Unit - III
Objective: To work with the concepts of Java Beans and Servlets and use Java Beans in storing data and Servlets for Server side Programming. **(CO3,CO7)**

Java Beans
Introduction to Java Beans, Advantages of Java Beans, BDK, Introspection, Using Bound properties, Bean Info Interface, Constrained properties, Persistence, Customizers, Java Beans API.

Servlets
Lifecycle of a Servelet, JSDK, The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization Parameters, The javax.servelet.HTTP package, Handling, HTTP Request & responses, Using Cookies, Session Tracking, Security Issues.

Unit - IV
Objective: To know the concepts of JSP, Installation of JSDK and use of JSP for developing Server Pages. **(CO1, CO3, CO4)**

Introduction to JSP
The Problem with Servelets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC.Setting up the JSP Environment: Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat.

JSP Application Development

Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Conditional Processing – Displaying Values, Using an Expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Passing Control and Data Between Pages – Sharing Session and Application Data Memory Usage Considerations.

Unit -V

Objective: To gain knowledge of JDBC and database programming and use of various drivers for connecting with various databases. **(CO1, CO2, CO5, CO6)**

Database Access: Database Programming using JDBC, Studying Javax.sql.* package. Accessing a Database from a JSP Page, Application – Specific Database Actions Deploying JAVA Beans in a JSP Page.

Course Outcomes:

After successful completion of the course, a successful student will be able to-

  CO1 :Understand XML and how to parse and use XML data with Java
  CO2 : Use the knowledge for developing web pages for different applications.
  CO3 : Identify with the need for and be able to write validated XHTML 1.0.
  CO4 : Apply sound, non-browser specific web design principles.
  CO5 : Use JavaScript to access the DOM to reference web   document object CSS
          properties.
  CO6: Understand and apply Javascript, JSP, CSS & XHTML to create dynamic XHTML.
  CO7: Be aware of emerging technologies and developing W3C recommendation.

Text Books:
    1. Internet and World Wide Web: How to program, 6/e, Dietel and Dietel, Pearson.
    2. The Complete Reference Java2, 3/e, Patrick Naughton and Herbert Schildt, TMH.
    3. Java Server Faces, Hans Bergstan, O'Reilly.

References:
    1. Web Programming, building internet applications, 2/e, Chris Bates, Wiley Dreamtech
    2. Programming World Wide Web, Sebesta, PEA
    3. Web Tehnologies, 2/e, Godbole and Kahate, TMH
    4. An Introduction to Web Design and Programming, P.Wang and Sanda Katila, Thomson.
    5. Web Technologies, 1/e, A.A.Putambekar, Technical Publications.

Web Resources:

    1. www.sssi.org.au/userfiles/event_doc1320138204.pdf
    2. http://catalogue.pearsoned.co.uk/samplechapter/0130428205.pdf
    3. http://www.tutorialspoint.com/web_developers_guide/web_basic_concepts.htm
    4. https://onlinecourses.nptel.ac.in/explorer/search?category=COMP_SCI_ENGG

Course code	17300401 Web Technologies									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

Course outcomes										
	CO1	✓								✓
	CO2				✓					
	CO3		✓					✓		
	CO4								✓	
	CO5	✓				✓			✓	
	CO6						✓			
	CO7		✓					✓		

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
	✓				

Mode of Evaluation : Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300403 Software Engineering**	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Basics about software and programming				

Course Objective:
1. Knowledge of basic SW engineering methods and practices, and their appropriate application.
2. Describe software engineering layered technology and Process frame work.
3. A general understanding of software process models such as the waterfall and evolutionary models. .

Unit- I
Objective: To know the basic features of software and how to change in nature. **(CO1, CO3)**

Introduction to Software Engineering:
The evolving role of software, Changing Nature of Software, Legacy systems, Software myths, Software engineering-a layered technology, Process frame work, CMMI, Process Patterns, Process assessment.

The software problem:
Cost, schedule and quality, Scale and change.

Unit- II
Objective: To introduce the software process models such as waterfall and evolutionary models. **(CO2, CO3)**

Software Process:
Process and project, component software process, Software development process models : Waterfall model, prototyping, iterative development, relational unified process, time boxing model, Extreme programming and agile process, using process models in a project. Project management process.(Text Book 1)

Unit- III
Objective: To elicit the concepts of software requirements and SRS document preparation. **(CO3, CO4)**

Software requirement analysis and specification:
Value of good SRS, requirement process, requirement specification, functional specifications with use-cases, other approaches for analysis, validation.

Planning a software project:
Effort estimation, project schedule and staffing, quality planning, risk management planning, project monitoring plan, detailed scheduling.

Unit- IV
Objective: To gain knowledge of various software architectural styles. **(CO2, CO5)**

Software Architecture:

Role of software architecture, architecture views, components and connector view, architecture styles for C & C view, documenting architecture design, evaluating architectures.

Design:
Design concepts, function-oriented design, object oriented design, detailed design, verification, and metrics.

Unit - V
Objective: To gain the basic knowledge in software testing approaches such as unit testing and integration testing and introduce the metrics of the model. **(CO1, CO2, CO4)**

Coding and Unit testing
 Programming principles and guidelines, incrementally developing code, managing evolving code, unit testing, code inspection, metrics.

Quality Management
 Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

Testing
Testing concepts, testing process, black-box testing, white-box testing, metrics.

Course Outcome:
After successful completion of the course, a successful student will be able to-

 CO1   : Identify the minimum requirements for the development of application.
 CO2   : Develop, maintain, efficient, reliable and cost effective software solutions
 CO3   : Critically thinking and evaluate assumptions and arguments
 CO4   : Understand the process to be followed in the software   development life
           cycle.
 CO5   : Analyze quality of software.

Text Books:
1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley
2. Software Engineering, 7/e Roger S.Pressman, TMH

References:
1. Software Engineering, 8/e, Sommerville, Pearson.
2. Software Engineering Principles and Practice, W S Jawadekar, TMH

Web Resources:

1. http://ce.sharif.edu/courses/8485/1/ce474/resources/root/Pressman_Sofware%20Engineering.pdf
2. http://www.slideshare.net/rhspcte/software-engineering-ebook-roger-s-pressman
3. https://onlinecourses.nptel.ac.in/explorer/search?category=COMP_SCI_ENGG

Course code	17300402 Software Engineering
Course Designed By	Department of Computer Applications

Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1				✓			✓			
	CO2	✓	✓							✓	
	CO3				✓	✓					✓
	CO4				✓		✓				
	CO5			✓					✓		✓
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300404 Cryptography & Network Security**	3	1	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Fundamentals of image display				

Course Objective*:*

1. To impart knowledge in theories, principles and techniques of computer and network security.

2. To learn various cryptographic algorithms , generation of digital signatures and have knowledge of email security.

Unit –I
Objective: To introduce the concepts providing security to the information passed through networks **.(CO4)**

Introduction :
Attacks, Services & Mechanisms, Security, Attacks, Security Services.

Conventional Encryption: Classical Techniques, Conventional Encryption Model, and Steganography, Classical Encryption Techniques.

Modern Techniques:
Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Block Cipher Design Principles, Block Cipher Modes of Operation.

Unit –II
Objective: To understand the use of cryptography algorithms and protocols to achieve computer security. **(CO1)**

Conventional Encryption Algorithms:
Triples DES, International Data Encryption Algorithm, RC4, CAST-128, Key Distribution, Random Number Generation, Placement of Encryption Function.

Unit –III
Objective: To know the key generation and its usage by applying in various algorithms. **(CO1)**

Public Key Encryption
Principles of Public-Key Cryptosystems, RSA Algorithm, Diffie-Hellman Algorithm, Key Management, Fermat's & Euler's Theorem, Primality, the Chinese Remainder Theorem.

Unit –IV
Objective: To know the usage of Digital Signatures for passing the confidential information through networks. **(CO2)**

Hash Functions:
Message Authentication & Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Birthday Attacks, Security of Hash Function & MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA).

Digital Signatures:
Digital Signatures, Authentication Protocol, Digital Signature Standard (DSS).

Unit –V
Objective: To know the security mechanisms to protect computer systems and networks.**(CO3,CO4)**

Network & System Security:
Authentication Applications: Kerberos, X.509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP), Security: Architecture ,Authentication Header, encapsulating security payloads, combining Secuirty associations, Key Management.

Web Security:
Secure Socket Layer & Transport Layer Security.

System Security:
Intruders, Viruses.

Course Outcomes:
After successful completion of the course, a successful student will be able to-
CO1: Design efficient secure algorithms for message communication.
CO2: Masters in creation of digital signatures.
CO3: Awareness about Intruders and Hackers.
CO4: Knowledge about key generation , various attacks and viruses.

Text Books:
1. William Stallings, "Cryptography and Network Security: Principles and Practice", Fifth Edition, PEA, 2011.
2. Data Computer Communications, Stallings, 7th Edition PEA, 2004.

References:

1. Atul Kahate, "Cryptography and Network Security", TMH,2nd Edition,2008.
2. Data Communications, Gupta, Prentice Hall, 1st edition, 2011.
3. Network Security Essentials, William Stallings, 3rd edition, Pearson, 2007.

Web Resources:
1. Cryptography and Network Security Stallings
2. Cryptography and Network Security Forouzan
3. http://www.inf.ufsc.br/~bosco/ensino/ine5680/material-cripto-seg/2014-1/Stallings/Stallings_Cryptography_and_Network_Security.pdf
4. http://sharif.edu/~amini/files/stallings.pdf

Course code		**17300404 Cryptography & Network Security**									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓				✓				
	CO2			✓		✓					✓
	CO3		✓		✓				✓		
	CO4					✓		✓			✓

Category	**Programming**	**Core**		**Mathematics Based**	**Non Computer Based**	**Latest Technology**	
		✓					

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300461A Human Computer Interaction**	4	0	0	4
Teaching	**Total Contact Hours 64**				
Prerequisite (s)	Basics about computers and their interactions				

Course Objective*:*

1. To develop an understanding of user interface design.
2. To bring familiarity with the vocabulary associated with sensory and cognitive systems.
3. To make familiar with a variety of both conventional and non-traditional user interface paradigms.

Unit - I
Objective: To develop and understand user interfaces and importance of designing in general. **(CO1, CO2)**

Introduction:
Importance of user Interface, definition, importance of good design. Benefits of good design. A brief history of screen design.

The graphical user interface:
Popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user –interface popularity, characteristics- Principles of user interface.

Unit - II
Objective: To introduce the concepts of alternatives of spatial keyboard and mouse computing. **(CO2, CO4)**

Design process
Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business functions.

Unit - III
Objective: To know the designing aspects of the screen for planning purposes**. (CO3, CO5)**

Screen Designing
Design goals, Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design, system menus and navigation schemes.

Unit - IV
Objective: To introduce the basic navigation tools and components in windows and to use the components. **(CO4, CO5)**

Windows
Selection of window, selection of Device- Based and Screen-Based controls.

Components
Clear text and messages, Icons and images, choose the proper colors.

Unit - V
Objective: To aware of various software tools and interaction devices in user interface. **(CO1, CO2, CO5)**

Software tools
Specification methods, interface, Building Tools.

Interaction Devices
Keyboard and function keys, pointing devices, speech recognition digitization and generation, image and video displays, drivers.

Course Outcome:
After successful completion of the course, a successful student will be able to-

   CO1 : Design good user interface
   CO2 : Understand the requirements as a user.
   CO3 :Understand the usage of different software tools and interaction devices in user
         interface.
   CO4 : Understand the basic navigation tools and components in windows and their usage.
   CO5 : Understand interaction devices in user interface.

Text Books:
   1. Human Computer Interaction. 3/e, Alan Dix, Janet Finlay, Goryd, Abowd and Russell Beal, PEA, 2004.
   2. The Essential guide to user interface design,2/e, Wilbert O Galitz, Wiley DreamTech.

References:
   1. Designing the user interface. 4/e, Ben Shneidermann, PEA.
   2. User Interface Design, Soren Lauesen, PEA.
   3. Interaction Design PRECE, ROGERS, SHARPS, Wiley.
   4. Human Computer, Interaction Dan R.Olsan, Cengage, 2010.

Web Resources:
   1. http://www.sigchi.org/chi97/proceedings/tutorial/rjkj.htm
   2. http://www.idemployee.id.tue.nl/g.w.m.rauterberg/publications/HCI-tutorial.pdf
   3. https://onlinecourses.nptel.ac.in/explorer/search?category=COMP_SCI_ENGG

Course code		**17300461A Human Computer Interaction**									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1			✓			✓				
	CO2									✓	✓
	CO3					✓					
	CO4	✓							✓		
	CO5							✓			✓

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
		✓			

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300461B Cloud Computing	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Knowledge about Networking and databases				

Course Objective:
1. Learn about the cloud environment, building software systems.
2. Understand different cloud programming platforms and tools
3. Have details knowledge on reading and writing in cloud storage
4. Be familiar with application development and deployment using cloud platforms

Unit - I
Objective: To gain knowledge about clustering, virtualization and cloud, Performance, Security and other advantages. **(CO1, CO3)**

Systems modeling, Clustering and virtualization
Scalable Computing over the Internet, Technologies for Network based systems, System models for Distributed and Cloud Computing, Software environments for distributed systems and clouds, Performance, Security and Energy Efficiency

Unit - II
Objective: To understand the concepts of Virtual machines and virtualization its role in Data Center Automation. **(CO3,CO4)**

Virtual Machines and Virtualization of Clusters and Data Centers
Implementation Levels of Virtualization, Virtualization Structures/ Tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.

Unit - III
Objective: To edify the basics of Cloud Platform, Models, Security and SOA. **(CO1, CO2, CO5)**

Cloud Platform Architecture
Cloud Computing and service Models, Architectural Design of Computer and Storage Clouds, Public Cloud Platforms, Inter Cloud Resource Management, Cloud Security and Trust Management. Service Oriented Architecture, Message Oriented Middleware.

Unit - IV
Objective: To discuss about different Cloud Platforms. **(CO2, CO4)**

Cloud Programming and Software Environments
Features of Cloud and Grid Platforms, Parallel & Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments.

Unit - V
Objective: To know the mechanism of resource management and scheduling in Cloud. **(CO3, CO5)**

Cloud Resource Management and Scheduling

Policies and Mechanisms for Resource Management Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds, Fair Queuing, Start Time Fair Queuing, Borrowed Virtual Time, Cloud Scheduling Subject to Deadlines, Scheduling Map Reduce Applications Subject to Deadlines.

Course Outcome:

After successful completion of the course, a successful student will be able to-

    CO1   : Understand the systems, protocols and mechanisms to support cloud computing.
    CO2   : Develop applications for cloud computing.
    CO3   : Understand the hardware necessary for cloud computing.
    CO4   : Design and implement a novel cloud computing application.
    CO5   : Handle the security features in cloud computing.

Text Book:

    1. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra MK Elsevier.

References:

    1. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte and Robert Elsenpeter, TMH
    2. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen Vecctiola and S Tammarai Selvi, TMH
    3. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier.
    4. Cloud Computing: A Hands on approach, Arshadeep Bahga and Vijay Madisetti, University Press.

Web Resources:

    1. www.cloudipedia.com/files/2009/11/cloud_computing_made_easy.pdf
    2. https://studytm.files.wordpress.com/2014/03/cloud-computing-bible.pdf
    3. https://onlinecourses.nptel.ac.in/explorer/search?category=COMP_SCI_ENGG

Course Code		17300461B Cloud Computing									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1				✓					✓	
	CO2	✓									✓
	CO3			✓		✓	✓				
	CO4				✓			✓		✓	
	CO5		✓			✓			✓		
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
									✓		
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C

Course Code	17300461C Mobile Computing	4	0	0	4
Teaching	Total Contact Hours 64				
Prerequisite (s)	Basics about Networking and Mobile apps				

Course Objective:
1. To study the specifications and functionalities of various protocols/standards of mobile networks.
2. To illustrate architecture and protocols in mobile computing and to identify the trends and latest development of the technologies in the area.
3. To design successful mobile computing applications and services.
4. To evaluate critical design tradeoffs associated with different mobile technologies, architectures, interfaces and business models and how they impact the usability, security, privacy and commercial viability of mobile computing services and applications.

Unit-I
Objective: To develop the applications, characteristics of mobile computing.**(CO2,CO5)**
Introduction
Mobile Computing, Mobile Computing Vs wireless Networking, Mobile Computing Applications, Characteristics of Mobile computing, Structure of Mobile Computing Application. MAC Protocols, Wireless MAC Issues, Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes.

Unit -II
Objective: To know the architecture of IP in mobile. **(CO2, CO3)**

Mobile Internet Protocol and Transport Layer
Overview of Mobile IP, Features of Mobile IP, Key Mechanism in Mobile IP, route Optimization. Overview of TCP/IP, Architecture of TCP/IP, Adaptation of TCP Window, Improvement in TCP Performance.

Unit- III
Objective: To gain knowledge about the telecommunication system.**(CO1,CO4)**

Mobile Telecommunication System
Global System for Mobile Communication (GSM) , General Packet Radio Service (GPRS) , Universal Mobile Telecommunication System (UMTS).

Unit-IV
Objective: To understand the applications and design issues of adhoc networks. **(CO4, CO5)**

Mobile Ad-Hoc Networks
Ad-Hoc Basic Concepts , Characteristics , Applications, Design Issues , Routing , Essential of Traditional Routing Protocols ,Popular Routing Protocols, Vehicular Ad Hoc networks (VANET) , MANET Vs VANET , Security.

Unit- V
Objective: To understand the operating system concepts and its functioning present in mobile devices.**(CO2,CO3)**

Mobile Platforms and Applications

Mobile Device Operating Systems , Special Constrains & Requirements , Commercial Mobile Operating Systems , Software Development Kit: iOS, Android, BlackBerry, Windows Phone , MCommerce , Structure , Pros & Cons , Mobile Payment System , Security Issues.

Course Outcomes:

After successful completion of the course, a successful student will be able to-

 CO1 : Explain the basics of mobile telecommunication system
 CO2 : Choose the required functionality at each layer for given application
 CO3 : Identify solution for each functionality at each layer
 CO4 : Use simulator tools and design Ad hoc networks
 CO5 : Develop a mobile application.

Text Book:
1. Prasant Kumar Pattnaik and Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.

References:
1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
4. William .C.Y. Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, Tata Mc Graw Hill,2006.
5. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.

Web Resources:
1. Android Developers : http://developer.android.com/index.html
2. Apple Developer : https://developer.apple.com/
3. Windows Phone Dev Center : http://developer.windowsphone.com
4. BlackBerry Developer : http://developer.blackberry.com/

Course Code	17300461C Mobile Computing									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓				✓				✓
	CO2				✓					✓	
	CO3	✓				✓			✓		
	CO4			✓				✓			
	CO5		✓			✓				✓	

Category	Programming	Core	Mathematics Based	Non Computer Based	Latest Technology
					✓

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C

Course Code	**17300411 OPERATING SYSTEMS LAB**	0	0	3	2
Teaching	**Total Contact Hours 48**				
Prerequisite (s)	Fundamentals of scripting and commands of operating system				

Course Objective(s):
1. Design and implementation of operating system.
2. To know process management concepts & Techniques.
3. To familiarize students with the Linux environment.
4. To learn the fundamentals of shell scripting/programming.

List of Programs

1. Multiprogramming-Memory management- Implementation of fork (), wait (), exec () and exit (), System calls.(CO1,CO3)
2. Simulate the following CPU scheduling algorithms.(CO1,CO3)
   a) Round Robin b) SJF c) FCFS d) Priority scheduling
3. Simulate Multiprogramming with (CO1, CO3)
   a) Fixed number of tasks (MFT).
   b) Variable number of tasks (MVT).
4. Simulate Bankers Algorithm for (CO1,CO3)
   a) Dead Lock Avoidance   b) Dead Lock Prevention
5. Simulate the following page replacement algorithms.(CO1,CO3)
   a) FIFO   b) LRU   c) LFU
6. Simulate the following File allocation strategies (CO1, CO2)
   a) Sequenced   File allocation b) Indexed File allocation c) Linked File allocation

LINUX PROGRAMMING
1. Study of Unix/Linux general purpose utility command list man,who,cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history,chmod, chown, finger, pwd, cal, logout, shutdown.(CO1,CO4)
2. Study of Unix/Linux text processing utility commands. (CO1, CO4)
3. Study of Unix/Linux Process management utility commands. (CO1, CO4)
4. Study of Unix/Linux File system commands. (CO2, CO4)
5. Write a program to display the good morning, good afternoon, good evening and good night depending on the users log on time. (CO1, CO2)
6. Write a shell script which deletes all lines containing the word "UNIX" in the files supplied as arguments to this shell script(CO1,CO2)
7. Write a shell script which displays a list of all files in the current directory to which you have read, write and execute permissions(CO1,CO2)
8. Write a menu-driven program performing arithmetic operations. (CO1)
9. Study of Bash shell, Bourne shell and C shell in Unix/Linux operating system.
10. Study of Unix/Linux files system (tree structure). (CO2)
11. Study of bashrc, /etc/bashrc and Environment variables.(CO5)
12. Write a C program that makes a copy of a file using standard I/O, and system call
13. Write a C program to emulate the UNIX ls –l command. (CO1)

14. Write a C program that illustrates how to execute two commands concurrently with a command pipe. Ex: - ls –l | sort.(CO1)
15. Write a C program that illustrates two processes communicating using shared memory.(CO3)
16. Write a C program to simulate producer and consumer problem using semaphores.(CO3)
17. Write C program to create a thread using pthreads library and let it run its function. (CO3)
18. Write a C program to illustrate concurrent execution of threads using pthreads library.(CO3)

Course Outcomes:

After successful completion of the course, a successful student will be able to-
1. Use Unix utilities and perform basic shell control of the utilities
2. Use the Unix file system and file access control.
3. Use of an operating system to develop software
4. Use Linux environment efficiently
5. Solve problems using bash for shell scripting

Course Code	17300212 Operating Sysems Lab									
Course Designed By	Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1			✓							
	CO2	✓			✓						✓
	CO3		✓			✓	✓				
	CO4	✓						✓		✓	
	CO5		✓		✓						
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
	✓										
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300412 Web Technologies Lab	0	0	3	2
Teaching	Total Contact Hours 48				

Prerequisite (s)	Knowledge about programming in Java				

Course Objective:
1. Learn web programming by designing.
2. Develop web based applications, their validations and deployment using HTML, XML, JavaScript, JavaBeans, Servlets, JDBC and JSP.

List of Programs

1. Write HTML code for creating a Weather Forecasting table with cities, their maximum and minimum temperatures. .(CO3)
2. Write HTML code for displaying a Restaurant Menu with images of food items and their costs. .(CO3)
3. Write HTML code for internal linking .(CO3)
4. Write HTML code for external linking.(CO3)
5. Write HTML code for Login Form validation using Javascript. .(CO3)
6. Write HTML code for creating a Student Registration Form .It should display "Thanks " Message in the end with students name. .(CO3)
7. Write an HTML page including any required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box. .(CO3)
8. Write an HTML page that contains a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size). .(CO3)
9. Write a calculator program in HTML that performs basic arithmetic operations (+,, /, * and %). Use CSS to change the foreground and background color of the values, buttons and result display area separately. Validate the input strings using JavaScript regular expressions. Handle any special cases like division with zero reasonably.(CO3)
10. Develop static pages (using Only HTML) of an online Book store. The pages should resemble: www.amazon.comThe website should consist the following pages.Home page, Registration and user Login, Books catalog, Shopping Cart, Payment By credit card, Order Confirmation. .(CO3)
11. Validate the Registration, user login, and payment by credit card pages designed in above program using JavaScript. .(CO3)
12. Write HTML code showing the use of filters. .(CO3)
13. Write HTML code showing the working of frames. .(CO3)

14. Write HTML code for Inline style sheet.(CO3)
15. Write HTML code for Embedded style sheet.(CO3)
16. Write HTML code for External style sheet.(CO3)
17. Write code for a number guessing game using Javascript. .(CO3)

18. Write code for performing arithmetic operations on numbers entered by user based on operation selection done by the user using Javascipt. .(CO3)
19. Create and save an XML document at the server, which contains 10 users information. .(CO7)
20. Write a Program to validate XML schema by including DTD. (CO7)
21. Write a servlet that takes name and age from an HTML page. If the age is less than
22. Write a Servlet Program for Printing "Good Morning " message.(CO4)
23. Write a Servlet Program for printing the favourite flower chosen by a user.(CO4)
24. Implement the "Hello World!" program using JSP .(CO4)
25. Write code for establishing connection with a database using Jdbc connectivity and servlets.(CO4)
26. Write a JSP which does following job- inserts the details of 3 or 4 users who registers with the website by using registration form. Authenticate user by his password.(CO4)
27. Create tables in database which contains the details of book such as Book name, price, quantity, amount using JDBC. (CO5)
28. Modify the catalogue page in such a way that you should connect to the database and extract data from tables and display them in catalogue page using JDBC. (CO5)
29. Design the static web pages required for an online book store web site(CO6).
30. Write an XML file which will display the Book information .It includes the following:1) Title of the book 2) Author Name3) ISBN number 4) Publisher name5) Edition6) Price.(CO7)

Course Outcomes:
After successful completion of the course, a successful student will be able to-

CO1 : Design and implement a basic website.
CO2 : Implement different navigation strategies.
CO3 : Use client-side technologies (XHTML, CSS, forms, JavaScript, and
CO4 : Use server-side technologies (Servlets and JSP) to implement websites.
CO5 : Develop simple back-end database to support a website.
CO6 : Recognize and evaluate website organizational structure and design elements.
CO7 : Create XML applications.

Course Code	17300412 Web Technologies Lab									
Course Designed By	Department of Computer Applications									
Program Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes — CO1				✓						
Course outcomes — CO2	✓						✓		✓	
Course outcomes — CO3			✓			✓				✓

	CO4		✓						
	CO5	✓			✓				✓	
	CO6			✓						
	CO7				✓			✓		✓

Category	Programming		Core		Mathematics Based	Non Computer Based	Latest Technology		
	✓								

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300421 Mini Project	0	0	2	2
Teaching	Total Contact Hours 32				
Prerequisite (s)	Knowledge about design phase and data collection				

Course Objective*:*
1. Learn to work as a team and to focus on getting a working project done on time with each student being held accountable for their part of the project.
2. Learn about and go through the software development cycle with emphasis on different processes - requirements, design, and implementation phases.
3. Understand programming language concepts.
4. Apply theoretical knowledge by operating and optimizing software development.

Guidelines to prepare Mini-Project

The student is expected to take up any industry oriented application and develop a mini-project on this topic preferably on C, C++, JAVA ,. NET. The implementation should involve all the phases of software development life-cycle i.e. problem formulation, design, implementation and testing phases.

Course Outcomes:

After successful completion of the course, a successful student will be able to-

CO1   : Gain practical experience of working on real applications
CO2   : Apply the concepts learned by them in various subjects.
CO3   : Gain experience of working as a team or group.
CO4   : Understand the importance of planning and designing in application design.

Course Code		17300421 Mini Project									
Course Designed By		Department of Computer Applications									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓						✓			✓
	CO2					✓			✓		
	CO3		✓				✓			✓	
	CO4				✓			✓			✓
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
									✓		
Mode of Evaluation :Reviews by Presentation											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300501 Data Warehousing and Data Mining**	4	0	0	4
Teaching	**Total Contact Hours - 65**				
Prerequisite (s)	**Knowledge of Databases, Query Languages**				

Course Objectives:

1. To impart knowledge on data mining principles techniques
2. To demonstrate basic data mining algorithms, methods and tools
3. To identify business applications of data mining, applying critical thinking, problem-solving, and decision-making skills

Unit - I

Objective: To introduce the data mining principles and data preprocessing. (**CO1, CO2**)

Introduction

Fundamentals of data mining, Data Mining Functionalities, Major issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

Data Preprocessing

Needs for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit - II

Objective: To implement the data warehouse and the development process. (**CO1**)

Data Warehouse and OLAP

Data Warehouse and OLAP Technology for Data Mining and Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining.

Unit - III

Objective: To provide the mining patterns, associations and advanced pattern mining. (**CO3**)

Mining Frequent Patterns, Associations, and Correlations:

Basic Concepts and Methods. Frequent Item set Mining Methods, Pattern Evaluation Methods.

Advanced Pattern Mining

Pattern Mining: A Road Map, Pattern Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Patterns, Pattern Exploration and Application.
Unit - IV

Objective: To introduce the basic concepts of classifications and their advanced methods. (**CO3**)

Classification

Basic Concepts, Decision Tree Induction, Bayes Classification methods, Rule-Based Classification,

Advanced Methods

Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Classification Using Frequent Patterns, lazy learners (or learning from your neighbours), other Classification Methods.

Unit - V

Objective: To providing the specifications of advanced clusters analysis and outlier detection.(**CO4,CO5**)

Cluster Analysis
Basic Concepts and Methods

Cluster Analysis , Partitioning Methods, Hierarchical Methods ,Density-Based Methods, Grid-Based Methods, Evaluation of Clustering
Advanced Cluster Analysis

Probabilistic Model-Based Clustering ,Clustering High-Dimensional Data , Clustering Graph and Network Data Clustering with Constraints.

Course Outcomes:

After successful completion of the course, a student will be able to

   CO1: Understand why the data warehouse in addition to traditional database systems.
   CO2: Perform the preprocessing of data and apply mining techniques on it.
   CO3: Identify the association rules, classification and clusters in large data sets.

CO4: Solve real world problems in business .

CO5: Solve real world problems scientific information using data mining.

Text Book:

1. Data Mining Concepts & Techniques "Jiawei Han, Micheline Kamber,Jian Pei,3e.

References:

1. Introduction to data mining: Pang- Ning Tan, Michel Steinbach, Vipin Kumar, Addision –Wesley.
2. Data Mining Concepts & Techniques "Jiawei Han, Micheline Kamber,Jian Pei,1e.
3. Data Mining Techniques, Arun K Pujari, University Press.
4. Data Warehousing Fundamentals, Paulraj Ponnaiah, Wiley.
5. The Data Warehouse Life cycle Tool kit, Ralph Kimball, Wiley .

Web Resources:

1. www.dataminingbook.info/uploads/book.pdf
2. www.cs.rpi.edu/~zaki/PaperDir/DMABOOK.pdf
3. www.ccs1.hnue.edu.vn/hungtd/DM2012/DataMining_BOOK.pdf
4. www.web.engr.illinois.edu/~hanj/bk2/toc.pdf

COURSE CODE		17300501 Data Warehousing and Data Mining									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓			✓	✓		✓		✓	
	CO2	✓	✓				✓		✓		
	CO3			✓		✓		✓			✓
	CO4	✓			✓			✓	✓	✓	
	CO5	✓	✓	✓			✓	✓			✓
Category	**Programming**		**Core**		**Mathematices Based**		**Non Computer Based**		**Latest Technology**		
									✓		
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300502 OOAD through UML	4	0	0	4
Teaching	Total Contact Hours - 65				
Prerequisite (s)	Knowledge of Object Oriented Concepts and Methodology				

Course Objectives:

1. To provide a snapshot of the activities in the different phases of the object-oriented development life cycle
2. To model a real-world application by using object diagram, E-R models
3. Design an application using class diagram, Sequence Diagram, Collaboration diagram and etc

Unit –I
Objective: To bring out the language together and agree on a standard for laying out a way to visualize complex systems and their requirements (**CO1**, **CO2, CO5**)

Introduction to UML:
The meaning of Object-Orientation, object identity, encapsulation, information hiding, polymorphism, genericity, importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture.

Unit –II
Objective: To understand the structure of a system by showing the system's *classes*, their attributes, operations (or methods), and the relationships among objects. To know the use of Object diagrams to render a set of objects and their relationships as an instance. (**CO2, CO3**)

Basic structural Modeling:
Classes, relationships, common mechanisms, diagrams.

Advanced structural modeling:
 Advanced relationships, interfaces, types & roles, packages, instances.

Class & object diagrams:
Terms, concepts, examples, modeling techniques, Class & Object diagrams.

Unit –III
Objective: To know the relationships and interactions among software objects in the Unified Modeling Language (UML).To understand the objects and classes involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. (**CO3,CO4**)

Collaboration diagrams

Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self messages.

Sequence diagrams

Terms, concepts, differences between collaboration and sequence diagrams, depicting synchronous messages with/without priority call back mechanism broadcast message.

Unit –IV

Objective: To understand the behavior – the set of all signals compatible with the system. An important feature of the behavioral approach is that it does not distinguish a priority between input and output variables. (**CO3,CO4**)

Behaviour Modeling

Interactions, use cases, use case diagrams, activity diagrams.

Advanced Behavioural Modeling

Events and signals, state machines, processes & threads, time and space, state chart diagrams.

Unit –V

Objective: To know the interaction of volumes, or to get an idea of how they look from different angles and to explore ideas. They can be used to exhibit and sell a design to help visualize a design. (**CO2,CO4**)

Architectural Modeling

Terms, concepts, examples, modeling techniques for component diagrams and deployment diagrams.

Course Outcomes:

After successful completion of the course, a student will be able to

CO1: Analyse the case studies.
CO2: Model in different views with respect user requirement.
CO3: Designing use case, logical, component and deployment.
CO4: Prepare document of any project.
CO5: Model a real world application by using ER-Diagrams.

Text Books:

1. The Unified Modeling Language User Guide, Grady Booch,Rambaugh, Ivar Jacobson, PEA.
2. Fundamentals of Object Oriented Design in UML,Meilir Page-Jones,Addison Wesley

References:

1. Head First Object Oriented Analysis & Design, Mclaughlin, SPDOReilly, 2006.
2. Object Oriented Analysis & Design,Grady Booch, TMH,First Edition, 2005.
3. The Unified Modeling Language Reference Manual, 2/e, Rambaugh, Grady Booch, etc., PEA,2005.
4. Object-Oriented Design with UML, Barclay, Savage, Elsevier, 2008.

Web Resources:

1. http://www.cs.umd.edu/~mvz/cmsc435-s09/pdf
2. http://www.dorsethouse.com/pdf/Dorset-House-fundood.pdf
3. http://www.matincor.com/documents/intro_ooad.pdf
4. http://pdfmanualdownload.hol.es/pdf/object-oriented-analysis-and-design-satzinger.pdf

COURSE CODE		17300502 OOAD through UML									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓		✓	✓	✓		✓		✓	
	CO2		✓				✓		✓		✓
	CO3			✓		✓					✓
	CO4	✓							✓	✓	
	CO5	✓	✓	✓			✓	✓			✓

Category	Programming		Core		Mathematices Based	Non Computer Based	Latest Technology		
								✓	
Mode of Evaluation :Written Examination									

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300503 Computer Graphics and Multimedia Systems**	4	0	0	4
Teaching	**Total Contact Hours – 65**				
Prerequisite (s)	**Basic Programming skills and mathematics**				

Course Objectives*:*

1. To know principles and current technologies of multimedia systems
2. To gain knowledge about issues in effectively representing, processing, and retrieving multimedia data such as sound and music, graphics, image and video will be addressed
3. To understand hands-on experience in those areas by implementing some components of a multimedia streaming system as their term project

Unit –I

Objective:
Be familiar with various software programs used in the creation and implementation of basic primitives. (**CO1**, **CO2, CO5**)

Introduction

Overview of Graphics System, Bresenham technique, Line Drawing and Circle Drawing Algorithms, DDA , Line Clipping , Text Clipping.

Unit –II
Objective:
To understand the behavior of two dimensional transformations such as Scaling, Rotation and Interactive Input methods. (**CO1, CO5**)

2D Transformations

 Two dimensional transformations, Scaling and Rotations , Interactive Input methods, Polygons, Splines,Bezier Curves, Window view port mapping transformation.

Unit –III
Objective:
To know the relationships and interactions between new emerging electronic technologies and graphic design. (**CO1**, **CO3**)

3D Transformations

3D Concepts, Projections, Parallel Projection , Perspective Projection , Visible Surface Detection Methods , Visualization and polygon rendering , Color models , XYZ-RGB-YIQ-CMY-HSV Models,- animation , Key Frame systems , General animation functions , morphing.

Unit –IV
Objective:

To know the importance of technical ability and creativity within design practice. (**CO3**, **CO5**)

Overview of Multimedia

Multimedia hardware & software, Components of multimedia, Text, Image , Graphics , Audio , Video , Animation and Authoring.

Unit –V
Objective: Understand the relationship between critical analysis and the practical application of design. (**CO3**, **CO5**)

Multimedia Systems and Applications

Multimedia communication systems , Data base systems, Synchronization Issues , Presentation requirements , Applications , Video conferencing , Virtual reality , Interactive video , video on demand

Course Outcomes:

After successful completion of the course, a student will be able to

CO1: solve a wide range of graphic design problems.
CO2: Interactive experiences for a wide range of audiences.
CO3: Use various software programs used in the creation and implementation of multi
      -media (interactive, motion/animation, presentation, etc.).
CO4: Known relationship between critical analysis and the practical application of
      design.
CO5: Develop issues related to emerging electronic technologies and graphic design.

Text Books

1. Hearn D and Baker M.P, "Computer graphics – C Version", 2nd Edition, Pearson Education, 2004(unit 1, 2 & 3)
2. Ralf Steinmetz, Klara steinmetz, "Multimedia Computing, Communications and Applications", Pearson education, 2004 (Unit 4 & 5)

References

1. Siamon J. Gibbs and Dionysios C. Tsichritzis, "Multimedia programming", Addison Wesley,   1995.

2. John Villamil, Casanova and Leony Fernanadez, Eliar, "Multimedia Graphics", PHI, 1998.

Web Resources:

1. https://publications.drdo.gov.in/ojs/index.php/djlit/article/viewFile/3418/1849
2. www.riemysore.ac.in/ict/unit__6___multimedia.html

		COURSE CODE 17300503 Computer Graphics and Multimedia Systems									
		COURSE DESIGNED BY				DEPARTMENT OF COMPUTER APPLICATIONS					
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓			✓	✓				✓	
	CO2	✓	✓				✓		✓		
	CO3		✓					✓			✓
	CO4				✓						
	CO5	✓		✓			✓				
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
	✓										
		Mode of Evaluation :Written Examination									

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300562A Software Project Management**	4	0	0	4
Teaching	Total Contact Hours -65				
Prerequisite (s)	Knowledge of project development and related activities				

Course Objectives*:*

1. To impart knowledge about specific roles within a software organization as related to project and process management
2. To Understand the basic infrastructure competences (e.g., process modeling and measurement)
3. To expose knowledge about the basic steps of project planning, project management,
4. To gain knowledge about quality assurance, and process management and their relationships

Unit –I
Objective: To introduce the concepts of different process models and evaluation and improving software economics through principles of conventional and modern software engineering methods.(**CO1**)

Conventional Software Management:
The waterfall model, conventional software management performance.

Evolution of Software Economics:
Software Economics, pragmatic software cost estimation.

Improving Software Economics:
Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new way:
The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Unit –II
Objective: To understand the phases in developing a product and the basic infrastructure competences. (**CO2**)

Life cycle phases:
Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process:
The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

Unit –III
Objective: To understand the Management perspective and technical perspective in product development and the basic infrastructure competences. (**CO1, CO2**)

Model based software architectures:
A Management perspective and technical perspective.

Work Flows of the process:
Software process workflows, Iteration workflows.

Checkpoints of the process
Major mile stones, Minor Milestones, Periodic status assessments

Iterative Process Planning
Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

Unit –IV
Objective: To understand the basic steps of project planning, project management and quality assurance. (**CO1, CO3**)

Project Organizations and Responsibilities:
Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Process Automation:
Automation Building blocks, The Project Environment.

Project Control and Process instrumentation
The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation.

Unit –V
Objective: To understand the relationship between future software management and modern process transitions. (**CO2, CO3**)

Tailoring the Process:
Process discriminates.

Future Software Project Management:
Modern Project Profiles, Next generation Software economics, modern process transitions.

Course Outcomes:

After successful completion of this course, a student will be able to

CO1: Capable to determine the purpose and importance of project management from the Perspectives of planning, tracking and completion of project.

CO2: Compare and differentiate organization structures and project structures.

CO3: Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Software Project Management in practice, PankajJalote, PEA,2005,

References:

1. Software Project Management, Bob Hughes,3/e, Mike Cotterell, TMH
2. Software Project Management, Joel Henry, PEA
3. Effective Software Project Management, Robert K.Wysocki, Wiley,2006
4. Project Management in IT, Kathy Schwalbe, Cengage

Web Resources:

1..http://walkerroyce.com/PDF/Successful_Software_Management.pdf
2.http://muele.mak.ac.ug/pluginfile.php/200806/mod_resource/content/1/Book%20Bhwalbe.pd
3.http://gvpce.ac.in/syllabi/Software%20Project%20Managment.pdf
4.http://elibrary.com.ng/UploadFiles/file0_1618.pdf

COURSE CODE		17300562A Software Project Management									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓		✓	✓		✓	✓			✓
	CO2	✓		✓		✓	✓		✓	✓	✓
	CO3		✓		✓			✓	✓		✓
Category	**Programming**		**Core**		**Mathematices Based**		**Non Computer Based**		**Latest Technology**		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300562B Data Science	4	0	0	4
Teaching	Total Contact Hours -65				
Prerequisite (s)	Knowledge of concepts related to data and its related activities				

Course Objectives*:*

1. To understand the basic concepts of data, methodologies for analyzing structured and unstructured data
2. To understand the relationship between the Data Scientist and the business needs

Unit- I
Objective: To address the growing need for data related skills. (**CO1, CO5**)

Introduction to foundations of Data Science

Data Manipulation at Scale
Map Reduce, Hadoop, and relationship to databases, algorithms, extensions, languages Databases, SQL and the relational algebra.

Unit-II
Objective: To recognize and analyze ethical issues in business related to intellectual property, data security, integrity and privacy. (**CO3**)

Parallel databases, parallel query processing, in-database analytics, Key-value stores and NoSQL, tradeoffs of SQL and NoSQL

Unit-III
Objective: To use data mining software to solve real world problems (**CO1, CO2, and CO3**)

Statistical Analytics
Programming in Python and R, Basic Data Mining-Basic statistical modeling, introduction to machine learning, over fitting Supervised learning-Linear and Logistic Regression, Classification, Unsupervised learning-Clustering, Association Rule mining

Unit-IV
Objective: To apply quantitative modeling and data analysis techniques to the solution of business problems communicate finding and present results using data visualization techniques. (**CO2, CO5**)

Graph/Text Data Analysis & Communicating Results
 Graph Analytics: Page Rank, community detection, recursive queries, iterative processing

Text Analytics:
TF/IDF, conditional random fields, Visualization, data products, visual data analytics.

Unit-V
Objective: To apply ethical practices in everyday business activities and make well reasoned ethical business and data management decisions. (**CO4**)

Parallel Computing
Concurrency and Data Decomposition, Message Based Parallelism –MPI, Thread Based Parallelism – OpenMP

Course Outcomes:

After successful completion of this course, a student will be able to

CO1: Apply fundamental algorithmic ideas to process data.
CO2: Leverage algorithmic insights in order to design novel data science algorithms.
CO3: Develop a solid background on foundations of data science algorithms.
CO4: Determine running times for common algorithms that process large-scale data.
CO5: Usage of terminology related to data science.

Text Books:

1. An Introduction to Data Science by Jeffrey M. Stanton.
2. DJ Patil (16 September 2011). "Building Data Science Teams". O'Reilly Media, Inc. Retrieved 7 July 2012.

References

1. Davenport, Thomas H. Patil, D.J. (2012). "Data Scientist: The Sexiest Job of the 21st Century". Harvard Business Review October 2012: 70-76. Retrieved 13 October 2012.
2. Mike Loukides (June 2010). "What is Data Science?" O'Reilly Media, inc. Retrieved 7 July 2012.
3. Longhow Lam (28 October 2010). "Introduction to R" The Comprehensive R Archive Network (CRAN). Retrieved 14 July 2012.

4. Emmanuel Paradis (12 September 2005). "R for Beginners". PDF. The Comprehensive R Archive Network (CRAN). Retrieved 14 July 2012.
5. Code School. "Try R". On-line Course. O'Reilly. Retrieved 16 May 2013.

Web Resources:

1. http://radar.oreilly.com/2010/06/what-is-data-science.html
2. http://www.nytimes.com/2009/08/06/technology/06stats.html
3. http://gerdleonhard.typepad.com/files/wef_ittc_personaldatanewasset_report_2011.pdf
4. http://radar.oreilly.com/2011/09/building-data-science-teams.html

COURSE CODE		17300562B Data Science									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓	✓		✓	✓			✓	✓
	CO2	✓		✓	✓	✓				✓	
	CO3	✓				✓	✓			✓	✓
	CO4		✓				✓	✓			
	CO5	✓		✓	✓			✓	✓		✓

Category	Programming	Core	Mathematices Based	Non Computer Based	Latest Technology	
					✓	

Mode of Evaluation :Written Examination

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300562C Mobile Application Development	4	0	0	4
Teaching	Total Contact Hours -65				
Prerequisite (s)	Knowledge of Java Programming and Networking basics				

Course Objectives*:*

1. To know the Mobile Application Development using J2ME Technology
2. To understand the basics of developing applications for Mobiles

Unit- I
Objective: To gain the new web-centric in highly distributive systems to meet instantaneous demand expected by concurrent users. (**CO3, CO4)**

J2ME Overview:
Java 2 Micro Edition and the World of Java, Inside J2ME

J2ME and Wireless Devices Small Computing Technology:
Wireless Technology, Radio Data Networks, Microwave Technology, Mobile Radio Networks, Messaging, Personal Digital Assistants.

Unit- II
Objective: To understand J2ME architecture, Development environment and the reality of working. (**CO1, CO2**)

J2ME Architecture and Development Environment:
J2ME Architecture, Small Computing Device Requirements, Run-Time Environment, MIDlet Programming, Java Language for J2ME, J2ME Software Development Kits, Hello World J2ME Style, Multiple MIDlets in a MIDlet Suite, J2ME Wireless Toolkit J2ME Best Practices and Patterns: The Reality of Working in a J2ME World, Best Practices

Unit- III
Objective: To gain the knowledge in J2ME application that you develop requires a way for a user to interact with it. (**CO1, CO5**)

J2ME User Interface
Commands, Items, and Event Processing J2ME User Interfaces, Display Class, the Palm OS Emulator, Command Class, Item Class, Exception Handling

High-Level Display Screens
Screen Class, Alert Class, Form Class, Item Class, List Class, Text Box Class, Ticker Class

Low-Level Display: Canvas:
The Canvas, User Interactions, Graphics, Clipping Regions, Animation

Unit- IV
Objective: To access and manipulate service-side components by web services and client-side applications. (**CO6**)

J2ME Data Management:
Record Management System, Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records

Record Listener JDBC Objects:
The Concept of JDBC, JDBC Driver Types, JDBC Packages, Overview of the JDBC Process, Database Connection, statement Objects, Result set, Transaction Processing, Metadata, Data Types

Exceptions JDBC and Embedded SQL:
Model Programs, Tables, Indexing, Inserting Data into Tables, Selecting Data from a Table, Metadata, Updating Tables, Deleting Data form a Table, Joining Tables, Calculating Data, Grouping and Ordering Data, Sub queries, Views

Unit- V
Objective: To implement routines to open communications with other applications network connection and also learn to utilize web services and create large-scale distributive systems. (**CO5, CO6**)

Generic Connection Framework:
The Connection, Hypertext Transfer Protocol, Communication Management Using HTTP Commands, Session Management, Transmit as a Background Process

Course Outcomes:

After successful completion of the course, a student will be able to-

CO1: Design, implement and evaluate a User Interface for a mobile application using J2ME.
CO2: Create a small but realistic working mobile application for small computing devices.
CO3: Categorize the challenges posed by developing mobile applications and be able to
　　　Propose and evaluate and select appropriate solutions.
CO4: Install and configure Android application development tools.
CO5: Design and develop user Interfaces for the Android platform.
CO6: Save state information across important operating system events.

Text Books:

1. J2ME: The Complete Reference, James Keogh, Tata McGraw- Hill Edition, 2003.
2. Wireless Java with J2ME, Morrison Michael, Tech Media, 2001.

References:

1. Enterprise J2ME: Developing Mobile Java Applications –Michael Juntao Yuan, Pearson Education, 2004.
2. Beginning Java ME Platform, Ray Rischpater, Apress, 2009.
3. Beginning J2ME: From Novice to Professional, Third Edition, Sing Li, Jonathan B. Knudsen, A press, 2005.
4. Kicking Butt with MIDP and MSA: Creating Great Mobile Applications, 1st edition, J.Knudsen, Pearson Education.

Web Resources:

1. http://www.vogella.com/articles/Android/article.html
2. http://androinica.com/category/androidguide/
3. http://www.learn-android-easily.com/
4. http://www.javatpoint.com/android-tutorial
5. http://www.raywenderlich.com/tutorials

COURSE CODE		17300562C Mobile Application Development									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓			✓		✓		✓		
	CO2		✓			✓					✓
	CO3				✓					✓	
	CO4			✓		✓		✓			
	CO5	✓			✓						✓
	CO6			✓			✓			✓	
Category	Programming			Core		Mathematices Based		Non Computer Based		Latest Technology	
										✓	
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
CourseCode	17300562D Machine learning	3	0	0	3
Teaching	Total Contact Hours:58				
Prerequisite (s)	Mathematical statistics, Algorithm Analysis, AI				

COURSE OBJECTIVES:

1. To understand the need for machine learning for various problem solving

2. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.

3. To understand the latest trends in machine learning

4. To design appropriate machine learning algorithms for problem solving

UNIT I   INTRODUCTION

Objective: To know the Basic and different machine learning approaches   and to use algorithms   in machine learning (CO1,CO3)

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II   NEURAL NETWORKS AND GENETIC ALGORITHMS

Objective: To discuss and apply Genetic algorithms to various problems. (CO3)

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III   BAYESIAN AND COMPUTATIONAL LEARNING

Objective:

To discuss and apply Bayesian algorithms or concepts to machine learning (CO4)

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naive Bayes Classifier – Bayesian

Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV   INSTANT BASED LEARNING

Objective: To discuss and differentiate The various machine learning approaches CO1)

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V   ADVANCED LEARNING

Objective: To Analyze and suggest appropriate machine learning approaches for machine learning (CO5)

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

COURSE OUTCOMES:

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

 CO1: Differentiate between supervised, unsupervised, semi-supervised machine learning
        approaches
 CO2: Discuss the decision tree algorithm and indentity and overcome the problem of
        Overfitting
 CO3: Discuss and apply the back propagation algorithm and genetic algorithms to various
        problems
 CO4: Apply the Bayesian concepts to machine learning

 CO5: Analyse and suggest appropriate machine learning approaches for various types of
        problems

TEXT BOOKS:

1.Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

REFERENCES:

1.Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and

Machine Learning), The MIT Press 2004.

2.Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

COURSE CODE		17300562D Machine learning									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10
Course outcomes	CO1		✓						✓		✓
	CO2			✓				✓			✓
	CO3		✓		✓		✓				
	CO4	✓			✓					✓	
	CO5	✓		✓						✓	
Category	**Programming**			**Core**		**Mathema tices Based**		**Non Compute r Based**		**Latest Technology**	
										✓	
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300563A Software Testing Methodologies**	4	0	0	4
Teaching	**Total Contact Hours -65**				
Prerequisite (s)	**Knowledge of software development cycle and phases**				

Course Objectives*:*

1. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods
2. To discuss various software testing issues and solutions in software unit test, integration, regression, and system testing
3. To know about test project, design test cases and data, conduct testing operations, manage software problems and defects, generate a testing report
4. To expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions
5. To gain software testing experience by applying software testing knowledge and methods to practice-oriented software testing projects
6. To understand software test automation problems and solutions
7. To learn how to write software testing documents, and communicate with engineers in various forms
8. To gain the techniques and skills on how to use modern software testing tools to support software testing projects

Unit - I

Objective: To know the basic idea of software testing techniques and strategies.(**CO2**)
Introduction
Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of Bugs.

Unit - II

Objective: To understand what type of testing techniques should be used in software development and basic concepts of testing.(**CO1,CO3,CO4**)

Transaction Flow Testing

Transaction flows, transaction flow testing techniques.

Dataflow testing

Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

Domain Testing

Domains and paths, nice & ugly domains, domain testing, domains and interfaces testing, domains and testability.

Unit - III
Objective: To enlighten the different products and expressions and introduce a logic based testing.(**CO1)**

Paths, Path products and Regular expressions
Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing
Overview, decision tables, path expressions, kv charts, specifications.

Unit - IV
Objective: To introduce how to use state charts, state graphs and introduce the testing tips.(**CO2)**

State, State Graphs and Transition testing
State graphs, good & bad state graphs, state testing, Testability tips.

Unit - V
Objective: To provide the different matrix of graph and node reduction.(**CO5**)

Graph Matrices and Application
Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.

Usage of JMeter and Win runner tools for functional / Regression testing, creation of test script for unattended testing, synchronization of test case, Rapid testing.

Course Outcomes:

After successful completion of the course, a student will be able to-

CO1: Apply software testing knowledge and engineering methods.

CO2: Design and conduct a software test process for a software testing project.

 CO3: Understand and identify various software testing problems, and solve   these   problems
          by designing and selecting software test models, criteria, strategies, and methods.

CO4: Use software testing methods and modern software testing tools for their testing projects.

Text Book:

1. Software Testing Techniques – Boris Beizer, Dreamtech, second edition

References:

1. The craft of software testing - Brian Marick, Pearson Education
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson
4. Effective methods of Software Testing, Perry, John Wiley
5. Art of Software Testing – Meyers, John Wiley
6. Software Testing Tools – Dr.K.V.K.K.Prasad, Dreamtech

Web Resources:

1. www.cs.cmu.edu/~luluo/Courses/17939Report.pdf
2. www.ir.nmu.org.ua/bitstream/.../24a555d1011fa1e62f0374963b072e04.pdf
3. www.i2.informatik.rwth-aachen.de/dl/mbt08/lec_notes_04.pdf

COURSE CODE		17300563A Software Testing Methodologies								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓			✓		✓	✓			
	CO2	✓		✓							✓
	CO3		✓				✓		✓		
	CO4	✓	✓			✓					
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
			✓								
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300563B Artificial Intelligence**	4	0	0	4
Teaching	**Total contact hours - 65**				
Prerequisite (s)	Basics of algorithms				

Course Objectives:
1. To study the concepts of Artificial Intelligence
2. To learn the methods of solving problems using Artificial Intelligence
3. To know the concepts of Expert Systems and machine learning

Unit – I
Objective: To overview of the basic concepts of artificial intelligence. **(CO1)**

Introduction to AI: Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

Unit – II
Objective: To introduce knowledge representation and predication logic **(CO2)**

Game playing: Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Unit – III
Objective:.To introduce fuzzy reasoning and Bayesian theory. **(CO2)**

Knowledge representation: Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.

Unit – IV
Objective: To introduce basic plan generation systems and machine learning. **(CO2, CO3)**

Basic plan generation systems: Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

Unit – V
Objective: To introduce expert systems. **(CO2, CO3)**

Expert systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

Course Outcomes
After successful completion of the course, a student will be able to-

CO1: Identify the problems that are amenable to solution by AI methods.
CO2: Identifying appropriate AI methods to solve a given problem.
CO3: Formalize a given problem in the language/framework of different AI methods.
CO4: Implementing basic AI algorithms.
CO5: Design and carry out an empirical evaluation of different algorithms on problem
formalization, and state the conclusions that the evaluation supports.

Text Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill-2008.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.

Reference books:

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
3. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

COURSE CODE		17300563B Artificial Intelligence								
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS								
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓		✓						
	CO2		✓	✓						✓	
	CO3	✓		✓							✓
	CO4				✓			✓			
	CO5			✓			✓				✓
Category	Programming		Core		Mathematics Based		Non Computer Based		Latest Technology		
									✓		
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300563C E-Commerce**	4	0	0	4
Teaching	Total Contact Hours -65				
Prerequisite (s)	Knowledge of Networking basics and other commercial activities				

Course Objectives:

1. To learn the advancements of electronic commerce this has become a compelling necessity in the present day communication based commerce which is happening in the digital space

2. To know the about electronic payment systems Safe and secure payment options and mechanism for generating trust among customers and building up their confidence for the particular site

Unit –I
Objective: To impart knowledge about the basic concepts of E-Commerce and its applications. (**CO1, CO2, CO3**)

Electronic Commerce
Framework, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications. Consumer Oriented Electronic commerce, Mercantile Process models.

Unit –II
Objective: To know the concepts of electronic payment systems and EDI. (**CO2, CO4**)

Electronic payment systems
Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

Inter Organizational Commerce
Electronic Data Interchange (EDI), EDI Implementation, Value added networks.

Unit –III
Objective: To gain the knowledge about the concepts of Intra Organizational Commerce and SCM. (**CO2**)

Intra Organizational Commerce
Work Flow, Automation Customization and Internal Commerce, Supply chain Management.

Unit –IV
Objective: To impart knowledge about the Corporate Digital Library, Advertising and Marketing on Internet. (**CO6)**

Corporate Digital Library
Document Library, Digital Document types, corporate Data Warehouses.

Advertising and Marketing
Information based marketing, advertising on Internet, on-line marketing process, market research.

Unit –V
Objective: To introduce the concepts of Consumer Search and Resource Discovery and Desktop video processing. (**CO5, CO7)**

Consumer Search and Resource Discovery
Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia
Key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Course Outcomes:

After successful completion of the course, a student will be able to-

CO1: Understand modern computing infrastructures from the perspective of the internet and
      Organizations.
CO2: Having ability to solve theoretical and practical issues of conducting business over
      the internet and the Web
CO3: Reflect on general principles revealed through practical exploration of specific tools,
      techniques and methods in e-business.

Text Books:

1. Frontiers of electronic commerce –Kalakota, Whinston, Pearson,First edition,2007.
2. Electronics Commerce,Chung H.Michael,PEA,First Edition 2000.

References:

1. Electronic Commerce – Gary P.Schneider –Thomson,7th Edition, 2007.
2. Electronic Commerce Tanban Efrain,PEA,First edition 2001.
3. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.

Web Resources:

1. www.tutorialspoint.com/e_commerce/e_commerce_tutorial.pdf
2. www.pearsonhighered.com/samplechapter/0131735160.pdf
3. www.wiley.com/college/turban/0471073806/sc/ch09.pdf

COURSE CODE		17300563C E-Commerce									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓		✓	✓					✓	
	CO2		✓				✓					
	CO3			✓					✓		✓
Category	Programming		Core		Mathematices Based		Non Computer Based		Latest Technology		
										✓	
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300511 Data Warehousing And Data Mining Lab**	0	0	3	2
Teaching	**Total Contact Hours -45**				
Prerequisite (s)	**Knowledge of database tools and languages**				

Course Objectives*:*

1. To expertise how to use data warehousing tools
2. To understand how to use data mining tools basic principles, concepts and applications of data warehousing and data mining
3. To understand the task of data mining as an important phase of knowledge recovery process

Using Weka and Informatica tools

1. Design a DFD with Simple Transformation, Make your own assumptions by taking any Schema of your choice? (**CO1, CO2**)
2. Design a DFD taking into consideration the following Ports for Customer Schema: Cno, Cname, C location. By employing a FLAT FILE, and Insert any 5 Records in the Customer Schema? (**CO1, CO2**)
3. Design a DFD taking into consideration the following Ports as Emp_Id, Ename,Salary, Dept_No and perform the following on Dept_No Port by grouping up the Salary Port by using Filter Transformation? (**CO1, CO2**)
4. Calculate the TAX for the schema EMPLOYEE by considering the following:- Emp_Id, Ename, Salary, Dept_No by using Expression Transformation. Tax should be calculated on the Salary port with 20% (**CO1, CO2**)
5. Consider the DEPT Schema with the ports Dept_No, Dname, Dlocation and perform XML Transformation?
6. Design a DFD taking into consideration the following EMP_Schema:Emp_Id, Ename, Deptno, Salary.Apply "Router transformation" (**CO1, CO2**)
7. Design a DFD taking into Consideration the Employee Schema and take the Following ports: Emp_Id, Ename, Salary, Deptno and Sort on the port called Salary by using   "Sorter Transformation"? (**CO1, CO2**)
8. Design a DFD taking into consideration the following information EMP Table and DEPT Table and Join the Two Tables (EMP, DEPT) with a "Joiner Transformation"?
9. Design a DFD taking into consideration EMP_Schema and calculate the SUM & AVERAGE of Salary using Aggregator Transformation. (**CO1, CO2**)

10. Demonstrations of association rule process on data set using aprioriate Algorithm. (**CO1,CO2**)
11. Demonstrations on classification rule process on dataset student.arff, J48 algorithm. (**CO1,CO2**)
12. Demonstrations of classification rule process on dataset employee.arrf using ID3 algorithm. (**CO1,CO2**)
13. Demonstrations of classification rule process on dataset employee.arrf using Naïve Bayes algorithm. (**CO1,CO2**)
14. Demonstrate clustering rule process on dataset student.arrf using single K-means. (**CO1,CO2**)
15. Creation of simple transformation for employee data. (**CO3,CO4**)

Course Outcomes:

After successful completion of this course a student will be able to -

CO1: Apply data mining techniques in real applications.
CO2: Decision on which concepts to be used and how to be used in applications.

CO3: Design a Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.

CO4: Design a data warehouse or data mart to present information needed by management in a form that is usable for management client.

COURSE CODE		17300511 Data Warehousing and Data Mining Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓						✓			✓
	CO2		✓			✓			✓		✓
	CO3			✓	✓	✓				✓	
	CO4	✓	✓				✓				✓
Category	**Programming**		**Core**		**Mathematices Based**		**Non Computer Based**		**Latest Technology**		
									✓		
Mode of Evaluation : Practical Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300512 OOAD through UML Lab**	0	0	3	2
Teaching	Total Contact Hours -45				
Prerequisite (s)	Knowledge of general programming concepts				

Objectives:
1. Construct UML diagrams for static view and dynamic view of the system
2. Generate creational patterns by applicable patterns for given context
3. Create refined model for given Scenario using structural patterns
4. Construct behavioral patterns for given applications

Suggested Applications:

1. ATM application
2. Library management system
3. Online book shop
4. Railway reservation system
5. Banking system
6. Auction system
7. Point of sale system
8. Airline reservation system
9. Passport automation system.
10. Book bank
11. Exam registration
12. Stock maintenance system.
13. Online course reservation system
14. E-Ticketing
15. Software personnel management system
16. Credit card processing
17. E-Book management system
18. Recruitment system
19. Foreign trading system
20. Conference management system
21. BPO management system

Familiarization with Rational Rose or Umbrella
For each application (CO1)

For each application:
a) Identify and analyze events

b) Identify Use cases

c) Develop event table

d) Identify & analyze domain classes

e) Represent use cases and a domain class diagram using Rational Rose
(CO1, CO4, CO5)

For each application:
a) Develop Use case diagrams

b) Develop elaborate Use case descriptions & scenarios

c) Develop prototypes (without functionality)

d) Develop system sequence diagrams
(CO1, CO3)

For each application:
a) Develop high-level sequence diagrams for each use case

b) Identify objects for each use case

c) Develop detailed Sequence Diagrams / Collaboration Diagrams
(CO1, CO5)

For each application:
a) Develop Use case Packages

b) Develop Component Diagrams

c) Identify relationships between use cases and represent them
(CO1, CO7)

For each application:
 Develop sample diagrams for other UML diagrams - state chart diagrams, activity diagrams and deployment diagrams **(CO5)**

Text Books:

1. Object-Oriented analysis&design with unified process by Satzinger, Jackson & Burd Cengage.
2. UML 2 Toolkit, by Hans-Erik Eriksson, Magnus Penker,Leang Brian Lyons, David Fado: WILE\'-Dreamtech India Pvt.Lid.

Course Outcomes:

After successful completion of this course a student will be able to -

CO1: Understand the Case studies and design the Model.
CO2: Understand how design patterns solve design problems.
CO3: Develop design solutions using creational patterns.
CO4: Construct design solutions by using structural and behavioral patterns.
CO5: Able to construct UML diagrams for static view and dynamic view of the system.
CO6: Model creational patterns by applicable patterns for given context.
CO7: Create refined model for given Scenario using structural patterns.
CO8: Able to construct behavioral patterns for given applications.

COURSE CODE		17300512 OOAD through UML Lab									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1		✓		✓		✓			✓	✓
	CO2	✓							✓		
	CO3	✓		✓				✓			
	CO4		✓			✓					
	CO5	✓				✓					
	CO6						✓		✓		
	CO7	✓			✓			✓			✓
	CO8					✓				✓	
Category	**Programming**		**Core**		**Mathematices Based**		**Non Computer Based**		**Latest Technology**		
	✓										
Mode of Evaluation : Practical Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300513 Computer Graphics and Multimedia Systems Lab**	0	0	3	2
Teaching	**Total Contact Hours -45**				
Prerequisite (s)	**Knowledge of general programming concepts**				

Objectives:

1. Understand the need of developing graphics applications
2. Learn the hardware involved in building graphics applications
3. Learn algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc
4. Learn the representation and transformation of graphical images and pictures

Experiments:

1. Study of Fundamental Graphics Functions. **(CO1)**
2. Implementation of DDA Algorithm for line drawing**(CO1, CO4, CO5)**
3. Implementation of Bresenham's Algorithm for line drawing (**CO1, CO4, CO5**)
4. Menu driver program to rotate scale and translate a line point, square triangle about the origin.**(CO1, CO4, CO5)**
5. Program to implement reflection of a point line. **(CO1, CO4, CO5)**
6. Program to perform shearing on a line **(CO1, CO4, CO5)**
7. Implementation of Bresenham's Algorithm for circle drawing **(CO1, CO3)**
8. Implementation of Mid-Point Algorithm   **(CO1, CO3)**
9. Implementation of Bresenham's Ellipse Drawing Algorithm **(CO1, CO5)**
10. Program to implement polygon filling **(CO1, CO5)**
11. Program to implement various transformations on line, square and rectangle **(CO1, CO5)**
12. Programs on 2D transformations **(CO1, CO6)**
13. Programs to implement Cohen Sutherland line clipping algorithm **(CO1, CO6)**
14. Programs to implement Sutherland Hodgemann polygon clipping algorithm **(CO1, CO6)**
15. Program to draw Bezier curve. **(CO2, CO6)**
16. Programs on 3D transformations **(CO2, CO6)**
17. Implementation of visualization of projection of 3d images. **(CO2, CO6)**
18. Program to implement a 3D Scene**(CO2, CO6)**
19. Program to implement JPEG compression scheme for still images. **(CO2, CO6)**
20. Create an animation to represent the Growing Moon.**(CO3,CO4,CO5)**
21. Create an animation to indicate a Ball bouncing on Steps. **(CO3,CO4)**
22. Implement Simulation for moment of Cloud. **(CO4,CO5)**

23. Draw the Fan blades and to give proper Animation. **(CO3,CO4)**

Text Books:

1. Hearn D and Baker M.P, "Computer graphics – C Version", 2nd Edition, Pearson Education, 2004.
2. Ralf Steinmetz, Klara Steinmetz, "Multimedia Computing, Communications and pplications", Pearson education, 2004.

Course Outcomes:

After successful completion of this course a student will be able to –

CO1: Develop graphics applications.
CO2: Create hardware involved in building graphics applications.
CO3: Develop algorithms for graphic primitives like: line, circle, ellipse etc.
CO4: Model transformation of graphical images and pictures.
CO5: Understand the Case studies and design the Model.
CO6: Understand how design patterns solve design problems

		COURSE CODE 17300513 Computer Graphics and multimedia Systems Lab									
		COURSE DESIGNED BY DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10
Course outcomes	CO1		✓		✓		✓			✓	
	CO2	✓							✓		
	CO3	✓		✓				✓			
	CO4		✓			✓					✓
	CO5	✓				✓					
	CO6						✓		✓		
Category		**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**	
		✓									
		Mode of Evaluation :Practical Examination									

Description	Subject Teaching Methodology	L	T	P	C
Course Code	**17300601 BIG DATA ANALYTICS**	4	0	0	4
Teaching	**Total Contact Hours 64**				
Prerequisite (s)	Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.				

Course Objectives*:*

1. To understand the computational approaches to Modeling, Feature Extraction.
2. To know the need and application of Map Reduce
3. To apply the various search algorithms applicable to Big Data
4. To analyze and interpret streaming data
5. To learn how to handle large data sets in main memory
6. *To learn the various clustering techniques applicable to Big Data*

Unit –I
Objective: Learn ways of storing data that allow for efficient processing and analysis, and gain the skills you need to store, manage, process, and analyze massive amounts of unstructured data**.(CO1)**

Introduction to Big data
Big Data – Definition, Characteristic Features – Big Data Applications, Big Data vs Traditional Data - Risks of Big Data, Structure of Big Data, Challenges of Conventional Systems, Web Data ,Evolution of Analytic Scalability, Evolution of Analytic Processes, Tools and methods, Analysis vs Reporting, Modern Data Analytic Tools.

Unit –II
Objective: To process large data sets using Hadoop to extract values **(CO3)**

Hadoop framework
Distributed File Systems, Large-Scale File System Organization, HDFS concepts, MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication,Hadoop YARN. Introduction to SPARK, Features of Apache SPARK, Components of SPARK, Resilient Distributed Data Sets.

Unit –III
Objective: To understand the statistical and classification methods in data analytics. **(CO4)**

Data analysis

Statistical Methods: Regression modeling, Multivariate Analysis , Classification: SVM & Kernel Methods, Rule Mining, Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data, Predictive Analytics, Data analysis using R.

Unit –IV

Objective: To know utilization of data by various statistical and data mining approaches.**(CO2)**

Mining data streams

Streams: Concepts, Stream Data Model and Architecture, Sampling data in a stream, Mining Data Streams and Mining Time-series data, Real Time Analytics Platform (RTAP) Applications, Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Unit –V

Objective: To know the concepts of Querying large data sets in near real time with Pig and Hive.
(CO1, CO3)

Big data frameworks

Introduction to NoSQL, Aggregate Data Models, Hbase: Data Model and Implementations, Hbase Clients, Examples. Cassandra: Data Model, Examples - Cassandra Clients, Hadoop Integration. Pig, Grunt, Pig Data Model, Pig Latin, developing and testing Pig Latin scripts. Hive, Data Types and File Formats, HiveQL Data Definition, HiveQL Data Manipulation, HiveQL Queries

Course Outcomes:

After successful completion of the course, a student will be able to-

CO1 :Understand how to leverage the insights from big data analytics
CO2 :Analyze data by utilizing various statistical and data mining approaches
CO3 :Perform analytics on real-time streaming data
CO4 : Understand the various NoSQL alternative database models

Text Books:

1. Bill Franks, ―Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics‖, Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.

References:

1. Michael Berthold, David J. Hand, ―Intelligent Data Analysis‖, Springer, Second Edition, 2007.

2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, , O'Reilly Media, 2013.
5. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
6. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Web Resources

1. http://www.chinastor.org/upload/2014-05/14051214396874.pdf
2. https://link.springer.com/content/pdf/bfm%3A978-3-540-48625-1%2F1.pdf
3. https://www.dagstuhl.de/Reports/00/00331.pdf
4. https://www.sas.com/storefront/aux/en/spbdaa/64794_excerpt.pdf
5. https://leseprobe.buch.de/images-adb/c9/d1/c9d14466-7e79-4482-9a44-0ee4c8dcf43d.pdf

COURSE CODE		17300601 **BIG DATA ANALYTICS**									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1	✓					✓				✓
	CO2		✓	✓				✓	✓		✓
	CO3	✓			✓						
	CO4			✓		✓			✓	✓	
Category	**Programming**		**Core**		**Mathematics Based**		**Non Computer Based**		**Latest Technology**		
	✓								✓		
Mode of Evaluation :Written Examination											

Description	Subject Teaching Methodology	L	T	P	C
Course Code	17300611 BIG DATA ANALYTICS LAB	0	0	3	2
Teaching	Total Contact Hours 42				
Prerequisite (s)	knowledge of Programming Language (Java preferably), Practice of SQL (queries and sub queries)				

**Course Objectives*:*

1. To implement Map Reduce programs for processing big data
2. To realize storage of big data using H base, Mongo DB
3. To analyze big data using linear models
4. To analyze big data using machine learning techniques such as SVM / Decision tree, classification and clustering

Software's Required
Hadoop, YARN, SPARK, R Package, Hbase and MongoDB

List of Programs

 Hadoop

 1. Implement the following data structures in Java (CO2)
    a) Linked Lists   b) Stacks
 2. Implement the following data structures in Java (CO2)
    a) Queues   b) Set   c) Map
 3. Install, configure and run Hadoop and HDFS (CO1)
 4. Implement word count / frequency programs using MapReduce(CO2)
 5. Implement an MR program that processes a weather dataset.(C02)
 6. Implement the following file management tasks in Hadoop (CO2)
    a. Adding files and directories
    b. Retrieving files
    c. Deleting of files
7. Implement Matrix multiplications with Hadoop Map reduce.(CO1,CO2)
8. Installation of Apache Pig (CO1)
9. Installation of Hive (CO1)
10. Perform create, update and insert operations for NOSQL database using mongodb (CO2)
11. Install, Configure and Working with SPARK.(CO1)

R

12. Study basic functions and commands in R programming (CO3)
13. Implement Linear and logistic Regression (CO4)
14. Implement SVM / Decision tree classification techniques(CO3,CO4)
15. Implement clustering techniques (CO4)
16. Install and run Pig then write Pig Latin scripts to sort, group, join, project and filter your data. (CO1,CO5)
17. Visualize data using any plotting framework(CO4)
18. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R (CO5)
19. Implement Flajolet-Martin algorithm for counting distinct elements in stream data. (CO5)
20. To find Term Frequency and Inverse Document Frequency (tf-idf) Matrix for Recommendation Systems and Plot TF Using R used. (CO4, CO5)
21. To finding similar documents with Cosine Similarity in R. (CO5)

Course Outcomes:

After successful completion of the course, a student will be able to-

   CO1 :Able to install Pig, Hive, SPARK and configure Hadoop and HDFS
   CO2 :Process big data using Hadoop framework
   CO3 :Understand R programming basics.
   CO4 :Build and apply linear and logistic regression models
   CO5 :Perform data analysis with machine learning methods

References:

1. Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, ―An Introduction to Statistical Learning with Applications in R‖, Springer Publications, 2015(Corrected 6 th Printing)
3. Hadley Wickham,‖ggplot2 – Elegant Graphics for Data Analysis‖, Springer Publications,2nd Edition, 2016
4. Kristina Chodorow, "MongoDB: The Definitive Guide – Powerful and Scalable Data Storage", O'Reilley, 2nd Edition, 2013.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.
6. Tom White, ―Hadoop: The Definitive Guide – Storage and Analysis at Internet Scale‖, O'Reilley, 4th Edition, 2015.

COURSE CODE		**17300611 BIG DATA ANALYTICS LAB**									
COURSE DESIGNED BY		DEPARTMENT OF COMPUTER APPLICATIONS									
Program Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
Course outcomes	CO1			✓							✓
	CO2	✓					✓				
	CO3		✓		✓				✓		
	CO4							✓			
	CO5				✓						✓

Category	Programming		Core	Mathematics Based	Non Computer Based	Latest Technology	
	✓					✓	

Mode of Evaluation :Practical Examination