CURRICULUM FRAMEWORK AND SYLLABUS

FOR OUTCOME BASED EDUCATION IN

Master of Computer Applications (M.C.A) Degree Program

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2018-2019 ONWARDS

(Choice Based Credit System)

THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided ISO 9001-2008 certified
Autonomous Institution affiliated to Anna University)

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BOS meeting approved: 13-07-2018   Approved in 56th Academic Council meeting on 21-07-2018

THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI 625 015

DEPARTMENT OF COMPUTER APPLICATIONS

VISION

"Be the very pinnacle of academic and research excellence in Computer Applications"

MISSION

As a Department, We are committed to

- Achieve academic excellence in Computer Applications through innovative teaching and learning processes.
- To prepare the students to be professionally competent to face the challenges in the industry.
- Promote inter-disciplinary research among the faculty and the students to create state of art research facilities.
- To promote quality and ethics among the students.
- Motivate the students to acquire entrepreneurial skills to become global leaders.

Programme Educational Objectives (PEO)

Post graduates of MCA program will be

PEO1: Utilizing strong technical aptitude and domain knowledge to develop smart software solutions for the upliftment of society.

PEO2: Applying research and entrepreneurial skills augmented with a rich set of communication, teamwork and leadership skills to excel in their profession.

PEO3: Showing continuous improvement in their professional career through life-long learning, appreciating human values and ethics.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

Graduate Attributes for MCA Programme (GA)

1. Computational Knowledge:
Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

2. Problem Analysis:
Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

3. Design /Development of Solutions:
Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Computing Problems:
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage:
Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

6. Professional Ethics:
Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

7. Life-long Learning:
Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

8. Project management and finance:
Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

9. Communication Efficacy:

Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

10. Societal and Environmental Concern:

Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

11. Individual and Team Work:

Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

12. Innovation and Entrepreneurship

Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Programme Outcomes (PO) for Master of Computer Applications (2017-2018) onwards

On completion of MCA programme, the students are expected to

PO1: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO2: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO7: Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and

write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

PO11: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PEO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	▨	▨	▨	▨	▨		▨	▨		▨		
PEO2	▨	▨	▨	▨					▨		▨	▨
PEO3	▨	▨	▨		▨	▨	▨	▨		▨	▨	

PO-GA MAPPING:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	▨											
PO2		▨										
PO3			▨									
PO4				▨								
PO5					▨							
PO6						▨						
PO7							▨					
PO8								▨				
PO9									▨			
PO10										▨		
PO11											▨	
PO12												▨

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

MCA CURRICULUM 2018-2019 ONWARDS

CHOICE BASED CREDIT SYSTEM

Credit Distribution:

S.No.	Category of courses	Credits	Percentage of Credits to Total Credits
1	Foundation Courses	16	12.6%
2	Professional Core- Theory	63	49.6%
3	Professional Core - Practical	18	14.2%
4	Professional Core – Theory cum Practical	4	3.1%
5	Professional Electives	12	9.5%
6	Employability Enhancement Courses	14	11%
	Total Credits	**127**	**100%**

Foundation courses (FC):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA110	Mathematical Foundations of Computer Science	FC	3	1	-	4
17CA120	Programming in C	FC	3	1	-	4
17CA250	Accounting and Financial Management	FC	3	1	-	4
17CA310	Operations Research	FC	3	1	-	4

Professional Core (PC):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
17CA130	Computer Organization and Architecture	PC	3	-	-	3
17CA140	Data Structures	PC	3	1	-	4
17CA150	Database Management Systems	PC	4	-	-	4
17CA170	Data Structures using C Laboratory	PC	-	-	4	2
17CA180	RDBMS Laboratory	PC	-	-	4	2
17CA210	Organizational Behaviour	PC	3	-	-	3
17CA220	Object Oriented Programming using C++	PC	3	1	-	4
17CA230	Design and Analysis of Algorithms	PC	3	1	-	4
17CA240	Operating Systems	PC	4	-	-	4
17CA270	C++ Programming Laboratory	PC	-	-	4	2
17CA280	Algorithms Implementation and Analysis using C Laboratory	PC	-	-	4	2
17CA320	Internet and Java Programming	PC	4	-	-	4
17CA330	Object Oriented Modeling and Design Patterns	PC	3	1	-	4
17CA340	Software Engineering	PC	3	1	-	4
17CA350	Data Warehousing and Data Mining	PC	3	1	-	4
17CA370	Java Programming Laboratory	PC	-	-	4	2
17CA380	Data warehousing and Data Mining Laboratory	PC	-	-	4	2
17CA410	Electronic Commerce and Electronic Business	PC	3	-	-	3
17CA420	Computer Networks	PC	3	1	-	4
17CA430	Software Quality and Testing	PC	3	1	-	4
17CA470	Web Technologies Laboratory	PC	-	-	2	1
17CA480	Software Engineering Laboratory	PC	-	-	2	1
17CA490	Mathematical Computing Laboratory	PC	-	-	4	2
17CA510	Software Project Management	PC	3	-	-	3
17CA520	Management Information System	PC	3	-	-	3
17CA530	Data Analytics	PC	3	1	-	4
17CA560	Mobile Application Development	PC	2	-	4	4
17CA570	Enterprise Applications Development Laboratory	PC	-	-	4	2

Professional Electives (PE):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
17CAPA0	Agile Software Development	PE	3	-	-	3
17CAPB0	Programming In C# Using .Net	PE	3	-	-	3
17CAPC0	Storage Management Techniques	PE	3	-	-	3
17CAPD0	Cyber Security and Law	PE	3	-	-	3
17CAPE0	Wireless Ad Hoc Networks	PE	3	-	-	3
17CAPF0	Supply Chain Management	PE	3	-	-	3
17CAPG0	Managerial Economics	PE	3	-	-	3
17CAPH0	Business Analytics	PE	3	-	-	3
17CAPL0	Customer Relationship Management	PE	3	-	-	3
17CAPM0	Enterprise Resource Planning	PE	3	-	-	3
17CAPN0	Business Process Re-engineering	PE	3	-	-	3
17CAPQ0	Social Network Analysis	PE	3	-	-	3
17CAPR0	Open Source Software	PE	3	-	-	3
17CAPS0	Soft Computing	PE	3	-	-	3
17CAPT0	Cloud Computing	PE	3	-	-	3

Employability Enhancement Courses (EEC):

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
17CA290	Professional Communication	EEC	-	1	2	2
17CA610	Project	EEC	-	-	24	12

Thiagarajar College of Engineering, Madurai – 625 015
Department of Computer Applications
Scheduling of Courses

Sem-ester	Theory					Theory cum Practical	Practical			Credits
1st (23)	17CA110 Mathematical Foundations of Computer Science 3:1	17CA120 Programming in C 3:1	17CA130 Computer Organization and Architecture 3:0	17CA140 Data Structures 3:1	17CA150 Database Management Systems 4:0	-	17CA170 Data Structures using C Laboratory 0:2	17CA180 RDBMS Laboratory 0:2		23
2nd (25)	17CA210 Organizational Behaviour 3:0	17CA220 Object Oriented Programming using C++ 3:1	17CA230 Design and Analysis of Algorithms 3:1	17CA240 Operating Systems 4:0	17CA250 Accounting and Financial Management 3:1	-	17CA270 C++ Programming Laboratory 0:2	17CA280 Algorithms Implementation and Analysis using C Laboratory 0:2	17CA290 Professional Communication 0:2	25
3rd (24)	17CA310 Operations Research 3:1	17CA320 Internet and Java Programming 4:0	17CA330 Object Oriented Modeling and Design Patterns 3:1	17CA340 Software Engineering 3:1	17CA350 Data Warehousing and Data Mining 3:1	-	17CA370 Java Programming Laboratory 0:2	17CA380 Data Warehousing and Data Mining Laboratory 0:2		24
4th (21)	17CA410 Electronic Commerce and Electronic Business 3:0	17CA420 Computer Networks 3:1	17CA430 Software Quality and Testing 3:1	17CAPX0 Elective I 3:0	17CAPX0 Elective II 3:0	-	17CA470 Web Technologies Laboratory 0:1	17CA480 Software Engineering Laboratory 0:1	17CA490 Mathematical Computing Lab 0:2	21
5th (22)	17CA510 Software Project Management 3:0	17CA520 Management Information System 3:0	17CA530 Data Analytics 3:1	17CAPX0 Elective III 3:0	17CAPX0 Elective IV 3:0	17CA560 Mobile Application Development 2:2	17CA570 Enterprise Applications Development Laboratory 0:2			22
6th (12)	17CA610 Project 0:12									12
									Total Credits	127

THIAGARAJAR COLLEGE OF ENGINEERING: MADURAI – 625 015

Master of Computer Applications (M.C.A) Degree Program

Choice Based Credit System

COURSES OF STUDY

(For the candidates admitted from 2018-2019 onwards)

FIRST SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA110	Mathematical Foundations of Computer Science	FC	3	1	-	4
17CA120	Programming in C	FC	3	1	-	4
17CA130	Computer Organization and Architecture	PC	3	-	-	3
17CA140	Data Structures	PC	3	1	-	4
17CA150	Database Management Systems	PC	4	-	-	4
PRACTICAL						
17CA170	Data Structures using C Laboratory	PC	-	-	4	2
17CA180	RDBMS Laboratory	PC	-	-	4	2
Total			16	3	8	23

SECOND SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA210	Organizational Behaviour	PC	3	-	-	3
17CA220	Object Oriented Programming using C++	PC	3	1	-	4
17CA230	Design and Analysis of Algorithms	PC	3	1	-	4
17CA240	Operating Systems	PC	4	-	-	4
17CA250	Accounting and Financial Management	FC	3	1	-	4
PRACTICAL						
17CA270	C++ Programming Laboratory	PC	-	-	4	2
17CA280	Algorithms Implementation and Analysis using C Laboratory	PC	-	-	4	2
17CA290	Professional Communication	EEC	-	1	2	2
Total			16	4	10	25

BOS meeting approved: 13-07-2018   Approved in 56th Academic Council meeting on 21-07-2018

THIRD SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA310	Operations Research	FC	3	1	-	4
17CA320	Internet and Java Programming	PC	4	-	-	4
17CA330	Object Oriented Modeling and Design Patterns	PC	3	1	-	4
17CA340	Software Engineering	PC	3	1	-	4
17CA350	Data Warehousing and Data Mining	PC	3	1	-	4
PRACTICAL						
17CA370	Java Programming Laboratory	PC	-	-	4	2
17CA380	Data warehousing and Data Mining Laboratory	PC	-	-	4	2
Total			**16**	**4**	**8**	**24**

FOURTH SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA410	Electronic Commerce and Electronic Business	PC	3	-	-	3
17CA420	Computer Networks	PC	3	1	-	4
17CA430	Software Quality and Testing	PC	3	1	-	4
17CAPX0	Elective I	PE	3	-	-	3
17CAPX0	Elective II	PE	3	-	-	3
PRACTICAL						
17CA470	Web Technologies Laboratory	PC	-	-	2	1
17CA480	Software Engineering Laboratory	PC	-	-	2	1
17CA490	Mathematical Computing Laboratory	PC	-	-	4	2
Total			**15**	**2**	**8**	**21**

BOS meeting approved: 13-07-2018   Approved in 56th Academic Council meeting on 21-07-2018

FIFTH SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA510	Software Project Management	PC	3	-	-	3
17CA520	Management Information System	PC	3	-	-	3
17CA530	Data Analytics	PC	3	1	-	4
17CAPX0	Elective III	PE	3	-	-	3
17CAPX0	Elective IV	PE	3	-	-	3
THEORY CUM PRACTICAL						
17CA560	Mobile Application Development	PC	2	-	4	4
PRACTICAL						
17CA570	Enterprise Applications Development Laboratory	PC	-	-	4	2
	Total		**17**	**1**	**8**	**22**

SIXTH SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
PRACTICAL						
17CA610	Project	EEC	-	-	24	12
	Total				**24**	**12**

FC   : Foundation Course
PC   : Professional Core
PE   : Professional Elective
EEC   : Employability Enhancement Course

L   : Lecture
T   : Tutorial
P   : Practical

Note:
1 Hour Lecture/week is equivalent to 1 credit

1 Hour Tutorial/week is equivalent to 1 credit

2 Hour Practical/week is equivalent to 1 credit

Total credits to be earned for the award of degree: 127

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THIAGARAJAR COLLEGE OF ENGINEERING, MADURAI – 625 015

Master of Computer Applications (M.C.A) Degree Program
SCHEME OF EXAMINATIONS
(For the candidates admitted from 2017-2018 onwards)

FIRST SEMESTER

S.No.	Sub. Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	17CA110	Mathematical Foundations of Computer Science	3	50	50	100	25	50
2	17CA120	Programming in C	3	50	50	100	25	50
3	17CA130	Computer Organization and Architecture	3	50	50	100	25	50
4	17CA140	Data Structures	3	50	50	100	25	50
5	17CA150	Database Management Systems	3	50	50	100	25	50
PRACTICAL								
6	17CA170	Data Structures using C Laboratory	3	50	50	100	25	50
7	17CA180	RDBMS Laboratory	3	50	50	100	25	50

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

SECOND SEMESTER

S.No.	Sub. Code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	17CA210	Organizational Behaviour	3	50	50	100	25	50
2	17CA220	Object Oriented Programming using C++	3	50	50	100	25	50
3	17CA230	Design and Analysis of Algorithms	3	50	50	100	25	50
4	17CA240	Operating Systems	3	50	50	100	25	50
5	17CA250	Accounting and Financial Management	3	50	50	100	25	50
PRACTICAL								
6	17CA270	C++ Programming Laboratory	3	50	50	100	25	50
7	17CA280	Algorithms Implementation and Analysis using C Laboratory	3	50	50	100	25	50
8	17CA290	Professional Communication	3	50	50	100	25	50

THIRD SEMESTER

S.No.	Sub. code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	17CA310	Operations Research	3	50	50	100	25	50
2	17CA320	Internet and Java Programming	3	50	50	100	25	50
3	17CA330	Object Oriented Modeling and Design Patterns	3	50	50	100	25	50
4	17CA340	Software Engineering	3	50	50	100	25	50
5	17CA350	Data Warehousing and Data Mining	3	50	50	100	25	50
PRACTICAL								
6	17CA370	Java Programming Laboratory	3	50	50	100	25	50
7	17CA380	Data warehousing and Data Mining Laboratory	3	50	50	100	25	50

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FOURTH SEMESTER

S.No.	Sub. code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	17CA410	Electronic Commerce and Electronic Business	3	50	50	100	25	50
2	17CA420	Computer Networks	3	50	50	100	25	50
3	17CA430	Software Quality and Testing	3	50	50	100	25	50
4	17CAPX0	Elective I	3	50	50	100	25	50
5	17CAPX0	Elective II	3	50	50	100	25	50
PRACTICAL								
6	17CA470	Web Technologies Laboratory	3	50	50	100	25	50
7	17CA480	Software Engineering Laboratory	3	50	50	100	25	50
8	17CA490	Mathematical Computing Laboratory	3	50	50	100	25	50

FIFTH SEMESTER

S.No.	Sub. code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment*	Terminal Exam **	Max. Marks	Terminal Exam	Total
THEORY								
1	17CA510	Software Project Management	3	50	50	100	25	50
2	17CA520	Management Information System	3	50	50	100	25	50
3	17CA530	Data Analytics	3	50	50	100	25	50
4	17CAPX0	Elective III	3	50	50	100	25	50
5	17CAPX0	Elective IV	3	50	50	100	25	50
THEORY CUM PRACTICAL								
6	17CA560	Mobile Application Development	3	50	50	100	25	50
PRACTICAL								
7	17CA570	Enterprise Applications Development Laboratory	3	50	50	100	25	50

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SIXTH SEMESTER

S.No.	Sub. code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	
				Continuous Assessment *	Terminal Exam **	Max. Marks	Terminal Exam	Total
PRACTICAL								
1	17CA610	Project	3	150	150	300	75	150

*   Continuous Assessment (CA) evaluation pattern will differ from subject to subject and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** Terminal Examination will be conducted for maximum marks of 100/300 and subsequently be reduced to 50/150 marks for the award of terminal examination marks

LIST OF ELECTIVE COURSES OFFERED
FOR THE M.C.A DEGREE PROGRAMME

Sub. Code	Sub. Name	Category	No. of Hours / Week L T P			Credits
17CAPA0	Agile Software Development	PE	3	-	-	3
17CAPB0	Programming In C# Using .Net	PE	3	-	-	3
17CAPC0	Storage Management Techniques	PE	3	-	-	3
17CAPD0	Cyber Security and Law	PE	3	-	-	3
17CAPE0	Wireless Ad Hoc Networks	PE	3	-	-	3
17CAPF0	Supply Chain Management	PE	3	-	-	3
17CAPG0	Managerial Economics	PE	3	-	-	3
17CAPH0	Business Analytics	PE	3	-	-	3
17CAPL0	Customer Relationship Management	PE	3	-	-	3
17CAPM0	Enterprise Resource Planning	PE	3	-	-	3
17CAPN0	Business Process Re-engineering	PE	3	-	-	3
17CAPQ0	Social Network Analysis	PE	3	-	-	3
17CAPR0	Open Source Software	PE	3	-	-	3
17CAPS0	Soft Computing	PE	3	-	-	3
17CAPT0	Cloud Computing	PE	3	-	-	3

17CA110	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	Category	L	T	P	Credit
		FC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Prove implication problems using truth table method, replacement process, Analyzation method, truth table technique, rules of inference method	Apply
CO2:	Obtain PCNF and PDNF of given logical expression	Apply
CO3:	Check the validity of the verbal or symbolic arguments using rules of inference	Apply
CO4:	Construct verbal arguments with predicates in symbolic form and also to validate them	Apply
CO5:	Represent the given relation in matrix, digraph and vice versa	Apply
CO6:	Verify a given function is bijective or not, and also to find composition of functions	Apply
CO7:	Design Karnaugh map to get simplified form of a Boolean function	Apply
CO8:	Check whether the given grammar is regular or not using pumping lemma	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	-
Understand	30	30	20	30
Apply	60	60	70	70
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Mathematical logic:
Propositional Logic:
 Introduction – statements and notation, connectives- Conjunction, Disjunction, Negation, Conditional and biconditional,-Implications and Equivalence, Tautology and Contradictions, Normal forms: Conjunctive   Normal Form,Disjunctive Normal Form - Principal Conjunctive Normal Forms - Principal Disjunctive Normal Form, Rules of Inference: P,T,CP,AP rules – Consistency of premises.Validity by truth table technique.**Predicate Logic:** Predicates- Statement Function, Variables and Quantifiers, Predicate formulas – Free and Bound Variables,–Theory of   inferences on one place predicate using P,T,CP rules.

Set Theory :
Basic Concepts of set theory and Cartesian products , Relations, Binary relations, Equivalence relations and Partitions, Composition of relations. **Functions**: Types of functions, Inverse of a function, Composition of functions, Recursive functions.

Lattices & Boolean Algebra:
Partially ordered set : Definition of Partially ordered set(PO Set), Hasse Diagram, LUB, GLB, Meet and Join of elements of PO set.
Lattices as partially ordered sets :Definition and basic properties of lattices, Sub lattices, Special lattices.
Boolean Algebra: – Definition and examples – Boolean functions — Minimization of Boolean functions.
Automata Theory and Grammar :
Deterministic and Non-Deterministic finite Automaton, NDFA to DFA,NDFA with ε-moves, Regular language and Regular Expression, NFA and Regular Expressions, Pushdown Automaton, Introduction to Turing Machine.
Pumping Lemma (without proof) and its applications, , Grammar, Types of Grammars – Language to Grammar –Grammar to Language.

Reference Books

1. Trembly and Manohar, "Discrete mathematical structures with applications to Computer Science", Tata McGrawHill, 2002.
2. Kenneth H. Rosen, "Discrete mathematics and its applications", McGrawHill International Editions 1999.
3. Dr. M.K.Venkataraman.,Dr.N.Sridharan and N.Chandrasekaran, Discrete Mathematics,National Publishing Company,Chennai.of India(2004)
4. John E.Hopcraft,Rajeev Motwani,Jeffery D.Ullman, `` Introduction to Automata Theory, Languages and Computation ", Pearson Education, Asia, 2001.
5. John C.Martin, `` Introduction to Languages and the theory of Computation", Tata McGraw-Hill Publishing Company Limited,New Delhi.
6. http://www.research.ibm.com/haifa/dept/svt/papers/Mathematical_Logic.pdf
7. Mathematical Logic and its Application to Computer Science - Lecture Notes EitanFarchi, Ben-Chaim, March 3, 2010

	Category	L	T	P	Credit
17CA120 **PROGRAMMING IN C**	FC	3	1	-	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the reason why different constructs are available for iteration, such as "for" loops, "do...while" loops	Understand
CO2:	Demonstrate the difference between iteration and recursion in terms of C programming	Analyze
CO3:	Develop C programs for arrays and linked lists	Apply
CO4:	Develop C programs for Data structure concept with functions	Apply
CO5:	Summarize the Hardware interaction using Port I/O	Understand
CO6:	Develop C programs for File Management concept	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	10	10
Understand	20	20	20	20
Apply	50	50	50	50
Analyse	10	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction to Programming Language : Algorithms, Flowcharts, The Role of Programming Languages, Language Description, Structured Programming, Data Representation, Procedure Activations **Structured Programming Language:** Symbols and data types, Looping control structures, Decision control structures, Case control structures, Arrays and Strings **Functions and Pointers:** Functions, Structures, Union, Pointers, Type of Pointer **File Management:** File Management in C, Command Line Argument, Dynamic Memory allocation, Linked List and Preprocessors **Hardware Interface** : Types of I/O, Interaction with H/W in C, CPU Registers, Interrupts, DOS Function Requests, Interaction with HW using Port I/O, Operation on bits, Mouse Programming.

Reference books

1. Brian W Kernighan & Dennis Ritchie, "The C programming language", 2nd Edition, Prentice Hall ,2015
2. Yashavant Kanetkar," Let us C", BPB Publications 8th Edition, 2014
3. Darnell and Margolis, "ANSI C- A Systematic programming Approach", Narosa publications, 2010.
4. Ravi Sethi, Viswanatha. K.V "Programming Languages – Concepts & Constructs" , Pearson Education, Second Edition, 2007
5. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 2012
6. Reema. Thareja, "Programming in C", Oxford University Press, 2nd Edition,2016

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA130	COMPUTER ORGANIZATION AND ARCHITECTURE	Category	L	T	P	Credit
		PC	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain about computer architecture — Understand

CO2: Compute simple arithmetic operations for fixed-point and floating-point addition, subtraction, multiplication & division — Apply

CO3:   Design combinational and sequential digital functions — Apply

CO4: Construct an instruction set capable of performing a specified set of operations — Analyze

CO5: Demonstrate a memory system for a given set of specifications — Analyze

CO6: Explain pipelining concepts — Understand

CO7: Compare the different ways of communicating with I/O devices and standard I/O interfaces. — Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	15	15
Understand	20	20	15	15
Apply	40	30	30	30
Analyse	30	40	40	40
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Functional Units: Basic operational concepts, Bus structures, Machine instructions, memory locations, addressing modes, assembly language **Arithmetic:** Number representations, addition and subtraction of signed numbers, Design of fast adders, Multiplication of signed numbers, Fast multiplication and Integer division **Processing Unit:** Concepts, Execution of complete instruction, Multi bus organization, ALU; Control Unit: Hardwired Control, Micro programmed Control; Micro Instructions, Micro program sequencing, Micro instructions with next address field and pre-fetching **Memory:** RAM, ROM, Cache Memories, and Virtual memory **Input and output organization:** Accessing I/O devices, Interrupts, DMA, and Interface circuits **Advanced Processor Architecture:** RISC, Pipelining, Super Scalar Processors, VLIW, Parallel and Vector Processors.

Reference books

1. Carl Hamacher, Zvonko Vranesic, safwat Zaky, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2011.
2. William Stallings, "Computer Organization and Architecture", Tenth Edition, Pearson Education, 2015.
3. David A. Patterson, John L.Hennessy, "Computer Organization and Design", Fourth Edition, Morgan Kauffmann Publishers, 2011.

		Category	L	T	P	Credit
17CA140	**DATA STRUCTURES**	PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain the organization and operations of data structures Stack Queues, Trees, Graphs, Heaps and Hash tables.	Understand
CO2:	Compare and contrast the functionalities and applications of different data structures	Understand
CO3:	Demonstrate specific search and sort algorithms using data structures given specific user requirements.	Apply
CO4:	Apply the operations of data structures in designing software procedures based on specific requirements	Apply
CO5:	Assess the applicability of given data structures and associated operations to real time computer applications	Evaluate
CO6:	Identify suitable algorithms with appropriate data structures for real time software requirements	Apply
CO7:	Modify the existing operations of data structures for changing needs of the software requirements	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	30	20	10	10
Understand	30	20	20	20
Apply	30	30	40	40
Analyse	10	20	20	20
Evaluate	0	10	10	10
Create	0	0	0	0

Syllabus

Introduction: Introduction to Data Structures, Abstract data types

Linear Data Structures: Stacks and Queues, Sparse matrices and their representation
Linked list: Linear Linked Lists, Circular & Doubly linked list
Trees: Binary Search Trees, Red-Black Trees, AVL Trees, B-Trees, Huffman algorithm
Sorting: Insertion Sort, Bubble sort, Selection Sort, Mergesort, Quick sort, Counting sort, Radix sort.
Heaps: Binomial heaps, Fibonacci Heaps, Priority Queues using heaps
Searching: Linear Search, Binary search, Hash tables & hashing techniques.
Graphs: Representation, Graph traversals, Minimum Spanning Trees, Shortest Path
Case study: Usage of Data structures in any current real time projects.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, Third Edition 2009.

2. Tanaenbaum A.S.,Langram Y. Augestein M.J " Data Structures using C" Pearson Education , 2004
3. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C", Pearson Education, 2011.
4. Robert Kruse & Clovis L. Tondo " Data Structures and Program Design in C",Prentice Hall , 2012.
5. Ellis Horrowitz et al.," Fundamentals of Data Structures in C", Silicon press, Second edition, 2007.

17CA150	DATABASE MANAGEMENT SYSTEMS	Category	L	T	P	Credit
		PC	4	0	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain the structure and model of relational database systems	Understand
CO2:	Design multiple tables, and using group functions, sub queries	Apply
CO3:	Design a database based on a data model considering the normalization to a specified level	Analyze
CO4:	Estimate the storage size of the database and design appropriate storage techniques	Apply
CO5:	Analyze the requirements of transaction processing, concurrency control	Analyze
CO6:	Explain the basic requirements for Backup and recovery	Understand

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	20	20	20
Understand	30	20	20	20
Apply	30	30	20	20
Analyse	10	30	40	40
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction - Concepts, Relationships, System Architecture, Data Models, Relational languages **Data Definition Language:** Tables creation, Constraints, Displaying table information, Altering and Renaming an existing table, Truncating and dropping the table. **Data management and Retrieval** - DML operations – Insert, Delete & Update, Basic queries – select, Arithmetic operations, where clause, Sorting, CASE structure, DEFINE command, Complex queries – Functions and Grouping. **Database Design** – Relational Model , Decomposition, Functional Dependencies, Multivalued Dependencies, Normal forms **Storage Structure** – Storage and File Structure, Indexing and Hashing, **Query Processing** – Measures of query cost, Evaluation of Expressions, Query Optimization – Estimation statistics of Expression Results, Evaluation Plans, **Transaction and Concurrency control** - Transaction concepts, Concurrent Execution, Serializability, Recoverability, Concurrency Control, Lock based protocol, Deadlock handling.

Reference Books

1. Henry F. Korth, Abraham Silberchatz, S.Sudarshan , Database System Concepts, McGraw-Hill – 2010
2. Ramez Elmasri, Shamkant B. Navathe - Fundamentals of Database Systems –Fifth Edition - Addison Wesley Higher Education – 2010
3. Raghu Ramakrishnan, Johannes Gehrke - Database Management Systems - Third Edition - McGraw-Hill - 2014
4. C.J.Date, Longman, Dr.S.Swamynathan, Introduction to Database Systems, Pearson Education - 2010
5. Hoffer, Prescott & McFadden - Modern Database Management – Eighth Edition - Prentice Hall – 2010
6. Kifer, Bernstein & Lewis - Database Systems: An Application Oriented Approach, Compete Version – Second Edition - Addison Wesley Higher Education - 2010.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA170	DATA STRUCTURES USING C LABORATORY	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Design algorithms for the given problem specifications. — Analyze

CO2: Write C programs for the designed algorithm specification. — Apply

CO3: Write C programs to implement linear data structures : Stack and Queue using arrays and linked list in an application context — Apply

CO4: Implement Non linear data structures: Graph, Trees, Hashtable in an application context — Apply

CO5: Implement specific sort algorithms in application context. — Apply

CO6: Generate different test cases for testing the validity of the developed programs — Analyze

CO7: Write technical report on the observations from the experiments — Apply

Lab experiments

Develop C programs for

1. Conditional and Iterative Structures

2. Arrays, Functions and Strings

3. Structures and Unions

4. Pointers

5. File Handling

6. Stack ADT implementation – Array implementation

7. Queue ADT implementation – Linked list implementation

8. Binary Search tree implementation

9. Hash table implementation

10. Graph representation and traversals

11. Sorting Algorithms: A) Sorting algorithm of $O(n^2)$

B) Sorting algorithm of $O(n \log n)$

Mini Project:

    The course instructor shall provide real time problems/specifications to the students for mini project. The project shall be completed before the commencement of 2nd semester and a report shall be submitted.

Sample specification for mini project:

- Develop a C processor that performs stemming on the words in a document.

- Simulate a client server process in which the server process clients on a priority basis.

Note:

For Exercise 1 to 5, a collection of program specifications shall be designed by the course instructor and assigned to the students.

For Exercise 6 to 11, students shall develop C programs in any one application domain (e.g. Banking, Online shopping, Conference management etc.)

Reference Books

1. Brian W Kernighan & Dennis Ritchie, "The C programming language", 2nd Edition, Prentice Hall ,2015
2. Yashavant Kanetkar," Let us C", BPB Publications 8th Edition, 2014
3. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Printice hall International, 2010.
4. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C", Pearson Education, 2011.
5. Robert Kruse & Clovis L. Tondo " Data Structures and Program Design in C",Prentice Hall , 2012.

		Category	L	T	P	Credit
17CA180	**RDBMS LABORATORY**	PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Model Entity Relationship with E-R diagrams   Apply
CO2: Design database schema considering normalization and
 relationships within database   Apply
CO3: Write SQL queries to user specifications   Apply
CO4: Develop triggers, procedures, user defined functions and design
     accurate and PLSQL programs in Oracle and DB2.   Apply
CO5: Use the database from a front end application   Apply
CO6: Prepare technical report on the observations of the experiments Apply

List of Experiments

1. Basic SQL – DDL & DML, Views, Group operations, aggregate operations, System operations in Oracle
2. Intermediate SQL –Joins, Subqueries, DCL operations
3. Advanced SQL – Nested tables, V-arrays
4. ER Modeling
5. Database Design and Normalization
6. Stored procedures and using them in a client application
7. Triggers and their front end application
8. DBA mechanisms – Installation, Backup and recovery operations, Batch processing

9. **Mini Project**
   The course instructor shall provide real time problems / specifications to the students for mini project. The project shall be completed before the commencement of 2nd semester and a report shall be submitted.
   Sample Specifications
   Design a database for student mark entry system. Provide provisions for different queries, procedures and triggers.
   Sample Queries:
        1.List the name of students under one particular staff.
        2. Find the students who are below 50 marks in all subjects.
   Procedure:
        Write the procedure for calculating total marks (internal+ external) for a particular   student.
   Trigger: Raise the trigger for entering the internal mark more than 30.
   Marks: Algorithm = 10 E-R Diagram = 15. Table Design=15 Queries = 20.
            Procedure = 15. Trigger = 15. Viva =10.
Note: Experiments 1 to 8 are to be carried out in a single application domain preferably in Oracle/DB2.

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BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

	Category	L	T	P	Credit
17CA210 **ORGANIZATIONAL BEHAVIOUR**	PC	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Develop an Organisational Behaviour model for any type of Organization.   Apply

CO2: Develop Managerial skills for Individual Behaviours.   Understand

CO3: Develop the quality of Leadership.   Apply

CO4: Analyze the Common biases and eradication in Decision Making Process.   Analyze

CO5: Adapt to the organizational culture**.**   Apply

CO6: Analyze how to manage the Stress during a job.   Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	10	10	10
Understand	30	30	30	30
Apply	40	40	40	40
Analyse	10	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Organizational Behavior: Introduction to Organizational Behavior(OB), Contributing disciplines to OB Field, challenges and opportunities for OB, Developing an OB Model, Foundation of Individual Behavior, Ability - Learning. Values, Attitudes and Types of Attitudes. Job satisfaction- Measuring Job satisfaction, Effect of Job satisfaction on employee performance. **Personality and Values:** Personality determinants, Achieving personality fit, Factors Influencing perception, Attribution Theory, Perception / Individual Decision Making: Ethics in Decision Making. Motivation, Management by Objectives, Employee Recognition programs, Employee Involvement programs, Variable Pay Programs. **Understanding work teams**: Teams Vs Groups – Types of Teams, Creating Effective Teams – Turning Individuals into Team Players. **Communication:** Functions of Communication, Communication Process – Direction of communication, Interpersonal and Organizational communication, Barriers of effective communication, Current issues in Communication. **Leadership**: Leadership – Meaning, Trait Theories – Behavioral Theories, Contingency Theories, Contemporary issues in Leadership, The foundation of leadership.

Organizational structure: Inspirational approach – Emotional intelligence. Foundations of Organization structure, Meaning of Organizational structure – Common organizational Designs, New Design Options – Organizational Designs and Employee Behavior. Organizational culture: **Organizational culture and Stress Management:** Meaning – Creating and sustaining culture, How employees learn culture, creating an ethical organizational culture, creating a customer responsive culture, spirituality and organizational culture, Work stress and its Management.

Reference Books

1. Stephen P. Robbins, "Organisational Behaviour", 11/e, Pearson, 17 edition 2016
2. Uma Sekaran," Organisational Behaviour", 2/e, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2010.
   Sharma, R.A," Organisational Theory and Behaviour", 2/e, Tata McGraw-Hill Ltd., New Delhi, 2007.

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17CA220	OBJECT ORIENTED PROGRAMMING USING C++	Category	L	T	P	Credit
		PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Distinguish between Structured and Object Oriented problem solving approaches and apply them based on the problem given	Understand
CO2:	Identify classes and objects from the given problem description and able to create classes and objects using C++	Understand
CO3:	Improve secured data processing by applying Abstraction, Encapsulation and Information hiding	Apply
CO4:	Achieve code reusability and extensibility by means of Inheritance and Polymorphism.	Apply
CO5:	Handle Exceptions and identify Run Time Type Information (RTTI)	Apply
CO6:	Translate the informal description of an algorithm to solutions for problems in engineering, science and text processing using Object Oriented Programming.	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	10	10
Understand	20	20	20	20
Apply	40	40	50	50
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction to Programming Paradigms : Procedural Programming Vs. Object-Oriented Programming – **Entities** : Namespaces – Access Specifiers - Classes and Objects – Constructors - Destructors - Class Objects as Members - **OO Constructs** : **Abstraction** – Function Templates - Class Templates - **Encapsulation** – Member data and Member function binding – Information hiding - **Inheritance** – Base Class and Derived Class – Types :Single, Multiple, Multi-level, Hybrid- Access Specifiers and Inheritance - **Polymorphism** - Overloading : Operator Overloading – Method Overloading - Templates Overloading: - Overriding : Method Overriding - Virtual Base Classes – Virtual Functions - Virtual Constructors - Friends - Abstract Classes - **Streams**: Output Streams - Input Streams- File Streams - String Streams – **Exception Handling**: System Defined Exceptions– User Defined Exceptions - try-catch-throw-rethrow **Run-Time Type Information (RTTI)** : Dynamic Cast - Typeid - Uses and Misuses of RTTI

Reference Books

1. Bjarne Stroustrup,"The C++ Programming Language", 4th Edition, Addison-Wesley, 2015.
2. Scott Meyers," Effective C++ 55 Specific Ways to Improve Your Programs and Designs", Third Edition, Addison-Wesley, 2011

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3. Paul Deital & Harvey Deital, "C++ How to Program", 7th Edition, Pearson Education, 2010

4. Stanley Lippman, "C++ Primer", 4th Edition, Pearson Education, 2007.

5. Yashavant P. Kanetkar, "Let Us C++", BPB Publications, 2007.

6. Robert Laffore, "Object Oriented Programming using C++", 4th Edition, Sams Publishing, 2002.

7. Ashok Kamthane, "Object Oriented Programming with ANSI and Turbo C++", 4th Edition, Pearson Education, 2002.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA230	DESIGN AND ANALYSIS OF ALGORITHMS	Category	L	T	P	Credit
		PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to:

CO1: Summarize the relevance of algorithms for computational problems solving and real time applications.	Understand
CO2: Differentiate different algorithmic approaches, techniques and methods.	Understand
CO3: Apply design and analysis techniques for a given algorithm.	Apply
CO4: Apply optimization techniques for improving the efficiency of algorithms.	Apply
CO5: Analyze a given algorithm for its efficiency based on time and space it occupies.	Analyze
CO6: Evaluate any given problem with mathematical rigor to provide an algorithmic based solution.	Evaluate

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	15	10	10	10
Understand	40	10	20	20
Apply	25	30	20	20
Analyse	20	30	30	30
Evaluate	0	20	20	20
Create	0	0	0	0

Syllabus

Algorithms: The Role of Algorithms in Computing - Algorithms as a technology; **Analyzing and Designing Algorithms;** Growth of Functions-Asymptotic notations - standard notations and common functions; Divide and Conquer Method-Solving recurrences; Probabilistic Analysis and Randomized Algorithms-Hiring problem-Randomized algorithm; **Dynamic programming**-Matrix Chain Multiplication-Elements of dynamic programming; **Greedy Algorithms**-Elements of Greedy Strategy; Amortized Analysis-Aggregate analysis-Dynamic tables; **NP-Completeness**-Polynomial time-NP-Complete problems; **Approximation algorithms**-The vertex-cover problem-travelling salesman problem-Randomization and linear programming.

Reference Books

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Prentice-Hall, New Delhi, Third Edition, 2010. Chapters: 1 to 5, 15 to 17, 34 & 35.
2. M.A.Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education Asia, 2013.
3.. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2011.

	Category	L	T	P	Credit
17CA240 **OPERATING SYSTEMS**	PC	4	0	0	4

Course Outcomes

On successful completion of the course, the students will be able to

CO1:	Describe the evolution, types, structure and functions of operating systems	Understand
CO2:	Explain techniques involved in process, memory, device and file management	Understand
CO3:	Describe security and protection measures used in operating systems	Understand
CO4:	Execute Linux basic commands and shell scripts	Apply
CO5:	Implement processor scheduling, synchronization, deadlocks and disk allocation algorithms for a given scenario	Apply
CO6:	Analyze the code for the resource allocation	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	30	30	30
Apply	30	40	40	40
Analyze	0	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Operating System Introduction : Basics, OS Architecture, OS Operations. **Process Management:** Process states – Operations on process–Interrupts-Interprocess communication-Thread concepts -Job and processor Scheduling **Concurrent Execution:** Asynchronous Concurrent Processes- Concurrent Programming-Deadlock and indefinite postponement. **Memory Management:** Swapping, Paging, Segmentation, Virtual Memory – Demand paging, Page Replacement. **File & Storage Management:** File System, File Organization, Allocation methods, free space management, Disk Structure, Disk Scheduling, Swap-Space Management. **Linux Programming -** Command Line and Shell Scripting Basics. **Case Studies: Linux, Windows, Mobile Operating System**.

Reference Books & web resources

1. William Stallings, "Operating systems Internal and Design Principles", Eighth Edition, Pearson Education, Global edition. 2015.
2. Andrew Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson Education,Global edition, 2014.
3. Abraham Silberschatz, Greg Gagne, Peter B. Galvin, "Operating System Concepts", 9th edition, Wiley, 2013.
4. H M Deital, P J Deital and D R Choffnes, "Operating Systems", Third Edition ,Pearson Education, (2004),Reprint 2012.
5. Jason Canon," Shell Scripting: How to Automate Command Line Tasks Using Bash Scripting and Shell Programming",Linux Training Academy,2015
6. Christine Bresnahan Richard Blum," Linux Command Line and Shell Scripting Bible", Third Edition, 2015,Wiley.
7. http://nptel.ac.in/courses/Webcourse-contents/IISc BANG/Operating%20Systems
8. https://www.shellscript.sh/first.html
9. http://www.freeos.com/guides/lsst/

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA250	**ACCOUNTING AND FINANCIAL MANAGEMENT**	Category	L	T	P	Credit
		FC	3	1	-	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Apply Financial Statement Analysis for the given Balance sheet.   Apply

CO2: Summarize the concepts of Financial Planning   Understand

CO3: Describe the various sources of finance In Financial Management   Understand

CO4: Practice Journal, ledgers and Trail Balance for various Transaction   Apply

CO5: Illustrate the financial status of an Organization with the help of Final Accounts   Apply

CO6: Compute Trading account, Profit and Loss account and Balance Sheet for the given Trial Balance.   Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	Theory
Remember	10	10	20	20
Understand	20	20	20	20
Apply	70	70	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Accounting –Meaning and Scope,Need for Accounting, Definition, Principles, Accounting Functions-Recording, Classifying, Summarizing, Analysis and Interpretations.
Final Accounts- Manufacturing , Profit and Loss Accounts, Balance Sheet, Depreciation-causes and methods.
Financial Management-Meaning, Evolution, Objectives and Sources of Finance
Financial Statement Analysis- Comparative Statement, Common Size Statement, Trend Analysis, Ratio Analysis.
Working Capital Management- Meaning, need and requirements of Working Capital Estimation.
Capital Budgeting- Definition, Methods of Evaluation

Reference Books

1. M.C.Sukhla, T.S.Grewal, "Advanced Accounts Vol I", S.Chand and Publications, New Delhi, 2012
2. Prasanna Chandra, "Fundamentals of Financial Management", Tata McGraw Hill, 2012.
3. Pandey, "Financial Management" , Vikas Publishing House Pvt. Ltd., 2010
4. KY. Khan and P.K. Jain, " Financial Management", Tata McGraw Hill, 2012.
5. I.M.Pandey, "Management Accounting", Vikas Publishing House Pvt. Ltd., 3 rd Edition, 2014

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA270	**C++ PROGRAMMING LABORATORY**	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the concepts of oops for building object based applications	Understand
CO2: Write a program in different logic with suitable validations for a given problem	Apply
CO3: Implement the techniques and features of the Object Oriented Programming constructs to construct an application	Apply
CO4: Implement method overloading and method overriding for different user specifications	Apply
CO5: Write programs implementing inheritance for an application domain	Apply
CO6: Write technical report on the observations from the experiments	Apply

List of Experiments

Develop C++ programs for

1. Constructor and copy constructor.
2. Storage classes like auto, extern, register and static.
3. Static member data, static member function and bitwise operators.
4. Overloading and method overriding.
5. Inheritance
6. Pointer Arithmetic.
7. Inline Functions.
8. Functions & Recursion.
   a.Recursion b.Function with "this" pointer
9. Friend Function & Friend Class.
10. Exception handling methods.
11. Overload Unary & Binary Operators as Member Function & Non Member Function.
    a. Unary operator as member function b. Binary operator as non member function
12. Class Templates

- **Mini Project :**

  The course instructor shall provide real time problems/specifications to the students for mini project. The project shall be completed before the commencement of 3rd semester and a report shall be submitted.

- **Sample specification for mini project**:

  Simulate a client server process in which the server process clients on a priority basis.

  Note: For all exercises, students shall develop C++ programs in any one application domain (e.g. Banking, Online shopping, Employee management etc.)

Reference Books

1. Bjarne Stroustrup ,"The C++ Programming Language", 4th Edition, Addison-Wesley, 2015.
2. Scott Meyers," Effective C++ 55 Specific Ways to Improve Your Programs and Designs", Third Edition, Addison-Wesley, 2011
3. Paul Deital & Harvey Deital, "C++ How to Program", 7th Edition, Pearson Education, 2010
4. Stanley Lippman, "C++ Primer", 4th Edition, Pearson Education, 2007.
5. Yashavant P. Kanetkar, "Let Us C++", BPB Publications, 2007.
6. Robert Laffore, "Object Oriented Programming using C++", 4th Edition, Sams Publishing, 2002.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA280	**ALGORITHMS IMPLEMENTATION AND ANALYSIS USING C LABORATORY**	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	.Implement any balanced tree in C	Apply
CO2:	Develop C programs implementing graph algorithms in application context	Apply
CO3:	Develop C programs for implementing greedy approach, dynamic programming and backtracking techniques	Apply
CO4:	Write C programs by modifying existing programs/algorithms based on user specification	Analyze
CO5:	Analyze time complexity and space complexity of algorithms	Analyze
CO6:	Write technical reports on the observations in the experiments	Apply

Lab experiments

Develop C programs for
1. Linear Search and Binary search
2. Implementation of any one balanced tree structures
3. Graph Traversals (Breadth First and Depth First search)
4. Spanning Tree Implementation (Prims/ Kruskals)
5. Shortest Path Algorithms (Dijkstra's algorithm/ Bellmann Ford Algorithm)
6. Knapsack implementation (Greedy/Dynamic programming/Back tracking)
7. Huffman Coding Implementation.
8. Travelling Salesman problem
9. Euclids algorithm for finding GCD

Mini Project :

The course instructor shall provide real time problems/specifications to the students for mini project. The project shall be completed before the commencement of 3rd semester and a report shall be submitted.

Sample specification for mini project:
1. Develop a C program that finds the run time efficiency of any C program given as input.
2. Develop a visualization tool that demonstrates the working of algorithms.

Note: Algorithm analysis report comprising time complexity, space complexity shall be submitted by the students and verified by the course instructor at the lab session for each experiment.

Reference Books & web resources

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Printice hall International, 2010.
2. Brian W Kernighan & Dennis Ritchie, "The C programming language", 2nd Edition, Prentice Hall ,2015
3. Yashavant Kanetkar," Let us C", BPB Publications 8th Edition, 2014.
4. Fundamentals of Algorithmics, Gilles Brassard and Paul Bratley, Printice hall International, 2002.
5. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C", Pearson Education, 2011.
6. Robert Kruse & Clovis L. Tondo " Data Structures and Program Design in C",Prentice Hall , 2012.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

17CA290   **PROFESSIONAL COMMUNICATION**

Category	L	T	P	Credit
EEC	0	1	1	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Plan, organise, and present technical articles in the frame of the scientific method — Apply

CO2: Develop themselves through communication skills in corporate environment — Apply

CO3: Solve verbal aptitude questions related to placement and higher studies — Apply

CO4: Apply their interpersonal skills in technical, professional and social contexts — Apply

Assessment Pattern

Internal

No Common Continuous Assessment Test (CAT) will be conducted.

Students' performance will be continuously assessed in various classroom activities on Listening, Speaking, Reading and Writing for 50 marks as detailed below

Listening Test	- 10
Speaking Test- Presentation (Technical / Review: Movie/Book) and Group Discussion	- 20
Written Test – Verbal Aptitude for Placement and Higher studies	- 20

(The test will be conducted for 50 marks and reduced to 20)

External (Practical)

Test – Listening (20),Reading (10) and E-Mail Writing(10)	- 40
Group Discussion	- 25
Personal Interview / Situational Conversation	- 25
Resume Submission	- 10

List of Experiments

Sl. No.	Topic	No. of Hours	
		Tutorial	**Practical**
1	Characteristics of Technical Writing	2	
2	Development of Employability Skills	2	
3	Vocabulary Development	2	
4	Sentence Completion	1	
5	Error Spotting	1	
6	Interpretation of Verbal Analogy	1	
7	Interpretation of Reading (Comprehension - Conception)	1	

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8	Interpretation of Reading (Comprehension - Reasoning)	1	
9	Practice for writing E-mails/Technical Blogs/Forums	1	
10	PPT Preparation / Demonstration of Technical Presentation		2
11	Preparation of Resume		1
12	Preparation for Job Interviews		2
13	Demonstration of Group Discussion Skills		2
14	Developing Listening Skill (Comprehension)		2
15	Practice for Short Speeches / Situational Conversation		1
16	Review : English Movies / Novels		2
	Total Hours	12	12

*(Any two English movies and two novels shall be discussed based on students interest and relevance)

Reference Books:

1. Courseware on "Technical Communication for Scientists and Engineers", IIT Bombay, 2015.
2. Cappel, Annette and Sharp, Wendy, Cambridge English: Objective First, 4th Ed., CUP, New Delhi, 2013.
3. Sue Prince, Emma, The Advantage: The 7 Soft Skills You Need to Stay One Step Ahead, Pearson; 1 Edition, 2013.
4. Hart, Guy Brook, Cambridge English Business Benchmark: 2 Ed., CUP 2014
5. Lewis, Norman. How to Read better & Faster. New Delhi: Binny Publishing House. 1978
6. McCarthy, Michael and Felicity O'Dell.. English vocabulary in use: 100 Units of Vocabulary reference and practice. Cambridge: CUP. 1996

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

	Category	L	T	P	Credit
17CA310 **OPERATIONS RESEARCH**	FC	3	1	-	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Identify the Transportation and Assignment problems and to optimize in engineering fields	Understand
CO2:	Apply the various sequencing techniques	Apply
CO3:	Solve linear programming techniques to optimization problems arising in all Computer fields	Apply
CO4:	Solve Integer linear programming techniques to optimization problems arising in all Computer fields	Apply
CO5:	Summarize the inventory and queuing models	Understand
CO6:	Classify the various scheduling techniques in mini Project	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	10	10	10	10
Understand	10	10	10	10
Apply	60	60	60	60
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Linear Programming-Graphical Solution- The Simplex algorithm, Artificial Variable Technique - Duality-Dual Simplex - Variants of the Simplex Method **Transportation Model**- Initial Basic Feasible Solution methods Test for optimality-Variants of the Transportation problem **Assignment Model**- Hungarian algorithm Variants of the Assignment problem, Travelling Salesman Problem **Integer Linear Programming**- Gomary's cutting plane method Branch and Bound method **Sequencing Problem -** N jobs through 2 machines, N Jobs through 3 machines, N jobs through m machines **Scheduling -** Critical path Method, Project Evaluation and Review Techniques **Inventory control** - Purchase and production model with and without shortage , price break **Queuing Model**- Single channel model, Multichannel model.

Reference Books

1. Sharma J.K.: "Operations Research Theory and applications", Macmillan India Ltd., V Edition, 2015.
2. Hamdy A. Taha: Operations Research – An Introduction", Prentice Hall of India Pvt Ltd., EIGHT Edition, 2014.
3. Chandrasekara Rao, K. Shanti Lata Misra "Operation Research", Alpha science international Ltd-2015.
4. Kanti Swarup, P.K.Gupta and Man Mohan "Operations Research", Sultan Chand,2014

17CA320	**INTERNETAND JAVA PROGRAMMING**	Category	L	T	P	Credit
		PC	4	0	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Use the object oriented concepts of java for the given problem.	Understand
CO2:	Use exceptions, threads, collections, logs of Java for the given problem.	Understand
CO3:	Apply events through swing, RMI, JAR operations for the given application	Apply
CO4:	Select the proper library classes in Java based on the need of a problem	Apply
CO5:	Apply different Java technologies to solve Internet applications.	Apply
CO6:	Design an application using DHTML and JSP	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	30	20	20	20
Understand	30	30	30	30
Apply	40	50	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Internet Programming: Internet Basics, DHTML : Introduction - CSS - DOM:Collections- Event Model - Filters and Transitions. **Java Programming**: Java Basics:Java features, Array and Strings, Object Oriented Features, Language Interface: JNI, Utilities and Collections, Stacks, Queues and vectors **Multithreading and Exceptions**: Multithreaded Programming, Exception Handling, **Applets**: Applet life cycle, Built in String functions, Streams and serialization: I/O Streams, Object Serialization, Files, AWT Controls: Controls, Layout Managers, Menus, Graphics, Event Handling. **JSP** : Basics and Comments - Scripting Elements - Expressions - Scriplets - Declarations- Directives - Predefined variables. **Database Handling**: JDBC connectivity, Types of Statement, Types of Execute Methods. **Networking**: Networking Basics - Java and the Net – InetAddress – TCP/IP Client Sockets – URL –URL Connection – TCP/IP Server Sockets – A Caching Proxy HTTP Server – Datagrams, RMI Technology.

Reference Books & web resources

1. Herbert Schildt, "Java the Complete Reference", 9th Edition, McGraw Hill, 2014.
2. Margaret Levine Young, "The Internet - Complete Reference" , 2nd Edition, Tata McGraw Hill, 2002, (Reprint 2016).
3. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet and WWW How to Program", 5th

Edition, Tata McGraw Hill, 2011.

4. nptel.ac.in/courses/106105084/
5. nptel.ac.in/courses/106105084/28
6. nptel.ac.in/courses/106105084/30
7. www.nptelvideos.in/2012/11/internet-technologies.html
8. www.nptelvideos.com/java/java_video_lectures_tutorials.php

17CA330	**OBJECT ORIENTED MODELING AND DESIGN PATTERNS**	Category	L	T	P	Credit
		PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Understand the complexity of Industrial Strength Software and the application of Unified Process Model.   Understand

CO2: Identify classes and objects using Object Oriented Analysis techniques   Understand

CO3: Develop new classes from the problem domain by applying object oriented design principles   Apply

CO4: Incorporate design patterns to create classes with reusability and extensibility.   Apply

CO5: Design different design documents to show logical view using UML for any given application   Analyze

CO6: Develop different design documents to show physical view using UML for any given application .   Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	30	30
Apply	40	40	30	30
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Unified Process in Object Oriented Software Development - Basics of Software Development Process, Introduction to UP, Components of Unified Process Model, Life Cycle Phases of Unified Process Model, Application of OO diagrams in UP, Rationale for OO development - Object Orientation in Software development process, Flavors of Object Orientation, Basic Entities and Constructs of Object Orientation, Structured Approach Vs. Object Orientated Approach, **Modelling the real world problems using OO techniques and Design Patterns** - Object Oriented Analysis (OOA) of problem domain, OOA Techniques for Objects Identification, Object Oriented Design (OOD) of problem domain, Design Principles in Class Design, Design Patterns in Classes and Objects Identification and Refinement, Modeling with UML - Problem Domain Understanding, Traditional Analysis Methods and Models, Characteristics of Good Analysis, Deficiency with the traditional approaches,

UML – Introduction, UML diagrams for OOA and OOD, Object Oriented Analysis using UML-Scenario based Models - Use Case Analysis - Primary and Secondary Use Case Diagram - Notations, Guidelines, Purposes of Use Case Diagrams, Object Oriented Design using UML-Logical Model -UML Class Diagram basic and advanced concepts - Interaction Models – Sequence and Collaboration Diagrams, Behavioral Models, State Charts and Activity Diagrams, Physical Models – Package, Component and Deployment Diagrams, Case Study – Tutorial

Reference Books

1. Grady Booch, Robert A.Maksmichuk, Michael W.Engle, Bobbi J.Young, Jim Conallen, Kelli A. Houston, "Object-oriented analysis and design with applications", Third edition, Pearson Education, 2011.
2. Martin Fowler, "UML Distilled", Third edition, Pearson Education, 2011.
3. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", First Edition, Addison-Wesley Professional, 2010 (Reprint).
4. Ali Bahrami, "Object-oriented system development", First Edition, Tata McGraw Hill, 2010(Reprint).

	Category	L	T	P	Credit
17CA340　　　**SOFTWARE ENGINEERING**	PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain a process model for a software project development.	Understand
CO2:	Prepare the SRS, Design document, Project plan of a given software system	Analyze
CO3:	Apply Project Management and Requirement analysis, Principles to S/W project development.	Apply
CO4:	Analyze the cost estimate and problem complexity using various estimation techniques	Analyze
CO5:	Generate test cases using the techniques involved in selecting: (a) White Box testing (b) Block Box testing	Analyze
CO6:	Explain the advantages of configuration management and risk management activities.	Understand

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	20	30	30
Apply	20	40	30	30
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Software Process and Life Cycle Models: Introduction to Software Engineering, Software Process, Life cycle models: water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented, Aspect oriented, Agile Process Models. **Requirements Engineering tasks:** Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document. Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management, Data Modelling, OO analysis **Software Project Management:** Software Project Management: Estimation, LOC and FP Based Estimation, COCOMO Model, Project Scheduling: Scheduling, Earned Value Analysis - Risk Management. **Software Design:** Design process: Design concepts, Data design elements: Pattern based Software Design. **Software Testing**: Software testing strategies: fundamentals, Internal and external views of Testing-white box testing, basis path testing, control structure testing, black box testing, Regression Testing, Unit Testing, Integration Testing, Validation Testing, System Testing And Debugging.

Reference Books

1. Roger Pressman, Software Engineering: A Practitioners Approach, (8th Edition), McGraw Hill, 2015
2. Eric J. Braude and Micheal E. Bernstein, Software Engineering Modern Approach, second edition, Wiley, 2011.
3. Ian Somerville, Software Engineering, 9th edition, Addison Wesley, 2011.

17CA350	**DATA WAREHOUSING AND DATA MINING**	Category	L	T	P	Credit
		PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Identify data mining tools and techniques in building intelligent machines	Understand
CO2:	Analyze various data mining algorithms in applying in real time applications.	Analyze
CO3:	Analyze unsupervised and supervised naive algorithms in real world applications	Analyze
CO4:	Demonstrate the data mining algorithms to combinatorial optimization problems	Apply
CO5:	Illustrate the mining techniques like association, classification and clustering on transactional databases.	Apply
CO6:	Compare various supervised and unsupervised learning techniques in data mining	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	10	10
Understand	40	20	30	30
Apply	40	40	40	40
Analyse	0	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction to Data Warehousing – Components of data warehouse, Datawarehouse Architecture and Infrastructure. Technical Architecture and OLAP. **Data Mining –** Concepts , KDD vs Data mining , DBMS vs Data mining , Issues and Challenges, **Preprocessing –** Concepts , Discretization , Feature extraction & Selection , Missing data , Post processing , Attribute Oriented Induction, **Association Techniques -** Introduction Association Rules , Apriori algorithm , FP tree growth algorithm , Types of association rules, **Classification Techniques -** Introduction to Classification , Constructing decision tree – ID3 algorithm , Pruning. **Clustering Techniques -** Introduction to Clustering , Partitioning Method – K Means algorithm , Hierarchical Method , Density Based Method – DBSCAN method , Conceptual clustering – COBWEB algorithm, **Mining Applications** - Spatial data mining, Temporal data mining, Sequence mining, Text mining, Visual data mining, Web mining.

Reference Books

1. Jiawei Han, Micheline Kamper, Data Mining: Concepts and Techniques Morgan Kaufman, 2007, ISBN: 1-55860-489-8. Chap1-3, 5-10.
2. K.P.Soman, Shyam Diwakar, V.Ajay, "Insight into Data Mining – Theory and Practice", Prentice Hall of India, 2009. (Modules II, III and VI)
3. Arun K.Pujari, "Data Mining Techniques", Universities Press, 2010. (Modules I, IV, V and VI)
4. M.H Dunham, "Data Mining: Introductory and advanced topics", Pearson Education, 2006.

		Category	L	T	P	Credit
17CA370	**JAVA PROGRAMMING LABORATORY**	PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Understand the enabling technologies for building internet applications.	Understand
CO2:	Write Java programs for techniques and features of the networking and remote method development to Construct a internet application.	Apply
CO3:	Implement packages, access specifiers and interfaces in a program	Apply
CO4:	Implement Program for Events and interactivity using Layout Manager.	Apply
CO5:	Generate program for network chatting	Analyze
CO6:	Write technical report on the observations from the experiments	Apply

List of Experiments

Develop Java Programs for
1. Use of Objects
2. Using classes and inheritance
3. JNI concepts
4. Multithread applications
5. Exception handling
6. Implementing packages, access specifiers and interfaces
7. Streams
8. JDBC program using different statements
9. Applet program for Animation text, images and sounds
10. Events and interactivity using Layout Manager.
11. Socket program for network chatting
12. Client server application using RMI techniques

Mini Project :

The course instructor shall provide real time problems/specifications to the students for mini project. The project shall be completed before the commencement of 4th semester and a report shall be submitted.

References:

1. Herbert Schildt, "Java the Complete Reference", 9th Edition, McGraw Hill, 2014.
2. Margaret Levine Young, "The Internet - Complete Reference" , 2nd Edition, Tata McGraw Hill, 2002, (Reprint 2016).
3. Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet and WWW How to Program", 5th Edition, Tata McGraw Hill, 2011.

17CA380	DATA WAREHOUSING AND DATA MINING LABORATORY	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Develop various real time applications using data mining techniques — Understand

CO2: Test the developed code using VB.net and Weka/R tool — Apply

CO3: Apply text mining on the data warehouse — Apply

CO4: Perform multi-dimensional data model using Oracle — Analyze

CO5: Develop a program using a R Tool to solve a association rule — Apply

CO6: Develop a program to perform clustering and Classification using various algorithms. — Analyze

List of Experiments

Perform the given experiments:

1. Execute Queries and PL/SQL
2. Multi-dimensional data model using SQL queries. E.g. Star, snowflake and Fact constellation schemas
3. OLAP operations such slice, dice, roll up, drill up, pivot etc.
4. Text mining on the given data warehouse
5. Correlationship analysis between for the given data set
6. Attribute relevance analysis on the given data
7. Information gain for a particular attribute in the given data
8. Data pre-processing for data mining in Weka/R tool
9. Clustering in Weka/R tool.
10. Association rule analysis in Weka / R tool
11. **Mini Project:**

The course instructor shall provide real time problems / specifications to the students for mini project. The project shall be completed before the Commencement of 4th semester and a report shall be submitted.

Sample Specification: (Data Mining for Financial Data Analysis)

Design and construction of data warehouses for multidimensional data analysis and data mining .View the debt and revenue changes by month, by region, by sector, and by other factors, Access statistical information such as max, min, total, average, trend, etc.

17CA410	ELECTRONIC COMMERCE AND ELECTRONIC BUSINESS	Category	L	T	P	Credit
		PC	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Identify current management issues associated with electronic commerce strategies — Understand

CO2: Analyze the Internet's role in the decision process — Analyze

CO3: Demonstrate the functionality of Electronic Markets and different threats — Analyze

CO4: Develop Business models for Intranet and Extranet e-commerce — Apply

CO5: Explain the electronic payment systems — Understand

CO6: Summarize public policy, Taxation, Infrastructure for E-Commerce — Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	10	10
Understand	20	20	20	20
Apply	40	40	40	40
Analyze	20	20	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Foundations of Electronic Commerce (EC) - The EC field-Electronic markets - Information systems - Benefits and limitation of EC - Driving forces of Electronic Commerce - Impact of EC. Retailing in Electronic Commerce – Overview - Forecast of the B2C Electronic markets. **Electronic Commerce for service industries**- Ordering journals electronically-services-Employment placement and job market-Trading stocks online-Cyber banking and personal finance-Electronic Auctions. **Business-to-Business Electronic Commerce** (B2BEC)-Models of B2BEC-Traditional EDI-software agents for B2BEC-solutions of B2BEC-Managerial issues. Intranet and Extranet.

Electronic Payment Systems (EPS)-Electronic payment and protocols-Security schemes in EPS-Electronic credit card systems-Electronic funds transfer-Electronic cash-Unified payment systems-Prospects of EPS – Case studies. **Electronic Commerce strategy and implementation**-Strategic planning for Electronic Commerce-Competitive intelligence on the internet. Legal issues to Privacy in Electronic Commerce (EC)-Internet protocols-Client/Server technology-Internet Security-Selling on the web-Multimedia delivery-Webcasting-Challenges and Opportunities – Case studies.

Reference Books

1. "Electronic Commerce- A Managerial Perspective", Efraim Turban, Jae Lee and David King, Person Education, 2010. Chapters 1, 2, 5, 6, 7, 8, 9, 10 and 11.

2. "Electronic Commerce: A Managers Guide", Ravi Kalakotta and Andrew B. Whinston, Person Education, 2009.

   "E-Business and IS Solutions: An Architectural Approach to business Problems and Opportunities", William J. Buffan, Person Education, 2009.

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		Category	L	T	P	Credit
17CA420	**COMPUTER NETWORKS**	PC	3	1	0	4

Course Outcomes

On successful completion of the course, the students will be able to

CO1:	Describe the building blocks of Computer Networks	Understand
CO2:	Explain the functionalities and protocols of various layers in ISO/OSI Network model	Understand
CO3:	Implement a suitable routing strategies for a given network	Apply
CO4:	Use suitable transport/application layer protocol based on application requirements	Apply
CO5:	Suggest appropriate access control, congestion control and congestion avoidance technique for a given traffic scenario	Analyze
CO6:	Examine performance analysis for a network using tools like NS2, wire shark	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	40	40	40
Apply	30	30	20	20
Analyze	10	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Network Architecture and Components – ISO/OSI architecture – Functionalities of OSI Layers - TCP/IP architecture – Types of Networks (LAN, WAN, VPN, VLAN) – Network Components (NIC, Bridges, Switches, Routers, Hubs, Gateways)

Network Technologies to connect hosts – LAN Technologies (Ethernet, Token Ring) WAN Technologies (Circuit switching- ISDN , Packet Switching – Frame Relay - (IEEE802.11) – Multiple Access – CSMA/CD – Flow control techniques – Error control techniques.

Internetworking – IPv4 – Global Addresses – ARP – DHCP – ICMP – Routing – Intra domain Routing algorithms (RIP, OSPF) – Subnetting – Classless Addressing – Inter domain routing – Ipv6 – Multicasting – VoIP.

Protocol stack – End to End protocols [TCP (segment format, connection establishment & Termination, Congestion control, Flow Control), UDP] - Application layer protocols (SMTP, IMAP,POP, HTTP, FTP, DNS, Telnet).

Network Performance and Simulation – Bandwidth – latency – Throughput - Jitter – Delay– Network simulation using NS2, WireShark. **Fundamentals of Software defined networks**

Reference Books & web resources

1. BehrouzA.Foruzan, "Data Communication and Networking", Tata McGraw Hill, Fifth Edition, 2013
2. William Stallings, "Data and Computer Communications",Pearson Education Ninth Edition 2013

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

3. Larry L.Peterson and Bruce S. Davie, "Computer Networks – A systems Approach" Fifth Edition, Morgan Kaufmann Publishers,2011
4. Thomas D.Nadeau & Ken gray, "Software defined Networks", O'reilly, 2013
5. http://nptel.ac.in/video.php?subjectId=106105081
6. http://nptel.ac.in/courses/IIT-MADRAS/Computer_Networks/
7. Cisco network fundamentals - http://ptgmedia.pearsoncmg.com/images/9781587132087/samplepages/1587132087.pdf

17CA430	SOFTWARE QUALITY AND TESTING	Category	L	T	P	Credit
		PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain the basic concepts and the processes that lead to software quality and testing	Understand
CO2:	Design test cases from the given requirements using Black box testing techniques	Apply
CO3:	Identify the test cases from Source code by means of white box testing techniques	Apply
CO4:	Know about user acceptance testing and generate test cases for it	Analyze
CO5 :	Examine the test adequacy criteria to complete the testing process	Analyze
CO6:	Develop test cases and test suite using automated testing tools	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	30	30
Apply	40	30	30	30
Analyze	20	30	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Software Quality Management - Basics of Quality, Core Components of Quality, Software Quality Assurance, Software Quality Control, Total Quality Management, Six Sigma, **Fundamentals of Software Testing-** Basics of Software Testing, Test Approaches, Test Planning, Test Strategy, Defects Management, **Requirements based Test Case Design Techniques-** Equivalence Portioning, Boundary value analysis, Cause effect graphing, **Code Based Test Case Generation -** Cyclomatic Complexity - CFG Generation – Test Paths Generation - Test case generation from test paths **Test Adequacy Criteria** - Path Coverage, Statement Coverage, Condition Coverage, Decision Coverage, **Automated Software Testing** – Application of Automated Testing tools –Junit/NUnit/PhUnit/Selenium - Case Study – Cloud Testing

Reference Books

1. Limaye M.G., "Software Testing Principles, Techniques and Tools", Second Reprint, TMH Publishers, 2010.
2. Aditya P.Mathur, "Foundations of Software Testing", 2nd Edition, Pearson Education, 2013.
3. Alan Gilies, "Software Quality Theory and Management", 2nd Edition, Cengage Learning Publishers, 2013 (Reprint)
4. Frank Appel ,Testing with JUnit, 1st Edition, Packt Publishing Limited, 2015
5. Unmesh Gundecha, "Selenium Testing Tools Cookbook", 2nd Revised edition, Packt Publishing Limited, 2015
6. Kees Blokland, Jeroen Mengerink, Martin Pol, "Testing Cloud Services -How to Test SaaS, PaaS & IaaS", 1st Edition, Rocky Nook Publishers, O'Reilly Series, 2013
7. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing – Principles and Practices", 7th Reprint, Pearson Education, 2009.

17CA470	**WEB TECHNOLOGIES LABORATORY**	Category	L	T	P	Credit
		PC	0	0	1	1

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Select suitable Technology as per the application requirements. — Apply

CO2: Develop application in different frameworks — Apply

CO3: Apply the recent techniques and features to Construct an internet application. — Apply

CO4: Host Web applications — Apply

CO5: Work effectively in a team through proper communication based on the given task — Apply

CO6: Develop applications for any IT problems using Web Technologies. — Analyze

Lab experiments

I-Dynamic HTML- Develop a web application by having pages designed using
1. Cascading Style Sheets
2. Object Model and Collections
3. Event Model
4. Filters and TransitionsII-XML

II XML
1. Creating XML documents
2. XML style sheet
3. XML document object model
4. XML query language

III-Scripting Language- Enhance the web application with suitable client side validations and processing using javascript/ vbscript

IV-ASP
10. Server side ActiveX components
11. File System objects
12. Session tracking

V-JSP
13. Request, response, session, application
14. AJAX/JSON/ Angular JS/JQuery

VI- PHP & MySQL and protect it by performing **SQL injection**

Mini Project – The lab exercises are to be carried out in a single application domain such as shopping cart, internet banking, online bidding, online cab booking and the site has to be hosted in a free host web server. The report for the project has to be submitted during the commencement of 5th semester.

Reference Books & web resources
1. HTML, CSS and JavaScript All in One, Julie Meloni, Sams Teach Yourself, Second edition,2014,Pearson.
2. PHP and MySQL Web Development, Luke Welling and Laura Thomson,5th Edition, 2016, Addison Wesley.
3. Professional AngularJS, Valeri Karpov, Diego Netto, Wrox, 2015
4. Internet and WWW How to Program, Paul Deitel, Harvey Deitel, Abbey Deitel, 5th Edition, Tata McGraw Hill, 2011.
5. https://www.w3schools.com
6. www.oracle.com/technetwork/articles/javase/webappdev-142313.html

17CA480	SOFTWARE ENGINEERING LABORATORY	Category	L	T	P	Credit
		PC	0	0	1	1

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Apply SDLC to software development — Apply

CO2: Prepare SRS document and UML Design Documents for a given application — Apply

CO3: Prepare an UML Design Documents for a given application — Apply

CO4: Estimate LOC, function points and software size — Apply

CO5: Develop code using unit and integration testing tools — Apply

CO6: Test Develop software code for the given application — Analyze

List of Experiments

I. Selection of different life cycle Models.
1. Water Fall, Incremental, Evolutionary and Agile Models

II. Planning and Analysis
1. Develop Time-line chart / Gantt and project table.
2. Prepare SRS for the given domain problem.
3. Using COCOMO model to estimate effort for the given domain problem.
4. Calculate effort using FP oriented estimation model
5. Analyze the Risk related to the project and prepare RMMM plan.
6. Draw E-R diagram, DFD for the project.
7. Develop Use Case (Primary) diagram using UML

III. Software Design
1. Develop Use Case (Secondary/ Detailed) using UML
2. Develop Class Diagram using UML
3. Develop Interaction Diagrams using UML
4. Develop State Chart and Activity Diagrams using UML
5. Develop Component, Package and Deployment Diagrams using UML

IV. Implementation of the Software
1. Units / Components Development
2. Integration of components and Results generation

V. Testing the Developed System
1. a. White Box Testing / Structural Testing - Design of the test cases for Unit Testing – JUnit / NUnit

1 b. Black Box Testing / Functional Testing - System / GUI Testing- WinRunner

Prepare FTR. version control and change control for software configuration items.
2. Documentation of SCIs in SCM repository

Reference Books & web resources

1. R.S. Pressman, "Software Engineering: A Practitioner's Approach", 7Edition, McGraw Hill, 2010
2. *SRS* - www.csc.villanova.edu/~tway/courses/csc4181/**srs_template**-1.doc
3. Martin Fowler, "UML Distilled", Third edition, Pearson Education, 2011.
4. Aditya P.Mathur, "Foundations of Software Testing", 2nd Edition, Pearson Education, 2013.
5. Herbert Schledt, "Java2 Complete Reference", 7th Edition, McGraw Hill Publishers, 2007
6. Frank Appel ,"Testing with JUnit", 1st Edition, Packt Publishing Limited, 2015
7. Unmesh Gundecha, "Selenium Testing Tools Cookbook", 2nd Revised edition, Packt Publishing Limited, 2015

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17CA490	MATHEMATICAL COMPUTING LABORATORY	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Explore the possibility of suitable mathematical techniques for problem solving.	Understand
CO2:	Examine a given problem logically and provide an optimal solution.	Understand
CO3:	Apply suitable optimization technique to provide a feasible solution for a given problem.	Apply
CO4:	Develop a program using a high level language to solve a given optimization problem.	Apply
CO5:	Develop a program to statistically analyze a given data set for decision making.	Analyze
CO6:	Develop a program to solve a given problem mathematically.	Evaluate

List of Experiments

Given below is the list of mathematical concepts using which the programs have to be written by the students using C / C++ / JAVA to address a given problem. Using the list given below, Course handling faculty shall also generate a separate list of specific experiments for the conduct of practical sessions for the students.

1. Write a program to implement mathematical logic such as Equivalence and Implications - Equivalence of statements and Truth Tables.

2. Write a program to implement Recursion and Recurrences.

3. Write a program to apply suitable optimization technique to solve the following:
(a) Solving inequalities using Simplex, Two-Phase, Dual Simplex Methods, Revised Simplex Methods.
(b) Finding initial basic feasible solution using North-West Corner rule, Matrix minimum, Vogel's approximation method and also perform optimality test using MODI method.
(c) Solving Assignment problem using Hungarian method.
(d) Applying Gomary's Cutting Plane methods for all Integer Programming Problem (IPP) and mixed IPP.
(e) Identifying critical path for the given PERT and CPM Networks.

4. Solving linear regression, polynomial regression and non-linear regression based problems and solving multiple regression and correlation analysis based problems.

	Category	L	T	P	Credit
17CA510 **SOFTWARE PROJECT MANAGEMENT**	PC	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Identify suitable software process model for software projects.	Understand
CO2:	Differentiate different software product development techniques.	Understand
CO3:	Apply appropriate software cost estimation technique for a given project.	Apply
CO4:	Apply software project management principles for a software project.	Apply
CO5:	Develop software metrics for measuring and managing software processes.	Analyze
CO6:	To assess the software product for quality standards.	Evaluate

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	25	10	10	10
Understand	25	20	10	10
Apply	40	20	30	30
Analyse	10	30	30	30
Evaluate	0	20	20	20
Create	0	0	0	0

Syllabus

Project Management - An Overview; Software Product Lifecycle; **Software Processes**-Process Models-software development-Modern practices and methods; **Software Project Lifecycle Models; Umbrella Activities** in software projects- Software metrics-Software configuration management-Software quality assurance -Risk analysis and management; **Project In-Stream Activities**-Project Initiation -Project Planning-Project Tracking-Project Closure; **Engineering Activities**-Requirements Gathering, Analysis and Management-Software size and cost estimation techniques-Design and development-Testing and Maintenance. **Case studies** on software process models, cost estimation and software design and deployment.

Reference Books

1. Gopalaswamy Ramesh, Managing Global Software Projects, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2012.
2. Walker Royce, "Software Project Management", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011.
3. Bob Hughes, Mikecotterell, "Software Project Management", Third Edition, Tata McGraw Hill, 2012.
4. Robert T. Futrell, Donald F. Shefer and Linda I. Shefer, "Quality Software Project Management", Pearson Education, 2010.

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		Category	L	T	P	Credit
17CA520	**MANAGEMENT INFORMATION SYSTEM**	PC	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Explain the business applications in MIS	Remember
CO2:	Explain the Changing Business Environment for Information Technology	Understand
CO3:	Illustrate the Computer Hardware and Software Work Service Level Agreements	Apply
CO4:	Analyze the Challenges in Knowledge Management Systems	Analyze
CO5:	Use Pivot Tables for digital firm functions	Apply
CO6:	Demonstrate the core activities in the systems development process	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	20	15	15
Understand	20	20	15	15
Apply	40	20	40	40
Analyse	20	40	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Organizations, Management, and the Networked Enterprise: the role of information systems in Business today, Perspectives on Information Systems, contemporary approaches to information systems. **Information Systems, Organizations, and Strategy:** organizations and information systems, information systems impact organizations and business firms, using information systems to achieve competitive advantage, using systems for competitive advantage: management issues**. IT Infrastructure and Emerging Technologies:** IT infrastructure, infrastructure components, contemporary hardware platform trends, contemporary software platform trends. **Managing Knowledge:** the knowledge management landscape, enterprise-wide knowledge management systems, knowledge work systems. **Enhancing Decision Making:** decision making and information systems, business intelligence in the enterprise, business intelligence constituencies. **Building Information Systems:** Systems as planned organizational change, overview of systems development systems, alternative systems-building approaches, application development for the digital firm. **Managing Global Systems:** the growth of international information systems, organizing international information systems.

Reference Books

1. Kenneth C. Laudon Jone & P. Laudon, "Management Information Systems", Thirteenth Edition, Pearson Education Limited 2014.

2. Terry Lucey, "Management Information Systems", Ninth Edition, 2005, Thompson. Effy Oz "Management Information Systems", Fourth International Student Edition, Thomson, 6th Edition, 2008.

		Category	L	T	P	Credit
17CA530	**DATA ANALYTICS**	PC	3	1	0	4

Course Outcomes

On the successful completion of the course, students will be able to:

CO1:	Explain the nature, source and uses of data	Understand
CO2:	Analyze the correlation between various parameters of a data set using suitable techniques through statistical study	Analyze
CO3:	Apply statistical learning using various regression techniques in analytics	Apply
CO4:	Apply supervised learning techniques for data analytics	Apply
CO5:	Apply Unsupervised learning techniques for data analytics	Apply
CO6:	Identify suitable technique for various stages of data analytics	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	20	20	20
Understand	30	20	20	20
Apply	30	30	40	40
Analyse	20	30	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction: Intelligent data analysis – changing data - Nature of data – Modern data analytic tools

Statistical concepts : Probability – Probability distribution – Random sampling - Statistical inference – Prediction and prediction errors – Resampling.

Statistical learning: Introduction - Assessing model accuracy - Regression techniques**:** Simple linear – Multiple linear – Logistic regression – Case study .

Supervised learning Techniques: Logistic regression - Linear Discriminant Analysis – Quadratic Discriminant Analysis - Comparison of classification methods - Subset selection – Shrinkage methods – Dimension reduction methods – Considerations in high dimensions – Basics of decision tree – Bagging – Random forests – Boosting. – Case study.

UnSupervised Learning Techniques: Principal component analysis – K-means clustering – Hierarchical clustering – case study.

Reference Books & web resources

1. James, Gareth, Daniela Witten, and Trevor Hastie. "An Introduction to Statistical Learning: With Applications in R." , Springer, 1st edition , 6th printing, 2016. Chapters 1,2,3,4,5,6,8 & 10.
2. Michael R. Berthold, David J. Hand, "Intelligent Data analysis: An introduction", Springer, 2006. Chapters 1 & 2.
3. John W. Foreman, " Data smart: Using Data Science to Transform Information into Insight", Wiley publications, 2013.
4. Foster Provost, Tom Fawcett, "What You Need to Know about Data Mining and Data-Analytic Thinking", O'Reilly Media, 2013.

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5. Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. "The Elements of Statistical Learning: Data Mining, Inference, and Prediction." *Springer Series in Statistics,* 2009. http://statweb.stanford.edu/~tibs/ElemStatLearn/

6. Montgomery, D. C., and G. C. Runger, Applied Statistics and Probability for Engineers. John Wiley & Sons, 2010.

7. Witten, I. H., E. Frank, and M. A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 2016.

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17CA560	**MOBILE APPLICATION DEVELOPMENT**	Category	L	T	P	Credit
		PC	2	0	2	4

Course Outcomes

On the successful completion of the course, students will be able to:

Course Outcomes for Theory sessions:

CO1:	Explain the features and challenges of mobile devices, native app development frameworks, hybrid app development frameworks	Understand
CO2:	Apply the UI components, multimedia usage, location based services, data storage mechanisms for the given problem	Apply
CO3:	Apply HTML5 in UI design for the given problem	Apply
CO4:	Design an application based on the user requirements	Apply

Course Outcomes for Laboratory sessions:

CO5:	Select appropriate framework for developing applications based on the problem requirements	Analyze
CO6:	Design and develop mobile applications for societal and environmental IT problems	Create

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3*	
Remember	30	30	0	20
Understand	50	40	20	40
Apply	20	30	80	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

 * CAT 3 will be conducted as Practical test

Attainment of course outcome 5 and 6   is evaluated through mini project which provide mobile app solutions to complex real world issues

Mini project on societal, business and environmental applications
Mini Project Details:

Phase – I

- Team formation (Team size: 5)
- Problem identification in various IT, societal, business and environmental applications
- Requirements gathering and analysis for selecting tool (android, phonegap etc)
- Separate modules individually

Phase – II

- Design UI
- Develop programs module level, test and debug individually

Phase – III

- Integrate the modules and show the demo in a team

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- Test the app with the users, improve accordingly and conclude the results
- Document the above process as a report

Syllabus

Mobile Application Development Framework: Types- Features- challenge.
Android: Introduction – Architecture -Installation and configuration- ADE- APIs
User Interfaces: Components-views-Layouts and its types- Menus and its types – Dialogues and its types - Notifications and its types
Data Storage: SQLite database-Files- shared preferences-Content Providers
Location Based Services: Location Provider- Geo Coder- Map
Multimedia: Audio- Video- Animations- Drawing.
Phone Gap and HTML5: Phone Gap Introduction – Architecture- Installation and configuration, **HTML5 Introduction** -Data list control- Validation feature -Application Cache in HTML 5. **Events:** Listener and its types-handler and its types.
Geo location, Media, Storage

List of Experiments

Exp. No.	Topic	No. of Practical Sessions
1	Installation and Configuration of Native App development framework, Emulator creation	1
2	Layouts and menus	1
3	Dialogues and notifications	1
4	SQLite database	1
5	Implement location provider	1
6	Implement audio, video, animations	1
7	Installation and Configuration of Hybrid App development framework	2
8	Mini project phase-I review	1
9	Mini project phase-II review	1
10	Mini project phase-III review	2
	Total Sessions	**12**

Reference Books

1. RetoMeier, "Professional Android Application Development", Wrox, 2010.
2. Thomas Myer, "Beginning PhoneGap",Wrox, 2012.
3. Mark Murphy, "Beginning Android",Apress, 2009.
4. Rick Rogers et.al, "Android – Application Development", O'Reilly, 2009.
5. Matt Gifford, "PhoneGap Mobile Application Development Cookbook", PACKT, 2012.
6. Kerri Shotts, "PhoneGap 2.x Mobile Application Development", PACKT, 2013.
7. Eric Freeman & Elisabeth Robson, "Head First HTML5 Programming", O'Reilly, 2011.

17CA570	ENTERPRISE APPLICATIONS DEVELOPMENT LAB	Category	L	T	P	Credit
		PC	0	0	2	2

Course Outcomes

On the successful completion of the course, students will be able to:

CO1: Design a consistent application across all delivery projects in an Organisation. Apply

CO2: Provide reduction in costs and effort for the delivery projects. Apply

CO3: Achieve the business strategy, vision and target operating model. Apply

CO4: Communicate the project to the EA stakeholders. Apply

CO5: Provide the flexibility to include new ideas in the future. Apply

CO6: Develop quality Enterprise Application by means of integration of various developed components. Apply

Lab Experiments

Development of Enterprise Application using J2EE (Java 2 Enterprise Edition)/ .Net / Open Source Based development -Based on the discretion of the course faculty)
1. Application of Architectural Frameworks & Design Patterns
2. Client Tier development
3. Web Tier Development
4. Business Tier Development
5. System Integration With Enterprise Information System Tier
6. Packaging and Deployment

For any of the following enterprise applications:

1. HR Management

    a. Recruitment System

    b. Staff Appraisal System

2. Finance Management

    a. Billing

    b. Payroll Processing

3. Stock Management

    a. Sales and Purchase

    b. Marketing of Products

4. Production Management (Increase the QTY and QLTY)

    a. Cost Management

    b. Quality Assurance and Delivery of Finished Products

Reference Books & web resources

1. Martin Fowler, Patterns of Enterprise Application Architecture (Addison Wesley Signature Series), 1st Edition, 2010 (Reprint)
2. Inderjeet Singh, Beth Stearns,Mark Johnson, and the Enterprise Team, Designing Enterprise Applications with the J2EE^{TM} Platform, Second Edition, Addison Wesley,2011 (Reprint)
3. John Kanalakis," Developing .NET Enterprise Applications, 1st Edition, Apress, 2003.
4. Yakov Fain, "Enterprise Development with Flex", O'Reilly Series, 1st Edition, 2010
5. vo Jansch, "PHP/Architect's Guide to Enterprise PHP Development", Musketeers.me, LLC, 2008
6. Steven Holzner, PHP: The Complete Reference, McGraw Hill Education; 1 edition (30 November 2007).
7. http://docs.oracle.com/javaee/6/firstcup/doc/gcrky.html
8. http://www.oracle.com/technetwork/developer-tools/jdev/j2eedev-084379.html
9. http://j2eetutorials.50webs.com/
10. http://www.webagesolutions.com/knowledgebase/waskb/waskb017/

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17CAPA0	AGILE SOFTWARE DEVELOPMENT	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the fundamental principles and practices associated with each of the agile development methods	Understand
CO2: Describe the origins and motivations of the Agile Manifesto.	Apply
CO3: Practice the collection of user stories and pair programming	Apply
CO4 : Re factor code as well as tests to meet changing needs	Apply
CO5: Monitor the project backlogs to achieve complete product development	Analyze
CO6: Present a software project by following agile principles that best fit the technical and market demands	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	40	40	30	30
Analyse	20	20	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Agile Software Development: Basics and Fundamentals-Values, principles, stakeholders - Agile Principles-Agile Manifesto – **Agile Software Process Models** - **Exreme Programming** – Twelve Practices of XP- User Stories – Pair Programming – Test Driven Development – **Scrum** – Scrum Methodology – Sprints – Scrum Teams - Scrum Meetings - **Lean Software Development** - Lean Approach - Waste Management,Kaizen – **Kanban** – Kanban in Manufacturing- Principles of Kanban, Workflow of Kanban- Kanban boards, Kanban cards - **Agile Requirements**-User Stories-Backlog Management-Agile Architecture – Feature Driven Development - **Iteration I Project Presentation and Retrospective Analysis - Agile Risk Management** – Risk and Quality Assurance - **Iteration II-Project Presentation and Retrospective Analysis - Agile Review** - Agile Metrics and Measurements-Agile Testing-Test Driven Development, User Acceptance Test - **Scaling Agile for large projects**- Scrum of Scrums-Team collaborations-**Iteration III-Project Presentation and Retrospective Analysis.**

Reference Books:

1. Paul VII, "Agile: The Complete Overview of Agile Principles and Practices (Agile Product Management)", 1st Edition, 2016
2. Robert Martin, "Agile Software Development, Principles, Patterns, and Practices", Pearson New International Edition,2013
3. Mike Cohn, "User Stories Applied: For Agile Software Development", 1st Edition, Addison Wesley Signature Series,2004
4. Greene Jennifer," Learning Agile", 1st Edition, O'Reilly Series, 2014.
5. https://martinfowler.com/agile.html
6. http://www.agilemodeling.com/artifacts/userStory.htm
7. https://refactoring.com/
8. http://www.guru99.com/agile-scrum-extreme-testing.html
9. https://www.tutorialspoint.com/software_testing_dictionary/agile_testing.htm

17CAPB0	**PROGRAMMING IN C# USING .NET**	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the .NET framework	Understand
CO2: Apply the general programming structure of C# in developing software solutions based on user requirements	Apply
CO3: Develop windows application and web applications in .NET framework analyzing user requirements	Analyze
CO4: Demonstrate working advanced features of .NET programming	Understand
CO5: Design a document for GUI applications.	Apply
CO6:Develop Assemblies and Deployment in .NET for Mobile Application Development based on requirements	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	20	20	20
Understand	30	20	20	20
Apply	40	50	50	50
Analyse	10	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

The .Net framework: Introduction, The Origin of .Net Technology, Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS),Microsoft Intermediate Language (MSIL), Just-In –Time Compilation, Framework Base Classes. **C -Sharp Language:** Introduction-Boxing-unboxing, Interfaces, Properties, indexes, Namespace. Method parameter modifiers- Out-ref- Params. Decision Constructs and iteration constructs. **Introduction**-Data Types, Identifiers, Variables, Constants, Literals, Array and Strings,-OOPS concepts-Delegates and Events- -Generic Classes-Generic methods-Generic Interface-Implicitly Typed Local Variable- Anonymous Type. Implicitly Typed Local Variable- Anonymous Type, Object Initializers. LINQ-Introduction

Application Development on .NET: Building Windows Applications. Accessing Data with ADO.NET. Web applications with Web Forms, Web Services **.NET Assemblies:** Assemblies- Versioning- Attributes- Reflection- Viewing metadata − Type discovery – Reflecting on a type − Marshalling − Remoting − Using single call – Threads-Silver Light.

Reference Books

1. Andrew Troelsen, "Pro C# with .NET 3.0 4/E", APress, 2009.
2. Herbert Schildt, C# 3.0 The Complete Reference 4/E., McGraw-Hill, 2009.
3. Liberty, J., Donald Xie, "Programming C# 3.0", 5th Edition, O'Reilly, 2007
4. Robinson, "Professional C#", 3rd Edition, Wrox Press, 2004.

17CAPC0   STORAGE MANAGEMENT TECHNIQUES

Category	L	T	P	Credit
PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain basics Of Information Storage — Understand

CO2: Apply the Data Centre Environment for storing the data. — Apply

CO3: Develop Data Protection from Raid analyzing user requirements. — Apply

CO4: Demonstrate the Fibre Channel Storage Area Networks. — Understand

CO5: Apply Network-Attached, Object Based & Unified — Apply

   Storage for data center environment

CO6: Develop Storage Virtualization, technologies and process — Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	30	30	30
Understand	30	30	30	30
Apply	30	30	30	30
Analyze	10	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

INTRODUCTION TO STORAGE TECHNOLOGY Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

STORAGE SYSTEMS ARCHITECTURE Hardware and software components of the host environment, Key protocols and concepts used by each component.Physical and logical components of a connectivity environment, Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments.

INTRODUCTION TO NETWORKED STORAGE Evolution of networked storage, Architecture, components, and topologies of DAS, NAS, and SAN. Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfills the need , Understand the appropriateness of the different networked storage options for different application environments.

INFORMATION AVAILABILITY, MONITORING & MANAGING List reasons for planned/unplanned outages and the impact of downtime, Differentiate between Business Continuity (BC) and Disaster Recovery (DR),RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures , Architecture of backup/recovery and the different backup/recovery topologies , replication technologies and Remote replication technologies.

SECURING STORAGE AND STORAGE VIRTUALIZATION Information security, Critical security attributes for information systems, Storage security domains, List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes

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References

1. Robert Spalding, "Storage Networks: The Complete Reference", TataMcGrawHill, Osborne, 2003.
2. G.Somasundaram, Alok shrivastava,"Information Storage and Management", Wiley Publishing Inc., 2009.
3. G.Somasundaram, A.Shrivastava, "EMC Corporation,Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized and Cloud Environment", 2nd Edition, Wiley publication,2012.
4. Marc Farley, "Building Storage Networks", Tata McGraw Hill ,Osborne, 2001.
5. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Limited,2002.

	Category	L	T	P	Credit
17CAPD0 **CYBER SECURITY AND LAW**	PE	3	0	0	3

Course Outcomes

On successful completion of the course, the students will be able to

CO1:	Recognize the cyber security policies, standards and procedures for completeness and alignment with generally accepted practices	Understand
CO2:	Explain the functionalities of cyber security	Understand
CO3:	Describe E governance and IT Act	Understand
CO4:	Analyze the root causes of cyber crime	Apply
CO5:	Implement suitable security techniques for a given problem	Apply
CO6:	Suggest appropriate security countermeasures for the given scenario	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	20	20	20
Understand	40	40	40	40
Apply	30	30	30	30
Analyze	0	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Object and Scope of the IT Act-Genesis, Object, Scope of the Act, **Encryption-**Symmetric Cryptography, Asymmetric Cryptography, RSA Algorithm, Public Key Encryption, **Digital Signature-**Technology behind Digital Signature, Creating a Digital Signature, Verifying a Digital Signature, Digital Signature and PKI, Digital Signature and the Law, **E-Governance and IT Act 2000-**Legal recognition of electronic records- Legal recognition of digital signature-Use of electronic records and digital signatures in Government and its agencies, **Certifying Authorities-**Need of Certifying Authority and Power-Appointment, function of Controller-Digital Signature Certifications-Generation, Suspension and Revocation Of Digital Signature Certificate, **Domain Name Disputes and Trademark Law-**Concept of Domain Names-New Concepts in Trademark Jurisprudence-Cyber squatting, Reverse Hijacking, Meta tags, Framing, Spamming-Jurisdiction in Trademark Dispute, **The Cyber Crimes** - Tampering with Computer Source Documents-Hacking with Computer System-Publishing of Information- Offences : Breach of Confidentiality & Privacy-Related to Digital Signature Certificate.

Reference books & web resources

1. Vakul Sharma," Information Technology Law and Practice",3rd edition, Universal Law Publishing Co. Pvt. Ltd.,2012.
2. Universal's Concise Commentary,"The Information Technology Act, 2000" Universal Law Publishing Co. Pvt. Ltd.,2016.
3. William Stallings,Cryptography and Network Security:Principles and Practices,Seventh Edition,Pearson Educarion Asia,2016.
4. https://onlinecourses.nptel.ac.in/noc15_cs03
5. nptel.ac.in/courses/106105031/
6. https://onlinecourses.nptel.ac.in/noc17_cs08
7. https://onlinecourses.nptel.ac.in/noc17_cs0
8. www.nptelvideos.in/2012/11/cryptography-and-network-security.html

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		Category	L	T	P	Credit
17CAPE0	**WIRELESS AD HOC NETWORKS**	PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Define the basic principles of wireless ad hoc networks — Remember

CO2: Explain the functionalities and protocols of various layers. — Understand

CO3: Describe the different issues and working concepts of wireless Ad hoc networks based on different layers. — Understand

CO4**:** Apply different algorithms and techniques based on the layer wise problem solving. — Apply

CO5: Analyze the better problem solving approaches based on the layer wise issues. — Analyze

CO6: Evaluate the overall efficiency of the ad hoc network using any layer based algorithms and techniques. — Evaluate

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	**2**	**3**	
Remember	20	10	10	10
Understand	20	20	10	10
Apply	10	20	30	30
Analyse	50	40	40	40
Evaluate	0	10	10	10
Create	0	0	0	0

Syllabus

Introduction: Introduction-Fundamentals of Wireless Communication Technology - The Electromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of the Wireless Channel - IEEE 802.11 Standard. **Ad Hoc Routing Protocols**: Issues and Challenges - Classifications of Routing Protocols-Table-Driven Routing Protocols - On-Demand Routing Protocols – Hybrid Routing Protocols- Power-Aware Routing (PAR).**Multicast routing In Ad Hoc Networks**: An Architecture Reference Model for Multicast Routing Protocols -Classifications of Multicast Routing Protocols- Tree-Based Multicast Routing Protocols- Mesh-Based Multicast Routing Protocols-Energy-Efficient Multicasting - Multicasting with Quality of Service Guarantees – Application-Dependent Multicast Routing **Transport Layer, Security Protocols**: Designing a Transport Layer Protocol - Design Goals of a Transport Layer Protocol -Classification of Transport Layer Solutions - TCPOver Ad Hoc Wireless Networks -Other Transport Layer Protocols - Security Requirements - Issues and Challenges in Security Provisioning - Network Security Attacks - Key Management - Secure Routing **Qos and Energy Management**: Classifications of QoS Solutions - MAC Layer Solutions-Network Layer Solutions - QoS Frameworks for Ad Hoc Wireless Networks Energy Management in Ad Hoc Wireless Networks –Introduction - Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes.

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

Reference Books
1. C. Siva Ram Murthy and B.S. Manoj "Ad Hoc Wireless Networks: Architectures and Protocols", Pearson education, 2010.
2. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2010.
3. William Stallings, "Wireless Communications and Networks", Pearson education, 2010
4. J. Schiller, "Mobile Communications", Pearson education, 2010.
5. Vijay K. Garg, "Wireless Communications and Networking", Elsevier, 2010

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

14CAPF0	**SUPPLY CHAIN MANAGEMENT**	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain the Supply Chain	Understand
CO2:	Demonstrate the different phases in supply chain	Understand
CO3:	Identify the drivers of supply chain performance	Analyze
CO4:	Build supply chain models	Apply
CO5:	Analyze demand forecasting	Analyze
CO6:	Interpret the strengths and weakness of various transportation network processes.	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	10	10
Understand	20	30	20	20
Apply	40	40	40	40
Analyse	20	20	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Understanding the Supply Chain: The Objectives and Importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of a Supply Chain. **Supply Chain Performance: Achieving Strategic Fit and Scope:** Competitive and Supply Chain Strategies, Achieving Strategic Fit. **Supply Chain Drivers and Metrics:** Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing, Obstacles to Achieving Fit.

Designing the supply chain network: The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network, e-Business and the Distribution Network. **Network Design in the Supply Chain:** The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation, The Role of IT in Network Design.

Demand Forecasting in a Supply Chain: The Role of Forecasting in a Supply Chain, Characteristics of Forecasts, Components of a Forecast and Forecasting Methods, Basic Approach to Demand Forecasting, Measures of Forecast Error. **Transportation in a Supply Chain:** The Role of Transportation in a Supply Chain, Modes of Transportation and Their Performance Characteristics, Transportation Infrastructure and Policies, Design Options for a Transportation Network, Trade-Offs in Transportation Design.

Information Technology in a Supply Chain: The Role of IT in a Supply Chain, The Supply Chain IT Framework, Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, The Future of IT in the Supply Chain, Risk Management in IT.

Text Book

1. Chopra, S, and P. Meindl, "Supply Chain Management: Strategy, Planning and Operation", 2nd edition, Pearson Education, 2010.

2. David Simchi-Levi, Philip Kaminsky, and Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies", McGraw-Hill, New York, 2009.

		Category	L T P	Credit
17CAPG0	**MANAGERIAL ECONOMICS**	PE	3 0 0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Compute the relevant costs of any decision — Apply

CO2: Explain the concept of managerial economics, market and firm — Understand

CO3: Explain the concept of Demand, Supply and Elasticity in economics. — Understand

CO4: Analyze the Estimation of Production and Estimate of cost — Analyze

CO5: Assume the marginal analysis to make extent (how much) decisions — Analyze

CO6: Explain investment decisions that increase the firm value. — Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	50	50	50	50
Analyse	10	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Meaning and scope of Managerial Economics: Managerial Economics & its relationship with Economics - Fundamental Concepts; Opportunity, Cost Principle – Equi-marginal Principle - Marginal & Incremental Principle - Discounting Principle – Economic Profit & Accounting Profit. **Theory of Demand & Supply:** Law of Demand – Demand Function-Demand Curves -Types of Demand - Elasticity of Demand – Measurement of Elasticity-Business applications – Law of Supply – Elasticity of Supply. **Theory of Production:** Production Function; Short run & Long run – Optimal Combination of Factors of Production. **Revenue & Cost Concepts:** Fixed Costs – Variable Costs - Unit Costs - Cost Curves - Decision Making Costs – Break Even Analysis. **Market Structure:** Different types of Markets – Pricing under Perfect Competition, Monopoly, Monopolistic competition and Oligopoly.

Reference Books

1. G.S. Gupta, "Managerial Economics ",Tata Mc Graw-Hill, 2nd edition, 2011.
2. Joel Dean, "Managerial Economics", PHI.2, 2009.
3. Varshiney, R.L. & : Managerial Economics, S. Chand & Son, 2008.
4. Maheshwari. K.I. Mote, Paul & Gupta, Managerial Economics, Tata Mc-Graw Hill, 2010
5. Koutsoiannis. A, Modern Micro Economics, Mc-Millan., 2010

17CAPH0	BUSINESS ANALYTICS	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the evolution of business analytics, business intelligence, operations research and management science, and decision support systems. — Understand

CO2: Apply relative and absolute addressing in Excel formulas. — Apply

CO3: Compute the range, interquartile range, variance, and standard deviation of a set of data. — Apply

CO4: Explain the purpose and procedures of hypothesis testing, ANOVA tool. — Analyze

CO5: Explain the purpose of regression analysis and provide examples in business. — Apply

CO6: Apply the four-step process to develop a mathematical model for an optimization problem. — Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	40	40	30	30
Analyse	20	20	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Foundations of Business Analytics: Evolution of Business analytics, scope, Data for Business Analytics, Models in Business Analytics**,** problem solving with business analytics.
Analytics on Spreadsheets: Basic Excel, Excel Formulas, Excel Functions, Data Queries.
Descriptive Analytics: Descriptive Statistical measures - Populations and samples, Statistical notations, Measures of Location, Measures of Dispersion, and Measures of Association. **Statistical Inference:** Hypothesis testing, one-Sample Test, Two-Sample Test, Two tailed Hypothesis for mean, ANOVA. **Predictive Analytics:** Simple Linear regression, Multiple Linear regression, Residual Analysis, Building regression models, Regression with categorical Independant variables. **Prescriptive Analytics:** Building Linear Optimization models, Implementing Linear Optimization models on spreadsheets, Solving Linear Optimization models.

Reference Books

1. James Evan, Business Analytics- Methods, Models, and Decisions (2nd Edition), Pearson, 2013. (Chapters: 1, 2, 4, 7, 8, 13)
2. Gert H. N. Laursen, Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Wiley (2nd Edition),2010.
3. S. Christian Albright and Wayne L. Winston, Analytics: Data Analysis and Decision Making, Sixth Edition, 2014.

17CAPL0	**CUSTOMER RELATIONSHIP MANAGEMENT**	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Illustrate key concepts, technologies and best practices of CRM	Understand
CO2: Discuss the view of the organization of business and its integration with CRM	Understand
CO3: Apply CRM value proposition for different vertical markets	Apply
CO4: Illustrate CRM customer data acquisition, management, research, analysis and use	Apply
CO5: Use CRM Tools for various Process.	Apply
CO6: Demonstrate various Trends in CRM	Apply

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	30	20	20
Understand	30	30	20	20
Apply	40	40	60	60
Analyse	0	0	0	0
Evaluate	0	0	0	0

Syllabus

Introduction Definitions - Concepts and Context of relationship Management – Evolution - Transactional Vs Relationship Approach –CRM as a strategic marketing tool – CRM significance to the stakeholders. **Understanding Customer** Customer information Database – Customer Profile Analysis - Customer perception, Expectations analysis – Customer behavior in relationship perspectives; individual and group customer's - Customer life time value – Selection of Profitable customer segments. **CRM Structure** Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection – Models of CRM – CRM road map for business applications.**CRM Planning and Implementation** Strategic CRM planning process – Implementation issues – CRM Tools - Analytical CRM – Operational CRM – Call center management – Role of CRM Managers **TRENDS in CRM** E - CRM Solutions – Data Warehousing – Data mining for CRM – Open source CRM tools – CRM analytics, CRM in Financial Techniques.

Reference Books

1. G.Shainesh, Jagdish, N.Sheth, Customer Relationships Management Strategic Prespective, Macmillan 2010.
2. Alok Kumar et al, Customer Relationship Management : Concepts and applications, Biztantra, 2011
3. H.Peeru Mohamed and A.Sahadevan, Customer Relation Management, Vikas Publishing 2012
4. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2011
5. Buttle, Francis. Customer Relationship Management, Elsevier Publishing, 2012.

17CAPM0	ENTERPRISE RESOURCE PLANNING	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Classify the business processes and the business models underlying the ERP system — Understand

CO2: Differentiate the software lifecycle for traditional and ERP software. — Understand

CO3: Demonstrate different approaches for ERP software selection and deployment. — Apply

CO4: Examine the integration of ERP modules and its sub-modules. — Analyze

CO5: Compare Re-engineered business processes of chosen enterprise system. — Analyze

CO6: Assess the performance deployed ERP using metrics. — Evaluate

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	20	20
Understand	20	10	20	20
Apply	20	30	25	25
Analyse	20	30	25	25
Evaluate	20	20	10	10
Create	0	0	0	0

Syllabus

Enterprise Resource Planning (ERP)-Introduction-basic concepts-benefits of ERP and limitations. **Evolution of ERP**-Materials Requirements Planning (MRP) - Manufacturing Resource Planning (MRP II)-Business modeling. **ERP and its related technologies**-Data Mining-Data Warehousing-Business Process Reengineering-Decision Support System (DSS)-Management Information System (MIS) - Executive Information System (EIS)-OLAP. **ERP for manufacturing processes**-Distribution requirements planning (DRP)-Master production schedule. **ERP software selection**-Risks factors-Role of consultants. **Modules in an ERP software package**-Finance-sales and distribution-plant maintenance-materials management-quality management. **Future directions of ERP**- Mobile ERP system Case Studies of ERP implementation-Problems-challenges and software solution for the enterprises-performance indicators of an ERP package.

Reference Books

1. "Enterprise Resource Planning", Alexis Leon, TataMcGraw-Hill, 3rd Edition, 2014.
2. "Enterprise Resource Planning", Bret Wagner, Ellen Monk, Cengage Learning, 3rd Edition, 4th Edition, 2013.
3. "ERP to E^{2}RP A Case Study Approach", Sandeep Desai, Abhishek Srivastava, Prentice Hall of India, Delhi, 2013. .

17CAPN0	**BUSINESS PROCESS RE-ENGINEERING**	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Describe the current state of Business Process Reengineering	Understand
CO2: Apply the origami process based on Computer Aided Process Reengineering.	Apply
CO3: Demonstrate Purchase order process based CAPRE Techniques.	Apply
CO4: Analyze the concepts of TQM and CPI, modern business Process and practices.	Analyze
CO5: Analyze working knowledge of Business Accounting, Regulatory aspects of business and business practices in IT Fields.	Analyze
CO6: Analze the Case Studies on BPR like Software Support Process Simulating software Development Schedules	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	10
Understand	30	30	30	30
Apply	40	40	40	40
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Introduction to BPR (Business Process Reengineering)-BPR at its Best-Process Parameters-Disturbing Plot-Changing Scenarios. A New Perspective on Change in Business-The state of Business Process Reengineering-Computer Aided Process Reengineering-The SEI Process Maturity Model-Deming's Theories of Continuous Improvement-Sense's Theories of Causal Analysis-Process Examples-Origami Process Description-Purchase Order Process Description. **LEVEL 1 (Initial) Processes**:- The Origami Process at Level 1-The Purchase Order Process: First Attempt at Reengineering. TQM-Applying it to Level 1 Processes. Communications:- The foundation of Process Reengineering. **LEVEL 2 (Repeatable) Processes:-** Migration of the Origami Process to Level 2-Purchase Order Process: Second attempt at Reengineering-The Computer Aided Process Reengineering Method of Documentation. **LEVEL 3 (Defined) Processes:-** Migration of the Original Process to Level 3-Purchase Order Process: Third Attempt at Reengineering. **LEVEL 4 (Measured) Processes:-** Measuring the Origami Process-Purchase Order Process: Fourth Attempt at Reengineering-Process Drivers and Process Metrics-Input to Tasks-Staff Required for the task-Time Required to perform the task-Conditional Processing-Task Initiation-Rework-Costs-Process metrics. **OPTIMIZED (LEVEL 5) Processes:-** Origami Process Migration to Level 5. Modeling and Simulation Terminology and Techniques:- An Overview-Visual Paradigm-Icons-Iconic Blocks-Types of Simulation-Discrete & Continuous-Hybrid Simulation – Object Orientation – Requirements – Based Analysis - Hierarchical lock libraries-Open Architecture. **Process Reengineering Case Studies**-Applications of Computer Aided Process Reengineering-Software Support Process-Simulating Software Development Schedules-A Sample Process-Modeling Process-Determining the Best Process. Case Studies on BPR for different business sectors – Comparison of CMM Levels with BPR Levels.

Reference Books

1. Gregory A.Hansen, "Automating Business Process Reengineering", Prentice Hall, 2011.
2. Dennis E. Wisnosky and Rita C. Feeney, "A Practical Guide to BPR Project Management", Wisdom Systems, Inc.; Book and CD-ROM edition (June 12, 2011)
3. G. Darnton and M. Darnton, Business Process Analysis, Intern. Thompson Business Press, Boston, MA, 2014

17CAPQ0   **SOCIAL NETWORK ANALYSIS**

Category	L	T	P	Credit
PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Explain semantic web related applications.	Understand
CO2:	Explain key concepts and measures in network analysis	Understand
CO3:	Classify the Blogs and online communities	Analyze
CO4:	Demonstrate knowledge using ontology.	Apply
CO5:	Discuss social network features with Semantic Web applications	Apply
CO6:	Evaluate web-based social network extraction	Evaluate

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	40	20	20	20
Apply	40	20	30	30
Analyse	10	30	20	20
Evaluate	0	10	10	10
Create	0	0	0	0

Syllabus

Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web. **Social Network analysis**: Development of Social Network Analysis -Key concepts and measures in network analysis. **Electronic sources for network analysis:** Electronic discussion networks, Blogs and online communities - Web-based networks. **Knowledge representation on the Semantic web:** Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language. **Modelling and aggregating social network data:** State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data. **Social-semantic applications:** Generic Architecture- Sesame- Elmo – Graph util, Flink-Open academia. **Social network extraction:** Survey method-electronic data extraction- Data collection- Optimiztion- prediction- Evaluation.

Reference Books

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007. (Chapters 1 to 7)
2. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", First Edition Springer, 2011.
3. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
4. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
5. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

17CAPR0	OPEN SOURCE SOFTWARE	Category	L	T	P	Credit
		PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the significance of open source practices and Understand guidelines.

CO2: Manipulate open source databases based on user Apply requirements

CO3: Implement web programming with PHP   Apply

CO4:   Write desktop and web applications with Python   Apply

CO5: Integrate open source web frameworks in an application   Apply

CO6: Explain the architecture of open source Web frameworks   Understand

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	30	20	20
Understand	40	30	30	30
Apply	40	40	50	50
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

 INTRODUCTION : Need for free and open source software, Development environment tools and systems - FOSS practices -programming guidelines

  PHP : PHP Language Basics, Functions - calling a function, variable function, and anonymous function, Strings - cleaning, encoding and escaping and comparing strings, Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays, Objects – creation, introspection, and serialization, Web Techniques – processing forms and maintaining state.

PYTHON PROGRAMMING : Strings - Operators - Decisions- Functions - Classes and Objects - Files and Directories – Modules - Text processing - Accessing Databases - Simple web application using python.

OPEN SOURCE DATABASES: MYSQL – Mongo DB – Postgre SQL – Database demonstration with Mongo DB – Create, Insert, Delete, update and query, Projection, Aggregation, Sorting, Sharding - Integration with front end application.

OPEN SOURCE FRAMEWORKS: Client side web framework: Angular JS: Introduction – Modules – Directives – Data binding – Scope – Filters – Services – Events - HTTP - Tables - SQL - Forms ; Server web framework Django - Integrating with databases and applications.

Reference Books

1. Jesús M. González-Barahona, JoaquínSeoanePascual, Gregorio Robles, Introduction to Free Software, Free Technology Academy, Europe, 2009. (http://ftacademy.org/materials/fsm/1#1).
2. Allen B. Downey, Think Python, O'Reilly Publications, 2011.
3. James Payne, Beginning Python - Using Python 2.6 and 3.1, Wiley India Pvt. Ltd., 2010
4. Kevin Tatroe, Peter MacIntyre, Rasmus Lerdorf, "Programming PHP", O'Reilly Media, 2012.
5. Kristina Chodorow, "MongoDB: The Definitive Guide", 2nd Edition, O'Reilly media, 2013.
6. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Apress, 2009
7. Brad Green and Shyam Seshadri, "Angular JS", O'Reilly Publications, First edition, 2013.

	Category	L	T	P	Credit
17CAPS0 **SOFT COMPUTING**	PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Describe soft computing techniques and their roles in building intelligent machines   Understand

CO2: Analyze various fuzzy models in developing fuzzy inference systems to be appropriate with specific real time problems   Analyze

CO3: Apply specific unsupervised and supervised neural networks to find approximate solutions to real world problem   Apply

CO4: Use genetic algorithms to combinatorial optimization problems   Apply

CO5: Explain the behavior of evolutionary computing algorithms   Understand

CO6: Present the feasibility of applying a soft computing methodology for specific problem   Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	10	10
Understand	40	20	30	30
Apply	40	40	30	30
Analyse	0	20	30	30
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

INTRODUCTION TO SOFT COMPUTING : Introduction to soft computing – Artificial Intelligence – Applications – Techniques.

FUZZY SET THEORY Fuzzy Sets – Basic Definition and Terminology – Fuzzy set operators – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Fuzzy Modeling-Case study of fuzzy inference system in data analysis.

OPTIMIZATION TECHNIQUES: Introduction to optimization techniques - Genetic Algorithms - Selection - Genetic operators- Crossover and Mutation– Binary coded GA – Real coded GA - Particle Swarm Optimization – Ant Colony Optimization - Case study of genetic algorithm application in data analysis.

NEURAL NETWORKS: Introduction - Supervised Learning Neural Networks – Perceptrons - Adaline – Mutilayer Perceptrons – Feed forward - Back propagation - Unsupervised Learning Neural Networks – Kohenen networks- Hebbian networks - Case study for neural networks.

APPLICATIONS OF SOFTCOMPUTING: Case studies on Hybrid systems in Information retrieval/Analytics/Decision support systems.

Reference Books

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing- A Computational Approach to Learning and Machine Intelligence", Pearson Education, First edition, 2015. Chapters 2, 3,4,9,11

2. Rajasekaran, Sanguthevar, and GA Vijayalakshmi Pai. *Neural networks, fuzzy logic and genetic algorithm: synthesis and applications*. PHI Learning Pvt. Ltd., 2003. (Genetic algorithm)

BOS meeting approved: 27-04-2017   Approved in 54th Academic Council meeting on 17-06-2017

3. George J.Klir and, Bo Yuan, Fuzzy sets and Fuzzy Logic: Theory and Applications, Pearson Education, First Edition, 2015. (Case studies in Fuzzy systems)

4. Zimmermann, Hans-Jürgen. Fuzzy set theory—and its applications. Springer Science & Business Media, 2011.

5. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Education., 2007.

6. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 2008.

	Category	L	T	P	Credit
17CAPT0 **CLOUD COMPUTING**	PE	3	0	0	3

Course Outcomes

On the successful completion of the course, students will be able to

CO1:	Describe the key technologies, architecture, strengths, limitations and applications of cloud computing	Understand
CO2:	Explain the types and service models of cloud.	Understand
CO3:	Describe the core issues such as security, privacy, and interoperability in cloud platform.	Understand
CO4:	Apply suitable technologies, algorithms, and applications in the cloud computing driven systems	Apply
CO5:	Provide appropriate cloud computing solutions for the given scenario	Analyze
CO6:	Analyze how applications are deployed in cloud	Analyze

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	40	40	40
Apply	30	40	40	40
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Syllabus

Virtualization for Cloud: Need for Virtualization, Pros and cons of Virtualization, Types of Virtualization, System VM, Process VM, Virtual Machine monitor, Virtual machine properties, Interpretation and binary translation, HLL VM, Hypervisors : Xen, KVM , VMWare, Virtual Box, Hyper-V.
Cloud Architecture: Definition, Characteristics, Service models, Deployment models, Types, Challenges, Three-layer architecture, Concepts & Terminologies - Virtualization, Load balancing, Scalability and elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Service level agreement, Billing.
Service Models: SaaS – Multitenant, OpenSaaS, SOA. PaaS – IT Evolution, Benefits, Disadvantages. IaaS – Improving performance, System and storage redundancy, Cloud based NAS devices, Advantages, Server types. IDaaS – Single Sign-on, OpenID.Database as a Service, Monitoring as a Service, Communication as services.Service providers - Google, Amazon, Microsoft Azure, IBM, Sales force.
Cloud Storage: Overview of cloud storage, cloud storage providers, Cloud file system, Mapreduce. Case study: Walrus, Amazon S3, Hadoop.
Securing the Cloud: Identity and access management, Data loss prevention, Web security, E-mail security, Security assessments, Intrusion management, Security information and event management, Encryption and BCDR implementation, Network Security.
Deployment Tools: Eucalyptus, Nimbus, Openstack, Cloudstack, Open Nebula.

Reference Books
1. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.
2. John Rittinghouse & James Ransome, "Cloud Computing, Implementation, Management and Strategy", CRC Press, 2010.
3. T. Velte, A. Velte, R. Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill, 2009.
4. Cloud Security Alliance, "Providing greater clarity in Security as a Service", 2013.
5. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, "Mastering cloud computing", Morgan Kaufman, 2013.
6. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More", Jones and Bartlett learning, First edition, 2013.
7. ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", CreateSpace Independent Publishing Platform, 1st edition, 2013.
8. Massimo Cafaro (Editor), Giovanni Aloisio (Editor), "Grids, Clouds and Virtualization" Springer; edition, 2011.
9. GautamShroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, 2010.

ADDITIONAL ELECTIVE COURSES AND ONE CREDIT COURSE

IN

Master of Computer Applications (M.C.A) Degree Program

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2017-2018 ONWARDS

THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided ISO 9001-2008 certified
Autonomous Institution affiliated to Anna University)

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Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

17CAPU0	MACHINE LEARNING	Category	L	T	P	Credit
		PE	3	0	0	3

Preamble

The course aims to provide an understanding of machine learning's role in data-driven modeling, prediction, and decision-making.

Prerequisite

17CA230 - Design and Analysis of Algorithms
17CA350 - Data Warehousing and Data Mining

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Illustrate the steps involved in designing a machine learning algorithm. — Understand

CO2: Construct training and prediction algorithms for classification using decision trees, artificial neural networks and Support Vector Machines — Apply

CO3: Illustrate various Practical applications of Reinforcement Learning. — Understand

CO4: Compare the available design options and apply supervised and unsupervised learning algorithms to solve complex problems with an understanding of the trade-offs involved. — Analyze

CO5: Design and implement various machine learning algorithms in a range of real-world applications. — Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	M			S					
CO2		L	M		S						
CO3			S					M			
CO4			S		M		M				
CO5			S		M		M				

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	40	40	30	40
Analyse	20	20	30	20
Evaluate	0	0	0	0
Create	0	0	0	0

Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

Course Level Assessment Questions

Illustrate the steps involved in designing a machine learning algorithm (CO1):
1. What is Machine learning?
2. What are the five popular algorithms of Machine Learning?
3. What are the different Algorithm techniques in Machine Learning?
4. List down various approaches for machine learning?
5. Classify the various types of training experience suitable for learning tasks.

Construct training and prediction algorithms for classification using decision trees, artificial neural networks and Support Vector Machines (CO2):
1. What is algorithm independent machine learning?
2. What are the advantages of Naive Bayes?
3. Define Perceptron Training Rule.
4. Explain the two components of Bayesian logic program?
5. Derive the formula that calculates the margin given a set of linearly separable training examples
6. What are neural networks used for?

Illustrate various Practical applications of Reinforcement Learning (CO3):
1. What are the two classification methods that SVM (Support Vector Machine) can handle?
2. What is ensemble learning?
3. Assume that you have to build a classifier based on SVM to classify a set of images into one of the given 100 types of different flowers. Analyze and Illustrate the Pros and Cons of each of the following techniques to perform a multi-class classification using SVM: (i) One-against-One (ii) One-against-All (iii) Directed Acyclic Graph (DAG) SV
4. What linear function is used by a SVM for classification? How is an input vector x_i (instance) assigned to the positive or negative class?
5. Illustrate the constrained minimization problem that defines the SVM learning given a set of linearly separable training examples. What is the outcome of solving the problem?

Compare the available design options and apply supervised and unsupervised learning algorithms to solve complex problems with an understanding of the trade-offs involved (CO4):
1. What are the different methods for Sequential Supervised Learning?
2. What is the difference between deep learning and reinforcement learning?
3. Is classification supervised learning?
4. Illustrate the different types of supervised learning in machine learning?
5. How does unsupervised learning work?

Design and implement various machine learning algorithms in a range of real-world applications (CO5):

1. Examine the various strategies to be considered for implementing parallel machine learning algorithm in Hadoop framework.
2. Design and implement a parallel machine learning algorithm on top of the Hadoop framework for a research problem (Assignment)
3. Explain some applications of Machine Learning from Day-to-Day Life.
4. What is the best programming language for machine learning?

Concept Map
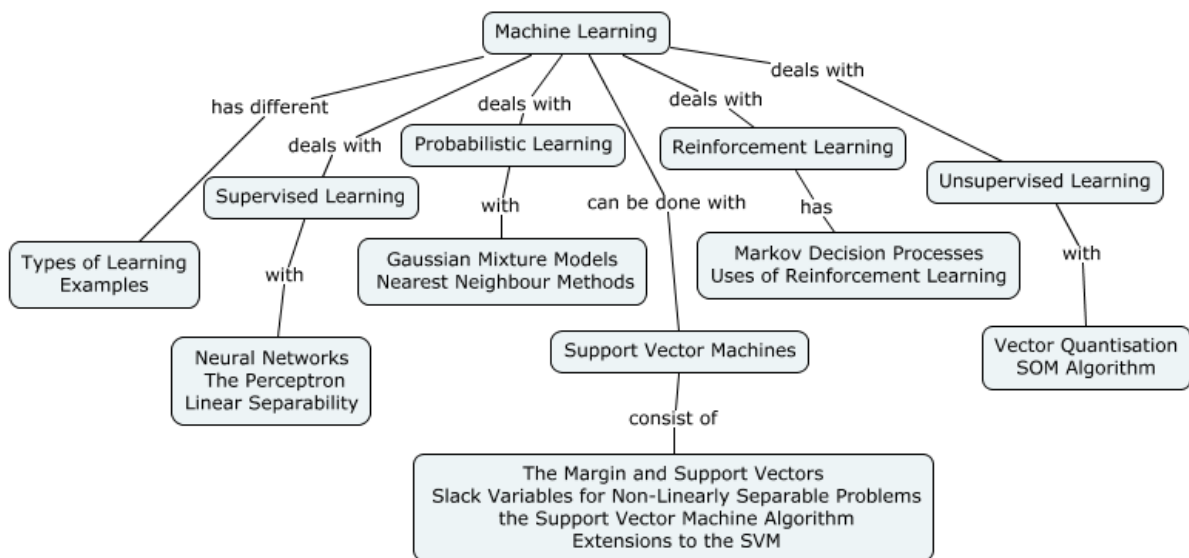
Syllabus

Introduction: Machine Learning, Types of Learning, Examples of Machine Learning Applications, **Supervised Learning**: Neural Networks, The Perceptron, Linear Reparability. **Probabilistic Learning**: Gaussian Mixture Models, Nearest Neighbour Methods. **Support Vector Machines:** The Margin and Support Vectors, Slack Variables for Non-Linearly Separable Problems, the Support Vector Machine Algorithm, Extensions to the SVM, **Reinforcement Learning:** Markov Decision Processes, Uses of Reinforcement Learning, **Unsupervised Learning:** Vector Quantization, the SOM Algorithm.

Reference Books

1. Tom Mitchell, "Machine Learning", McGraw Hill, Indian edition, 2017.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2013.
3. Alpaydin Ethem, "Introduction to Machine Learning", Prentice Hall, 3rd edition, 2015.
4. Stephen Marsland, "Machine learning: An algorithmic perspective", CRC, 2009.

Course Contents and Lecture Schedule

Module .No	Topics	No.of Lectures
1	**Introduction:** Machine Learning	2
1.1	Types of Learning	1
1.2	Examples of Machine Learning Applications	2
2	**Supervised Learning:**	1
2.1	Neural Networks,	2
2.2	The Perceptron,	2
2.3	Linear Separability,	2
2.4	The Multi-Layer Perceptron Algorithm.	2
3	**Probabilistic Learning:**	1
3.1	Gaussian Mixture Models	2
3.2	Nearest Neighbour Methods	2
4	**Support Vector Machines:**	2
4.1	The Margin and Support Vectors,	1
4.2	Slack Variables for Non-Linearly Separable Problems,	2
4.3	the Support Vector Machine Algorithm,	2
4.4	Extensions to the SVM	2
5	**Reinforcement Learning:**	2
5.1	Markov Decision Processes	2
5.2	Uses of Reinforcement Learning	1
6	**Unsupervised Learning:**	1
6.1	The K-Means Algorithm	2
6.2	Vector Quantisation	2
6.3	the SOM Algorithm	2
	Total	40

Course Designers

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Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

		Category	L	T	P	Credit
17CAPV0	**ARTIFICIAL INTELLIGENCE**	PE	3	0	0	3

Preamble

This course is designed to introduce the basics of artificial intelligence and its applications. The course is intended to facilitate the students to apply intelligent algorithms in real time environments and extend them for data analysis.

Prerequisite

17CA140 - Data Structures

17CA230 - Design and Analysis of Algorithms

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the nature and structure of Artificial intelligence agents	Understand
CO2: Use suitable uninformed or informed search algorithms for optimal solution	Apply
CO3: Demonstrate the adversarial search techniques and constraint satisfaction problem	Understand
CO4: Apply suitable algorithmic techniques to approach uncertainty with complete data and partial data	Apply
CO5: Adopt learning techniques for intelligent decision	Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	S	L	L	M	-	-	-	-	-	-	-	-
CO2.	S	S	S	M	L	-	M	-	-	-	-	-
CO3.	S	S	S	M	-	-	-	-	-	-	-	-
CO4.	S	S	S	M	L	-	M	-	-	-	-	-
CO5	S	S	S	M	L	-	M	-	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	20	20	20
Understand	50	40	40	40
Apply	30	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

Course Level Assessment Questions

Explain the nature and structure of Artificial intelligence agents (CO1):
1. Explain Simple – reflex agents.
2. Differentiate between Goal-based agents and Utility-based agents
3. Explain the various types of environments
4. Describe PEAS in terms of task environment.

Use suitable uninformed or informed search algorithms for optimal solution (CO2)
1. Consider the n-queens problem using the "efficient" incremental formulation. Explain why the state space has at least $3 \sqrt{n!}$ states and estimate the largest n for which exhaustive exploration is feasible.
2. Prove each of the following statements, or give a counterexample:
   a. Breadth-first search is a special case of uniform-cost search.
   b. Depth-first search is a special case of best-first tree search.
   c. Uniform-cost search is a special case of A* search.
3. Demonstrate Iterative – Deepening search for a given graph.

Demonstrate the adversarial search techniques and constraint satisfaction problem (CO3)
1. Illustrate minimax algorithm with an example.
2. Demonstrate alpha-beta pruning technique to minimize the number of game states.
3. Define Constraint Satisfaction problem.
4. Demonstrate how Job-shop scheduling is solved with Constraint satisfaction problem.
5. Explain the arc consistency and path consistency in a constraint satisfaction problem.

Apply suitable algorithmic techniques to approach uncertainty with complete data and partial data (CO4)
1. A doctor knows that the disease meningitis causes the patient to have a stiff neck, say, 70% of the time. The doctor also knows some unconditional facts: the prior probability that a patient has meningitis is 1/50,000, and the prior probability that any patient has a stiff neck is 1%. Use Bayes rule to find how many patients are expected to have meningitis across a total population of patients?
2. Explain the method for constructing Bayesian network.
3. We have a bag of three biased coins a, b, and c with probabilities of coming up heads of 20%, 60%, and 80%, respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins), and then the coin is flipped three times to generate the outcomes X_1, X_2, and X_3.
   a. Draw the Bayesian network corresponding to this setup and define the necessary CPTs.
   b. Calculate which coin was most likely to have been drawn from the bag if the observed flips come out heads twice and tails once.
4. Demonstrate Hidden Markov model.
5. A professor wants to know if students are getting enough sleep. Each day, the professor observes whether the students sleep in class, and whether they have red eyes. The professor has the following domain theory:
   • The prior probability of getting enough sleep, with no observations, is 0.7.
   • The probability of getting enough sleep on night t is 0.8 given that the student got enough sleep the previous night, and 0.3 if not.
   • The probability of having red eyes is 0.2 if the student got enough sleep, and 0.7 if not.
   • The probability of sleeping in class is 0.1 if the student got enough sleep, and 0.3 if not. Formulate this information as a dynamic Bayesian network that the professor

could use to filter or predict from a sequence of observations. Then reformulate it as a hidden Markov model that has only a single observation variable.

**Adopt supervised learning techniques for intelligent decision (CO5)**

1.Consider the following data set to decide on the waiting for a table:

Example	Input Attributes										Goal
	Alt	Bar	Fri	Hun	Pat	Price	Rain	Res	Type	Est	WillWait
x_1	Yes	No	No	Yes	Some	$$$	No	Yes	French	0–10	$y_1 = Yes$
x_2	Yes	No	No	Yes	Full	$	No	No	Thai	30–60	$y_2 = No$
x_3	No	Yes	No	No	Some	$	No	No	Burger	0–10	$y_3 = Yes$
x_4	Yes	No	Yes	Yes	Full	$	Yes	No	Thai	10–30	$y_4 = Yes$
x_5	Yes	No	Yes	No	Full	$$$	No	Yes	French	>60	$y_5 = No$
x_6	No	Yes	No	Yes	Some	$$	Yes	Yes	Italian	0–10	$y_6 = Yes$
x_7	No	Yes	No	No	None	$	Yes	No	Burger	0–10	$y_7 = No$
x_8	No	No	No	Yes	Some	$$	Yes	Yes	Thai	0–10	$y_8 = Yes$
x_9	No	Yes	Yes	No	Full	$	Yes	No	Burger	>60	$y_9 = No$
x_{10}	Yes	Yes	Yes	Yes	Full	$$$	No	Yes	Italian	10–30	$y_{10} = No$
x_{11}	No	No	No	No	None	$	No	No	Thai	0–10	$y_{11} = No$
x_{12}	Yes	Yes	Yes	Yes	Full	$	No	No	Burger	30–60	$y_{12} = Yes$

Use Decision tree algorithm to derive a decision tree.

2. Demonstrate how EM learning is applied in Bayesian networks.
3. Explain how boosting algorithm works with an example.
4. Our favorite Surprise candy comes in two flavors: cherry (yum) and lime (ugh). The manufacturer has a peculiar sense of humor and wraps each piece of candy in the same opaque wrapper, regardless of flavor. The candy is sold in very large bags, of which there are known to be five kinds—again, indistinguishable from the outside:
h1: 100% cherry, h2: 75% cherry + 25% lime, h3: 50% cherry + 50% lime,
h4: 25% cherry + 75% lime, h5: 100% lime
Given a new bag of candy, the random variable H (for hypothesis) denotes the type of the bag, with possible values h1 through h5.Apply Bayesian learning to the given scenario.

Concept Map
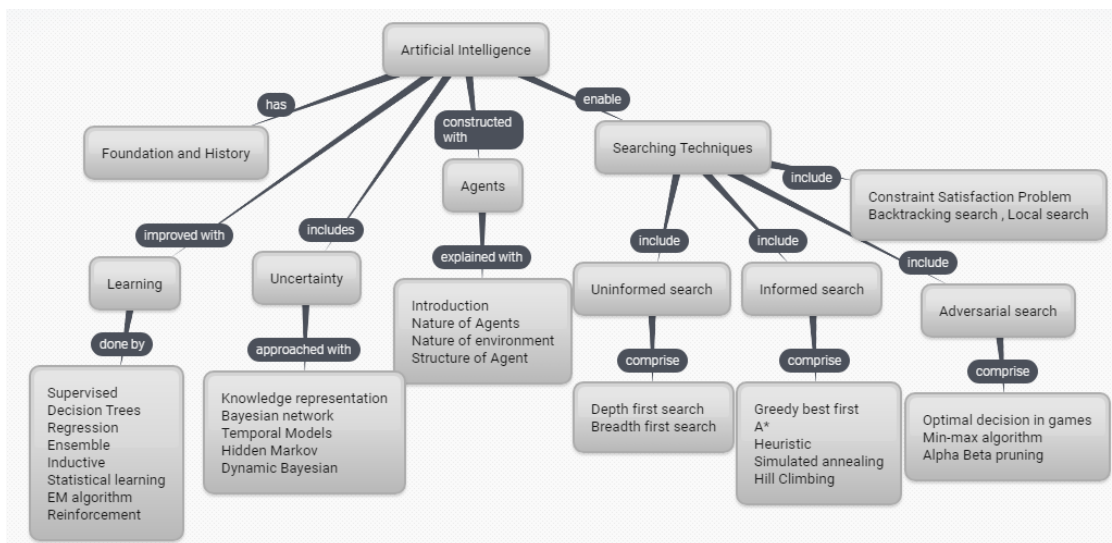
Syllabus

Introduction to Artificial Intelligence (AI): Foundations of AI – History of AI – Agents and Environments – Nature of Environments – Structure of Agents

Searching Techniques: Formulating problems – Searching for solutions - Uninformed search strategies – uniform cost search – Depth limited search – Deepening DepthFirst search - Informed search strategies - Greedy best first search – A* – Hill climbing search – Simulated Annealing - : Games – Optimal decisions in games – Alpha – Beta Pruning - Constraint Satisfaction Problems (CSP) - Defining CSP – Backtracking search for CSP – Local search for CSP

Uncertain knowledge and reasoning: Basic probability Notation – Inference – Bayes' rule - Representing Knowledge – Bayesian networks – Representation and inference – Temporal models – Hidden Markov Models – Dynamic Bayesian networks

Learning: Learning from Examples – Supervised learning – Decision trees – Regression and classification with linear models – Ensemble learning – Inductive learning – Statistical Learning – EM algorithm - Reinforcement learning – Passive and active reinforcement – Applications of Reinforcement learning – Case study.

Reference Books & web resources

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2010.
2. George F. Luger, Artificial Intelligence-Structures and Strategies for Complex problem solving, Pearson, 6th Edition, 2009.
3. David Poole, Alan Mackworth, Artificial Intelligence: Foundations for Computational Agents", Cambridge Univ. Press, 2010.
4. Gerhard Weiss, ―Multi Agent Systems‖, Second Edition, MIT Press, 2013.
5. Nils Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998.
6. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, 3rd Edition, 2008.
7. NPTEL course on Artificial Intelligence: https://nptel.ac.in/syllabus/106105077/

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lecture hours
1.	**Introduction**	
1.1	Foundation and history of AI	1
1.2	Agents and environments	1
1.3	Nature of Environments	1
1.4	Structure of Agents	2
2.	**Searching Techniques**	
2.1	Formulating problems ,Searching for solutions	1
2.2	Uninformed search strategies – Uniform cost search	1
2.3	Depth limited search – Deepening DepthFirst search	2
2.4	Informed search strategies - Greedy best first search – A*	2
2.5.	Hill climbing	1
2.6	Simulated Annealing	1
2.7	Adversarial search – optimal decision in games	1

Module No.	Topic	No. of Lecture hours
2.8	Alpha-beta pruning	1
2.9	Constraint Satisfaction Problem – Backtracking search	1
2.10	Local search for CSP	1
3	**Uncertain knowledge and reasoning**	
3.1	Basic probability Notation – Inference – Bayes' rule	1
3.2	Representing Knowledge	1
3.3	Bayesian networks – Representation and inference	3
3.4	Temporal models – Hidden Markov Models	2
3.5	Dynamic Bayesian networks	2
4	**Learning**	
4.1	Learning from Examples – Supervised learning	1
.4.2	Decision trees	2
4.3	Regression and classification with linear models	1
4.4	Ensemble learning	1
4.5	Statistical Learning – EM algorithm	2
4.6	Reinforcement learning	1
4.7	Case study	1
	Total	35

Course Designer

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17CAPW0	INTERNET OF THINGS	Category	L	T	P	Credit
		PE	3	0	0	3

Preamble

This course aims at providing a basic understanding of Internet of Things. It aims at providing hands on training for building simple applications using appropriate sensors, microcontroller board and other components.

Prerequisite

17CA120 – Programming in C

17CA330 – Internet and Java Programming

17CA420 – Computer Networks

Course Outcomes

Upon successful completion of this course students will be able to:

CO1: Describe Internet of Things and the protocols of IoT — Remember

CO2: Identify the various IoT components such as sensors, shields (Arduino, Raspberry Pi, Bluetooth, WiFi) — Understand

CO3: Program using Arduino studio and Rasperry Pi toolkits — Apply

CO4: Experiment various problems related with IoT using controllers and processors. — Apply

CO5: Explain the role of cloud and security in IoT — Understand

CO6: Demonstrate various applications of IoT integrating with Cloud and ensuring security — Apply

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2	S	M										M
CO3	S	M										M
CO4	S	M										M
CO5	M	L										
CO6	S	M	L		S	M	S	L	S	S	M	M

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	30	20	20	20
Understand	40	40	40	40
Apply	30	40	40	40
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

CO6 is assessed through Mini Project. Mini Project Details

Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

- Team formation (Team size: 5)
- Problem identification on various IT, societal, business and environmental needs (Eg. IoT based Smart Bin Application, Home Automation etc.)
- Identify and assemble the appropriate components needed to build the microcontroller board.
- Test the board with sample input.

Course Level Assessment Questions

Describe Internet of Things and the protocols of IoT (CO1):
1. Discuss the Evolution of IoT.
2. List the some of the protocols involved in IoT.
3. Distinguish among Raspberry Pi,Arduino and Zigbee.
4. Describe the architecture of Cloud of Things.
5. Discuss the two pillars of IoT

Identify the various IoT components such as sensors, shields (Arduino, Raspberry Pi, Bluetooth, WiFi) (CO2):
1. Illustrate the Arduino board with a diagram and name its components.
2. Illustrate the Rasperry Pi with a diagram and name its components.

Program using Arduino studio and Rasperry Pi toolkits (CO3):
1. Write a program to read the input from a switch port and copy it to a LED.
2. Write a program to glow an LED using Arduino

Experiment various problems related with IoT using controllers and processors (CO4):
1. Illustrate how a microcontroller can be connected to mobile device.
2. Show the connectivity of microcontroller with Bluetooth and USB.
3. Demonstrate the connectivity issues involved in IoT

Explain the role of cloud and security in IoT (CO5):
1. Discuss the integration of IoT with Cloud
2. Describe the right components to build cloud based applications in IoT
3. List the security issues related to IoT

Concept Map
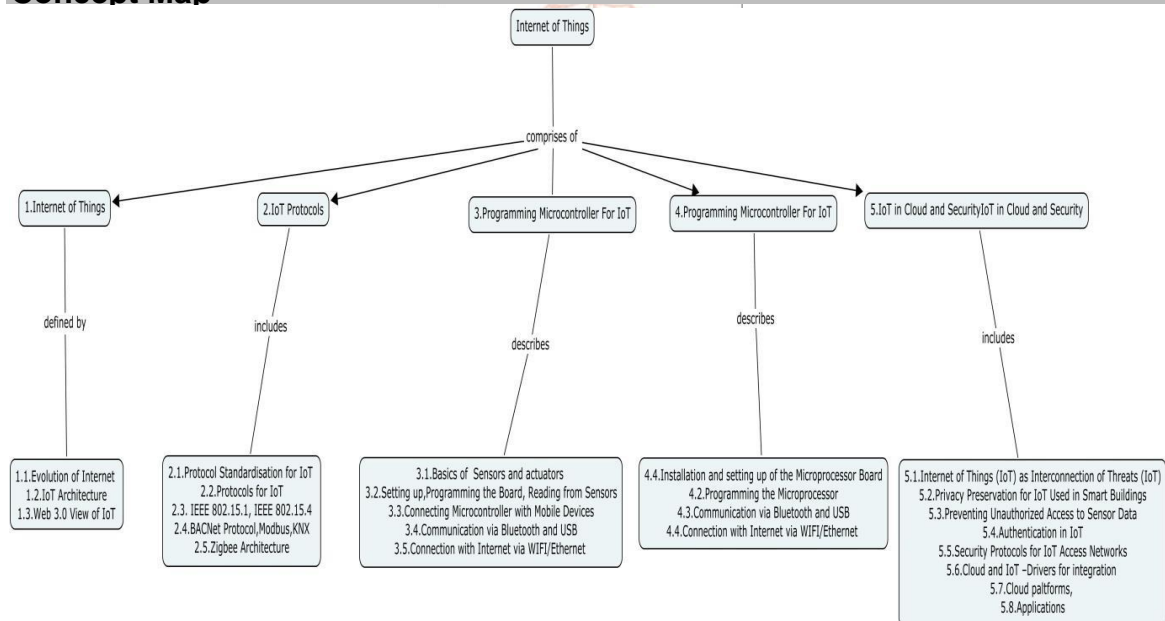
Syllabus

Internet of Things: Evolution of Internet, IoT Architecture, Web 3.0 View of IoT

IoT Protocols: Protocol Standardisation for IoT ,Protocols for IoT, IEEE 802.15.1, IEEE 802.15.4,BACNet Protocol, Modbus, KNX, Zigbee Architecture

Programming Microcontroller For IoT: Basics of microcontroller, Setting up, Programming the Board, Reading from Sensors, Connecting Microcontroller with Mobile Devices, Communication via Bluetooth and USB, Connection with Internet via WIFI/Ethernet

Programming Microprocessor For IoT: Installation and Setting up of the Microprocessor board, Programming the Microprocessor, Communication via Bluetooth and USB, Connection with Internet via WIFI/Ethernet

IoT in Cloud and Security: Internet of Things (IoT) as Interconnection of Threats (IoT), Privacy Preservation for IoT Used in Smart Buildings, Preventing Unauthorized Access to Sensor Data, Authentication in IoT, Security Protocols for IoT Access Networks, Cloud and IoT –Drivers for integration ,Cloud platforms, Applications

Reference Books & Web resources

1. Charalampos Doukas -Building Internet of Things with the Arduino, Create space, April 2012.
2. Fei Hu- Security and Privacy in Internet of Things (IoTs): Models, Algorithms and Implementation, CRC press ,2016
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles -Architecting the Internet of Things, Springer,2011
4. Donald Norris -The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black, Mc.Graw Hill,2015.
5. Cuno Pfister -Getting Started with the Internet of Things, O'Reilly Media, Inc.,2011
6. Honbo Zhou -The Internet of Things in the Cloud: A Middleware Perspective, CRC Press,2012
7. Olivier Hersent, David Boswarthick, Omar Elloumi, -The Internet of Things, Key applications and Protocols, Wiley, 2012
8. https://www.raspberrypi.org/
9. https://developer.ibm.com/iot/
10. http://www.microsoft.com/en-in/server-cloud/internet-of-things.aspx

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	**Internet of Things**	
1.1	Evolution of Internet	1
1.2	IoT Architecture	
1.3	Web 3.0 View of IoT	1
2	**IoT Protocols**	
2.1	Protocol Standardisation for IoT	1
2.2	Protocols for IoT	2
2.3	IEEE 802.15.1, IEEE 802.15.4	1
2.4	BACNet Protocol,Modbus,KNX	1

2.5	Zigbee Architecture	1
3	**Programming Microcontroller For IoT**	
3.1	Basics of sensors and actuators	2
3.2	Setting up,Programming the Board,reading from Sensors	2
3.3	Connecting Microcontroller with Mobile Devices	2
3.4	Communication via Bluetooth and USB	2
3.5	Connection with Internet via WIFI/Ethernet	2
4	**Programming Microprocessor For IoT**	
4.1	Installation and Setting up of the Microprocessor board	2
4.2	Programming the Microprocessor	2
4.3	Communication via Bluetooth and USB	2
4.4	Connection with Internet via WIFI/Ethernet	2
5	**IoT in Cloud and Security**	
5.1	Internet of Things (IoT) as Interconnection of Threats (IoT)	1
5.2	Privacy Preservation for IoT Used in Smart Buildings	1
5.3	Preventing Unauthorized Access to Sensor Data	1
5.4	Authentication in IoT	1
5.5	Security Protocols for IoT Access Networks	1
5.6	Cloud and IoT –Drivers for integration	1
5.7	Cloud paltforms	1
5.8	Applications	1
	Total Lectures	**36**

Course Designers:

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17CAPY0	STATISTICS FOR EXPLORATORY DATA ANALYSIS	Category	L	T	P	Credit
		PE	3	0	0	3

Preamble

This course is meant to equip students to explore data sets to formulate hypotheses and design experiments to verify those hypotheses. The course would give an elaborate view of descriptive and inferential statistics.

Prerequisite

17CA110 - Mathematical Foundations of Computer Science

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain Linear and non linear correlations.   Understand
CO2: Utilize the regression line and regression plane concepts to estimate   Apply
        specified Values.
CO5: Apply least square method in fitting linear and non linear regression   Apply
curve.
CO4: Apply correlation for descriptive data analysis.   Apply
CO5: Analyze the statistical analysis report to make inference.   Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
CO1	L	S	M	-	-	-	-	-	-	-	-	-
CO2	S	S	M	-	-	-	-	-	-	-	-	-
CO3	S	S	M	-	-	-	-	-	-	-	-	-
CO4	S	S	M	-	-	-	-	-	-	-	-	-
CO5			S									

S- Strong; M-Medium; L-Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	10	10	10	10
Understand	30	30	20	20
Apply	60	50	50	50
Analyse	0	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Explain Linear and non linear correlations. (CO1):
1. A sample of two variables of size 40 produces a correlation coefficient of $r = 0.682$.

   a. What is the point estimate for the population correlation coefficient, ρ?

   b. Construct a 95% confidence interval for ρ.

2. A sample of size 50 produces a correlation coefficient $r = 0.297$.

Test the hypotheses:
   H_0: $\rho = 0$.
   H_A: $\rho > 0$.
   $\alpha = 0.05$.

3. A researcher has a large number of data pairs (age, height) of humans from birth to 70 years. He computes a correlation coefficient.

a. Would you expect it to be positive or negative? Why?

b. What would you suggest to be a major problem with this approach?

Utilize the regression line and regression plane concepts to estimate specified Values (CO2):
.

   1. How does the correlation coefficient relate to the slope of the regression line?

   2. Some data are given as:

X	Y
1	16
2	23
4	35
3	28
5	44
6	40
3	22
8	61
9	82

a. Sketch a scatterplot.

b. Compute the correlation coefficient, r.

c. Compute the coefficients of the linear regression line, $y = b_1x + b_0$.

d. What is the estimated value, y_p for $x = 7$?

3. For the data of the previous problem, compute the 95% confidence interval for y_p for

a. x = 7.

b. x = 25.

c. x = 4.5. Note: X = 4.5556.

Apply least square method in fitting linear and non linear Regression curve (CO3) :
.

1. We can compute a Confidence Interval for the predicted value of y_p using a regression line.

a. For what value of x is the confidence interval for y_p the smallest?

b. Why is this the case?

2. Interesting data are given as:

X	Y
72	45
73	38
75	41
76	35
77	31
78	40
79	25
80	32
80	36
81	29
82	34
83	38
84	26
85	32
86	28
88	27

a. Sketch a scatterplot.

b. Compute the correlation coefficient, r.

c. Compute the coefficients of the linear regression line, $y = b_1x + b_0$.

d. What is the estimated value for X = 7?

3. Why linear regression sometime is referred to as *least squares*?

Apply and implement correlation for descriptive data analysis (CO4):.

1. Calculate the coefficient of correlation and obtain the lines of regression for the following data.

X:	9	8	7	6	5	4	3	2	1
Y:	15	16	14	13	11	12	10	8	9

2. The marks obtained by 9 students in Mathematics and Statistics are given below. Compute the correlation coefficient and obtain the lines of regression.

Roll No.	1	2	3	4	5	6	7	8	9
Marks in Mathematics	75	30	60	80	53	35	15	40	38
Marks in Statistics	85	45	54	91	58	63	35	43	45

Analyze the statistical analysis report to make inference (CO5):.

1. Given the correlation Pearson coefficient as -0.5 based on correlation analysis between two variable X and Y, what do you infer on the dependency between X and Y?

2. When you analyze a given a dataset and find that it's a half-normal distribution that has a skewness just below 1, what do you infer?

Concept Map
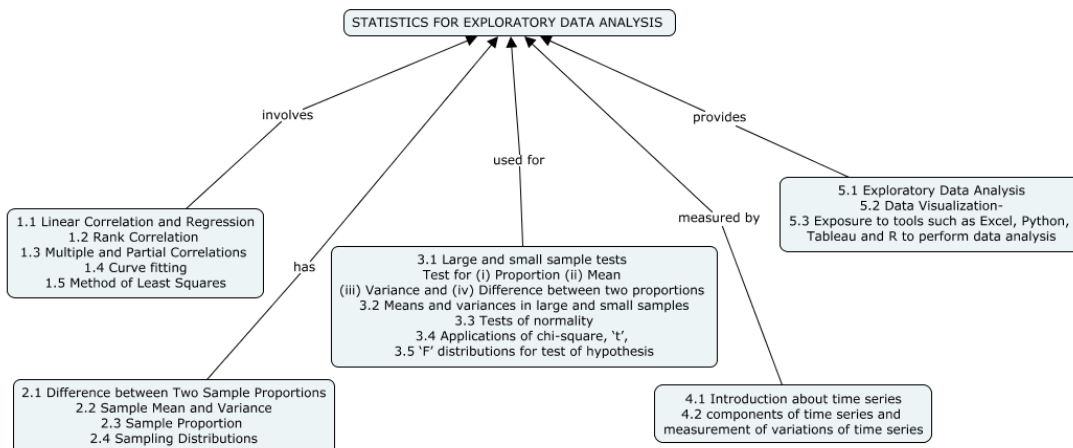
Syllabus

Statistics: Descriptive Statistics - Linear Correlation and Regression - Rank Correlation - Multiple and Partial Correlations - Curve fitting – Method of Least Squares.

Sampling Theory: Difference between Two Sample Proportions - Sample Mean and Variance
Sample Proportion - Sampling Distributions.

Test of Hypothesis: Large and small sample tests, Test for (i) Proportion (ii) Mean (iii) Variance and (iv) Difference between two proportions, Means and variances in large and small samples, Tests of normality, Applications of chi-square, 't', 'F' distributions for test of hypothesis.

Time Series: Introduction about time series, components of time series and measurement of variations of time series.

Data analysis: Exploratory Data Analysis–Overview-Data Visualization-Exposure to tools such as Excel, Python, Tableau and R to perform data analysis.

Reference Books

1. J. S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2017.

2. Douglas C Montgomery and George C Runges, "Applied Statistics and Probability for Engineers", John Wiley &Sons, 2016.

3. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2016.

4. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics", Sultan Chand, Ninth Edition , New Delhi ,2015.

5. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 2016.

Course Contents and Lecture Schedule

Module No.	Topic	No of Lectures
1.0	**Statistics**	
1.1	Introduction	1
1.2	Descriptive Statistics	1
1.3	Linear Correlation and Regression	2
1.4	Rank Correlation	2
1.5	Multiple and Partial Correlations	1
1.6	Curve Fitting	1
1.7	Method of Least Squares	2

2.0	**Sampling Theory**	
2.1	Difference between Two Sample Proportions	1
2.2	Sample Mean and Variance	1
2.3	Sample Proportion, Sampling Distributions.	2
3.0	**Test of Hypothesis**	
3.1	Large and small sample tests, Test for Proportion & Mean	2
3.2	Variance and Difference between two proportions	2
3.3	Means and variances in large and small samples	1
3.4	Tests of normality	2
3.5	Applications of chi-square, "T", "F" distributions for test of hypothesis.	2
4.0	**Time Series**	
4.1	Time series - Introduction	2
4.2	Components of time series,	1
4.3	Measurement of variations of time series.	2
5.0	**Data Analysis**	
5.1	Exploratory Data Analysis – Overview	1
5.2	Data Visualization	1
5.3	Data Analysis using Tools – Python, Excel, Tableau and R	4
	Total	**34**

Course Designers

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		Category	L	T	P	Credit
17CAP10	**BIG DATA ANALYTICS**	OC	1	0	0	1

Preamble

This course aims at providing introduction on using Big Data and familiarizing industrial practices on using different tools and techniques for Big Data Analytics.

Prerequisite

17CA150 - Database Management Systems

Course Outcomes

On the successful completion of the course, students will be able to

CO1: Explain the Big data framework and differentiate from standard data streams — Understand

CO2: Select suitable tools and techniques for big data analytics based on the requirements — Analyze

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	-	M	-	S	M	-	-	--	-
CO2	S	S	M	S	S	S	S	M	L

S- Strong; M-Medium; L-Low

Assessment Pattern

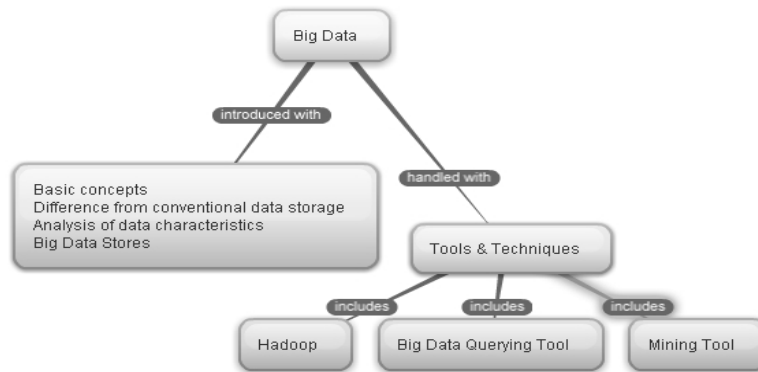| Bloom's Category	Terminal Examination
Remember	20
Understand	30
Apply	30
Analyse	20
Evaluate	0
Create	0

Course Level Assessment Questions

Explain the Big data framework and differentiate from standard data streams (CO1):

5. Write down the significance of Bigdata.
6. Give short notes on data floating on online shopping websites.
7. Explain about the support provided by Hadoop framework for Bigdata Processing.
8. NOSQL – State the need.
9. Give a detailed description on databases supporting Big Data processing.

Analyze and select suitable tools and techniques for big data analytics (CO2):

1. Discuss the methods of abstracting Hadoop Mapreduce jobs with Pig.
2. HIVEQL is a helpful tool in Big data processing – State valid reasons.
3. Explain the role of Mahout in extracting information from Bigdata of online stores.

Board of Studies approved: 27-04-2019   Approved in 58th Academic Council meeting on 15-06-2019

Concept Map

Syllabus

Introduction to Big Data - Defining Big Data, Delivering business benefit from Big Data, Analyzing data characteristics, Overview of Big Data stores **Tools and Techniques for analytics -** Abstracting Big Data, Performing AdHoc querying, Creating business value from extracted data- Apache Hadoop – Hive – MongoDB - Mahout.

Reference Books & Web resources

1. Zikopoulos, Paul, and Chris Eaton. *Understanding big data: Analytics for enterprise class hadoop and streaming data*. McGraw-Hill Osborne Media, 2011.

2. Franks, Bill. *Taming the big data tidal wave: Finding Opportunities in Huge data streams with advanced Analytics*. Vol. 56. John Wiley & Sons, 2012.

3. NPTEL Course on Big Data Computing: https://onlinecourses.nptel.ac.in/noc19_cs33/

4. Coursera : Introduction to Big Data offered by University of California SanDiego https://www.coursera.org/learn/big-data-introduction

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.	**Introduction to Big Data**	
1.1	Defining Big Data	1
1.2	Delivering business benefit from Big Data	1
1.3	Analyzing data characteristics	2
1.4	Overview of Big Data stores	1
2.	**Tools and Techniques to analyze big data**	
2.1	Abstracting Big Data – Tools	3
2.2	Performing AdHoc querying - Tools	3
2.3	Creating business value from extracted data – Tools	3
	Total	14

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