

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 2017-2018 ONWARDS



THIAGARAJAR COLLEGE OF ENGINEERING
(A Government Aided ISO 9001-2000 certified
Autonomous Institution affiliated to Anna University)

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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.

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)

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												■

Credit Distribution:

S.No	Category of courses	Credits	Percentage of Credits to Total Credits
1	Basic Sciences	8	6.3%
2	Humanities and Social Sciences	9	7.1%
3	Programme Core- Theory	64	50.4%
4	Programme Core - Practicals	18	14.1%
5	Programme Core – Theory cum Practical	4	3.1%
5	Programme Elective	12	9.5%
6	Project	12	9.5%
Total Credits		127	100%

Basic Science (BS) and Humanities & Social Sciences (HSS) Courses:

Sem-ester	Name of the Course	Category	Credits
1	Mathematical Foundations of Computer Science	BS	4
2	Operations Research	BS	4
BS Total Credits			8
1	Accounting and Financial Management	HSS	4
2	Organizational Behaviour	HSS	3
3	Professional Communication	HSS	2
HSS Total Credits			9

Programme Core, Elective & Practical Courses:

Sem-ester	No. of Core Courses	credits	No. of Elective Courses	credits	No. of Practical + Theory cum practical Courses	credits
1	5	19	-	-	2	4
2	5	19	-	-	3	6
3	5	20	-	-	2	4
4	3	10	2	6	3	4
5	3	11	2	6	1+1	6
6	-	-	-	-	1	12
Total Credits for Core courses		79	Total Credits for Elective courses	12	Total Credits for Practical courses	36

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

Sem-ester	Theory					Theory cum Practical	Practical			Credits
1 st (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 Programming Laboratory 0:2	17CA180 RDBMS Laboratory 0:2		23
2 nd (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
3 rd (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
4 th (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
5 th (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
6 th (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****COURSES OF STUDY****(For the candidates admitted from 2017-2018 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	BS	3	1	-	4
17CA120	Programming in C	PC	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 Programming 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	HSS	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	HSS	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	HSS	-	1	2	2
Total			16	4	10	25

THIRD SEMESTER

Course code	Name of the Course	Category	No. of Hours / Week			credits
			L	T	P	
THEORY						
17CA310	Operations Research	BS	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

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	PC	-	-	24	12
Total			24			12

BS : Basic Science
 PC : Programme Core
 PE : Programme Elective
 HSS : Humanities and Social Science

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

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 Programming Laboratory	3	50	50	100	25	50	
7	17CA180	RDBMS Laboratory	3	50	50	100	25	50	

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

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

SIXTH SEMESTER

S.No.	Sub. code	Name of the Course	Duration of Terminal Exam. in Hrs.	Marks			Minimum Marks for Pass	Marks for
				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			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

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

Preamble

A Computer Application student needs to have some basic mathematical tools and techniques to understand various designing concepts, storage methods, concepts in digital principles, managing databases etc. The main objective of this course is to introduce the basic terminology used in advanced courses in Computer application. This emphasizes the development of rigorous logical thinking for solving different kinds of problems that occur in computer applications. Based on this the course aims at giving adequate exposure in the theory and applications of Set theory, Propositional logic, Predicate logic, Lattices and Boolean Algebra, Automata theory which helps the learner to use them eventually in practical applications of computer science. These topics support the advanced courses in computer science such as digital principles, artificial intelligence, compiler and design, DBMS, Design of Software etc.

Prerequisite

Higher Secondary Level, Degree Level –Set Theory, Logic Theory

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	L	M	S	S	-	-	-
CO2	S	S	S	M	M	L	M	M	S	-	-	-
CO3	S	S	S	M	M	L	L	M	S	-	-	-
CO4	S	S	S	M	M	L	L	M	S	-	-	-
CO5	S	S	S	M	M	L	S	M	L	-	-	-
CO6	S	S	S	S	M	L	L	M	S	-	-	-
CO7	S	S	S	S	M	L	L	M	S	-	-	-
CO8	S	S	S	S	M	L	L	M	S	-	-	-

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

Prove implication problems using truth table method, replacement process, Analyzation method, truth table technique, rules of inference method (CO1):

1. Prove the following implication by analyzation method.
 $(PVQ) \wedge (P \rightarrow R) \wedge (Q \rightarrow S) \Rightarrow S \vee R$
2. Show that $(QV(P \wedge 7q) \vee (7P \wedge 7Q))$ is a tautology using replacement process.
3. Verify the following implication by truth table.
 $(P \rightarrow (Q \rightarrow R)) \Rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R))$
4. Show the implication using CP rule if necessary. $7PVQ, 7QVR, R \rightarrow S \Rightarrow P \rightarrow S$.

Obtain PCNF and PDNF of given logical expression (CO2):

1. Obtain CNF and DNF of $7(PVQ) \leftrightarrow (P \wedge Q)$
2. Obtain PCNF and PDNF of $(7P \rightarrow R) \wedge (Q \leftrightarrow P)$
3. Obtain principal disjunctive normal form of $P \rightarrow ((P \rightarrow Q) \wedge 7(7Q \vee 7P))$ and hence obtain principal conjunctive normal form.

Check the validity of the verbal or symbolic arguments using rules of inference(CO3):

1. Show that the following system of premises is inconsistent.
 If war is near, then the army would be mobilized. If the army has mobilized then labour costs are high. However the war is near and yet labour costs are not high.

- Pick out free and bound variables, scope of the quantifier from the following expression $(\forall x)[P(x) \rightarrow (\exists y)Q(x, y)]$ and also get free and bound occurrence of the variables involved in the expression.
- Prove by indirect method the following implication:
 $(\forall x)(P(x) \rightarrow Q(x)); (\exists y)P(y) \Rightarrow (\exists z)Q(z)$

Construct verbal arguments with predicates in symbolic form and also to validate them (CO4):

- Verify the validity of the following arguments:
 Everyone chooses between good and evil. Rishi has chosen not to do evil. If anyone chooses to do good or if he is forced to obey the laws then he has an excellent chance for happiness. Therefore, Rishi chances for happiness are excellent.
- Show that from (i) $(\exists x)(F(x) \wedge S(x)) \rightarrow (\forall y)(M(y) \rightarrow W(y))$;
 (ii) $(\exists y)(M(y) \wedge \neg W(y))$ the conclusion $(\forall x)(F(x) \rightarrow \neg S(x))$

Represent the given relation in matrix, digraph and vice versa. (CO5):

- Let R denote a relation on the set of ordered pairs of integers such that $\langle x, y \rangle R \langle u, v \rangle$ iff $xv=yu$. Show that R is an equivalence relation .
- Given $A = \{1,2,3,4\}$ and $R = \{(1,2),(1,1),(1,3),(2,4)\}$, $S = \{(1,4),(1,3),(2,3),(3,1),(4,1)\}$ are relations on A. Find $S \circ R, R \circ S, M_R, M_S, M_{(R \circ S)^{-1}}$ and graph of R,S.
- Discuss about all types of relations on the set $A = \{1,2,3,4\}$ where R is given by $R = \{(1,1),(2,2),(2,3),(3,2),(3,3)\}$.

Verify a given function is bijective or not, and also to find composition of functions.(CO6):

- Verify which of the following functions are bijective where $f, g : R \rightarrow R$, $f(x) = -5x$, $g(x) = x^2 - 8$, where $f, g : R \rightarrow R$, hence find $f \circ g, g \circ f, f \circ f, g \circ g$
- Let $X = \{1,2,3,4\}$ and a mapping $f : X \rightarrow X$ be given by $f = \{(1,2),(2,3),(3,4),(4,1)\}$. Execute f^3 , f^4 .
- Let $f(x) = x+2$, $g(x) = x-2$, $h(x) = 3x$, for $x \in R$, where R is the set of real numbers.
- Find $f \circ g, g \circ f, f \circ f, g \circ g$ and $f \circ g \circ h$.

Design Karnaugh map to get simplified form of a Boolean function (CO7):

- Prove that D_{70} is a Lattice and also verify D_{70} as Distributive Lattice.
- Simplify the Boolean function $f(a,b,c,d) = \sum(0,2,6,7,8,9,13,15)$ using Karnaugh map.
- Discuss algebraically the equality $\overline{ab} + \overline{bc} + \overline{ca} = \overline{ab} + \overline{bc} + \overline{ca}$ using basic laws of Boolean algebra.

Check whether the given grammar is regular or not using pumping lemma. (CO8):

- Construct a DFA that accepts all the strings on $\{0,1\}$ except those containing the substring 101.
- Define context free grammar and ambiguous grammar and hence identify the language generated by the grammar $S \rightarrow aSb/ab$
- Convert the following NFA to DFA.

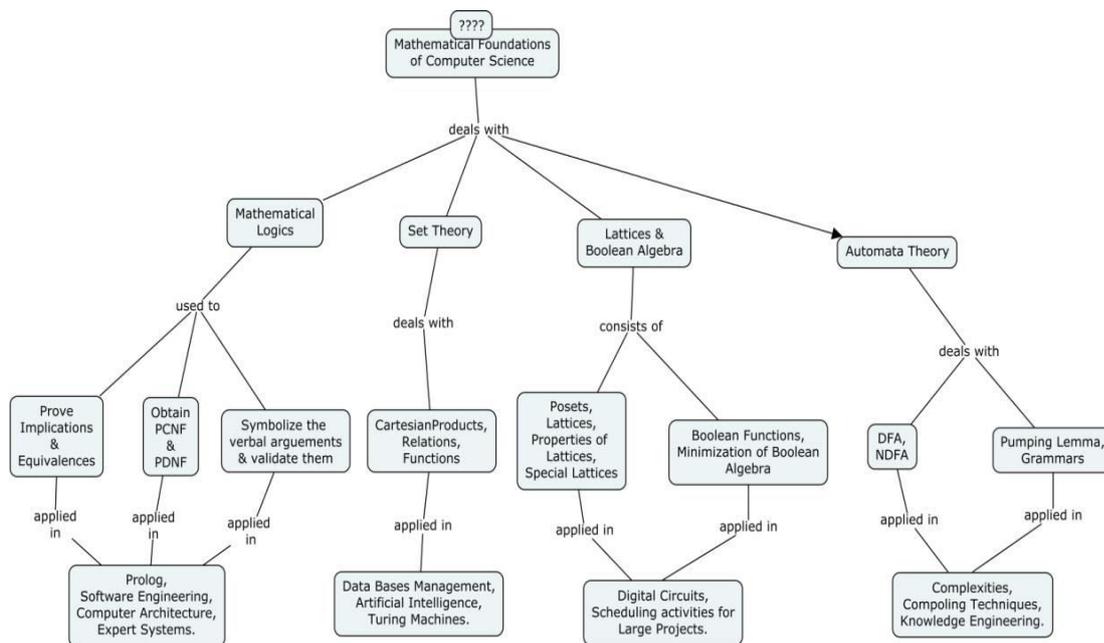
δ	a	b
S_0	$\{S_0, S_1\}$	ϕ
S_1	ϕ	$\{S_2\}$
S_2	ϕ	$\{S_2\}$

- (i) Draw transition diagram of N DFA.
(ii) Draw transition diagram of DFA with its state table.

4. Find whether the following languages are regular or not using pumping lemma:

(i) $L = \{0^{2n} / n \geq 1\}$ (ii) $L = \{1^{n^2} / n \geq 1\}$

Concept Map



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, NFA to DFA, NFA 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 Eitan Farchi, Ben-Chaim, March 3, 2010

Course Contents and Lecture Schedule

Module No	Topics	No. of Lectures
Module 1: Propositional and Predicate Calculus		
1.1	Introduction – Statements and Notations, Basic Connectives, Conditional, Biconditional	1
1.2	Implications and Equivalence, Tautology and Contradiction	1
1.3	Normal forms: Conjunctive Normal Forms - Disjunctive Normal Form	1
1.4	Principal Conjunctive Normal Forms - Principal Disjunctive Normal Form	1
1.5	The theory of inference for Propositional Calculus using Rule P, T	2
1.6	The theory of inference for Propositional Calculus using Rule CP, AP, Inconsistent	2
1.7	Predicates- Statement Function, Variables and Quantifiers	2
1.8	Predicate formulas – Free and Bound Variables	1
1.9	Theory of inferences on one place predicate using P, T, CP rules.	3
Module II- Set Theory		
2.1	Basic Concepts of set theory and Cartesian products	1
2.2	Relations, Binary Relations	1
2.3	Equivalence Relations and Partitions, Composition of Relations	2
2.3	Functions and types of functions	1
2.4	Inverse of a function and Composition of functions, Recursive functions	2

Module III :Lattices and Boolean Algebra		
3.1	Definition of Partially ordered set(PO Set), Hasse Diagram, LUB, GLB, Meet and Join	1
3.21	Lattice as PO	1
3.3	Properties of lattices	1
3.4	Special Lattice	2
3.5	Boolean Algebra and its properties	1
3.6	Boolean Function	1
3.7	Value of Boolean Expression	1
3.8	Minimization of Boolean functions	2
Module IV : Automata Theory		
4.1	Deterministic and Non-Deterministic finite automaton	1
4.2	NFA to DFA	1
4.3	NFA with ϵ -moves	1
4.4	Regular expressions and regular language	1
4.5	NFA and Regular Expressions	1
4.6	Pushdown automaton	1
4.7	Introduction to Turing machine	1
4.8	Pumping Lemma (without proof) and its applications	1
4.9	Grammars and its types	1
4.10	Grammar to Language	1
4.11	Language to Automata	1
Total		42

Course Designer:

Dr. M. Kameswari mkmat@tce.edu

17CA120**PROGRAMMING IN C**

Category	L	T	P	Credit
PC	3	1	-	4

Preamble

This is a course offered in first semester for the students of Computer Applications. This course has four credits dedicated to provide the students a strong foundation on programming concepts and its application. It also enables the students to solve problems using programmable logic.

Prerequisite

Fundamentals of Programming languages

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, Understand such as "for" loops, "do...while" loops
- CO2: Demonstrate the difference between iteration and recursion in terms of Analyze C programming
- 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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
CO1	L											
CO2	S	S	S	M	S		M			M		
CO3	S	S	S	M	S				M			
CO4	S	S	S	M	S		M					
CO5	M						M			M		
CO6	S	S	S	M	S							

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

Describe the reason why different constructs are available for iteration, such as "for" loops, "do...while" loops (CO1):

1. Differentiate between Structure and Union in C.
2. Explain how dynamic arrays are efficient compared to Static with example?
3. How is memory managed in C?
4. How garbage collection is done in C?

Demonstrate the difference between iteration and recursion in terms of C programming (CO2):

1. Explain how recursive functions affect the run time efficiency?
2. Is there any advantage of using recursion over looping control structures? Give a suitable example?
3. Analyze the factors that influence the execution times of a program?
4. Illustrate the limitation of array of pointers to strings using a sample?
5. Differentiate keywords BREAK and CONTINUE with an example?

Develop C programs for arrays and linked lists concepts (CO3) :

1. Write C code to implement linked list.
2. Compare the scenarios of usage of single dimension array and two dimensional array.
3. Implement the search of an element in array and linked list.

Develop C programs for Data structure concepts with functions (CO4) :

1. Write a program to perform stack operation using pointers?
2. Write a program to perform linked list operation using pointers?
3. Write a program to compute Matrix Multiplication using Pointers?

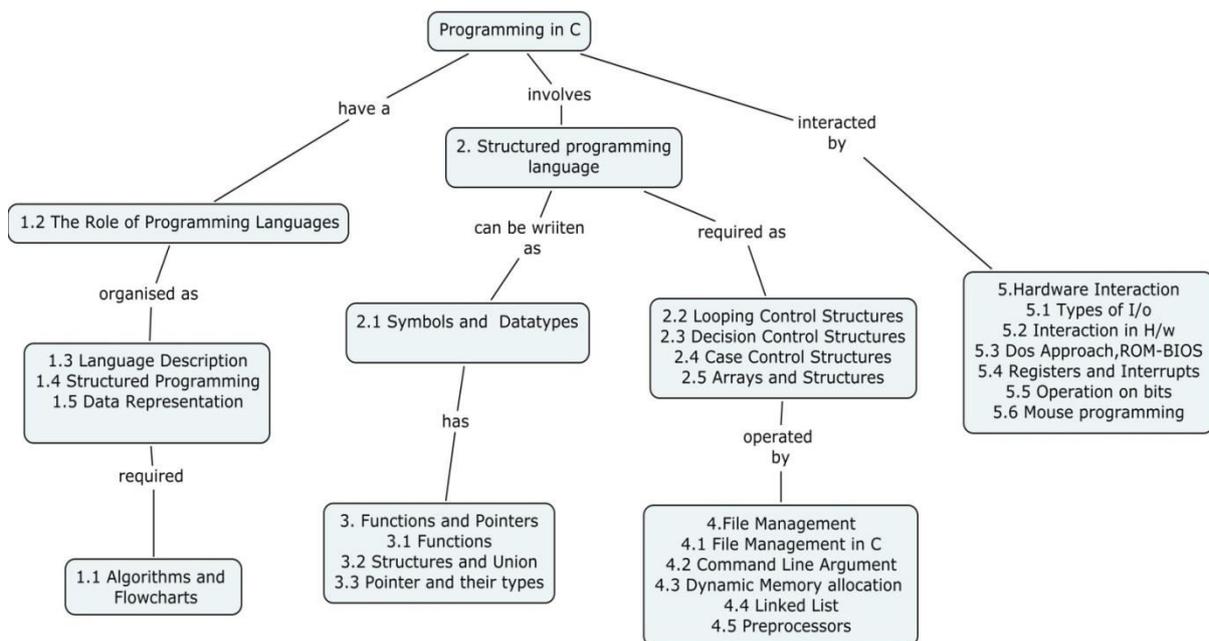
Summarize the Hardware interaction using Port I/O (CO5) :

1. Explain how interrupts can work in Hardware programming
2. Illustrate the usage of mouse programming
3. Illustrate the usage of init86()

Develop C programs for File Management concept (CO6):

1. Write a program to add the numbers present in two files.
2. Write a program to Search the elements in the file
3. Write a program to remove the record in a file.

Concept Map



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

Course Contents and Lecture Schedule

Module No.	Topic	No of Lectures
1	Introduction to Programming Language	
1.1	Algorithms, Flowcharts	1
1.2	The Role of Programming Languages	1
1.3	Language Description	2
1.4	Structured Programming	2
1.5	Data Representation	2
2	Structured Programming Language	
2.1	Symbols and data types	1
2.2	Looping control structures	2
2.3	Decision control structures	2
2.4	Case control structures	2
2.5	Arrays and Strings	2
3	Functions and Pointers	
3.1	Functions	3
3.2	Structures, Union	1
3.3	Pointers, Type of Pointer	3
4	File Management	
4.1	File Management in C	2
4.2	Command Line Argument	1
4.3	Dynamic Memory allocation	2
4.4	Linked List	2
4.5	Preprocessors	1
5	Hardware Interface	
5.1	Types of I/O	1
5.2	Interaction with H/W in C	1
5.3	DOS Approach, ROM – BIOS	1
5.4	Registers, Interrupts	1
5.5	Operation on bits	2
5.6	Mouse Programming	2
	Total	40

Course Designer

Dr. A.JohnSanjeevKumar

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17CA130**COMPUTER ORGANIZATION AND
ARCHITECTURE**

Category	L	T	P	Credit
PC	3	0	0	3

Preamble

This course is dedicated to number system, logic design, and memory and processing. This is the only course that is concerned with the hardware of a computer, its logic design and organization. It aims at making the student familiar with digital logic and functional design of arithmetic and logic unit that is capable of performing floating point arithmetic operations. .

Prerequisite

None

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 |

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S		M							
CO2		S				M	L					
CO3	M							S				
CO4			S		M		M					
CO5	S					S			L			
CO6		M				M						
CO7				S				M				

S-Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Explain about computer architecture (CO1):

1. What are the different units in a computer system?
2. What is an addressing mode?
3. What is an assembly language instruction?
4. What is the difference between machine language and assembly language?

Compute simple arithmetic operations for fixed-point and floating-point addition, subtraction, multiplication & division. (CO2):

1. Convert the decimal number 92.00625 into a binary number?
2. Multiply the number $-13 * 11$ using (a) sequential circuit binary multiplier (b) Booth Algorithm
3. Multiply the binary numbers 1010×0111 using any algorithm you know? Show all steps in calculation
4. Convert 1.7 to IEEE 32 bit floating point format.
5. Predict the Multiplier bit-pair recording table and give example of bit pair recording of 11010

Design combinational and sequential digital functions (CO3):

1. Obtain an algorithm to find all allowable weights for a weighted BCD code? Assume that all weights are positive integers.
2. Give a combinational circuit to multiply two numbers each of which is 3 bits long and has 1 bit sign? The output should have the right sign and magnitude.

Construct instruction set capable of performing a specified set of operations (CO4):

1. Analyze the characteristics, organization and operation modes of Asynchronous and Synchronous DRAMs in Detail?
2. Write a program for adding n numbers using straight line sequencing and branching statements.

Demonstrate a memory system for a given set of specifications (CO5):

1. Explain the connection between the processor and memory with neat diagram.

2. Explain in detail about Cache memory.
3. Define RAM and explain its types.

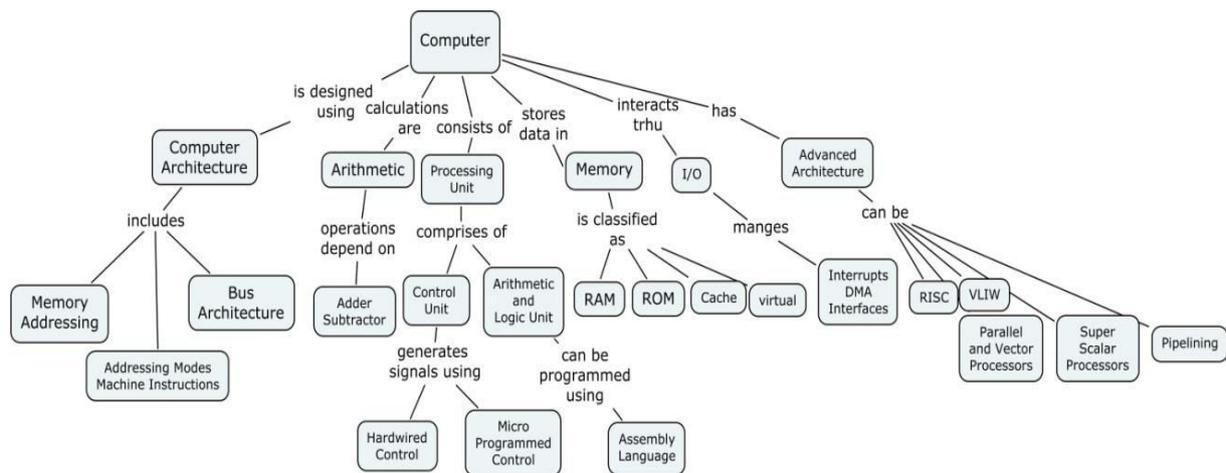
Explain pipelining concepts (CO6):

1. Classify Hazards and analyze their impact on Pipelining
2. A pipelined processor has two branch delay slots. An optimizing compiler can fill one of these slots 85 % of the time and can fill the second slot only 20% of the time. What is the percentage improvement in performance achieved by this optimization, assuming that 20% of the instructions executed are branch instructions?
3. Classify Hazards and analyze their impact on Pipelining

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

1. Draw a neat diagram of I/O Interface for input device and describe it.
2. Illustrate the Input and output interface Circuit in parallel port
3. What are the needs for input-output interface? Explain the functions of a typical 8-bit parallel interface in detail.

Concept Map



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.

Course Contents and Lecture Schedule

Module No	Content	No of Periods
	Functional Units	
1.1	Basic structure of Computers: Functional Units, Operational Concepts	1
1.2	Bus Structures	1
1.3	Machine instructions and programs	1
1.4	Memory locations and Addresses, Memory operations	1
1.5	Instructions and instruction sequencing	1
1.6	Addressing Modes	1
	Arithmetic	
2.1	Number Representation	1
2.2	Addition and Subtraction of signed numbers	1
2.3	Design of Fast Adders	1
2.4	Multiplication of numbers	1
2.5	Operand multiplication	1
2.6	Fast multiplication	1
2.7	Integer division	1
2.8	Floating point numbers and operations	1
	Processing Unit	
3.1	Processing Unit: Fundamental Concepts(Seminar)	1
3.2	Execution of complete Instruction	1
3.3	Multiple bus organization	1
3.4	Hardwired Control	1
3.5	Micro programmed control	1
3.6	Micro instructions with next address field	1
	Memory	
4.1	Main memory: Concepts	1

4.2	Semiconductor RAM memories	1
4.3	Read Only Memory	1
4.4	Cache Memories	1
4.5	Virtual Memories	1
4.6	Memory Management Requirements(Seminar)	1
	Input and output organization	
5.1	Accessing I/O devices	1
5.2	Interrupts	2
5.3	Direct Memory Access & interface circuits	2
	Advanced Processor Architecture	
6.1	RISC	1
6.2	Pipelining	1
6.3	Super Scalar Processors	1
6.4	Parallel and Vector Processors	1
6.5	VLIW	1
	Total	36

Course Designer:

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17CA140**DATA STRUCTURES**

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

This course aims at facilitating the students to understand the various data structures, their organization and operations. The course helps the students to assess the applicability of different data structures and associated algorithms to real world problems.

Prerequisite

None

Course Outcomes

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

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	M	-	-	-	-	-	-	-	-	--	-	-
CO2	M	L	-	-	-	-	-	-	-	-	-	-
CO3	S	L	-	-	-	-	-	-	-	-	-	-
CO4	S	L	M	L	L	-	M	-	-	-	-	-
CO5	S	L	M	M	L	-	S	-	-	-	-	-
CO6	S	L	M	M	-	-	S	-	-	-	-	-
CO7	S	L	M	M	L	-	S	-	-	-	-	-

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

Explain the organization and operations of data structures Stack, Queues, Trees, Graphs, Heaps and Hash tables. (CO1):

1. State the necessity of data structures.
2. List out the areas in which data structures are applied extensively.
3. List out few of the applications of tree data-structure.
4. Write down the pseudocode to implement stack using arrays..
5. Explain the purpose of hash tables.

Compare and contrast the functionalities and applications of different data structures (CO2):

1. Explain why B trees are used in RDBMS.
2. Analyze whether a queue can be constructed with stack.
3. Justify the use of adjacency list representation in representing sparse graph.
4. How many different trees are possible with 10 nodes?
5. If the balance factor of a node in AVL tree is -2, what is the next sequence of steps?

Demonstrate specific search and sort algorithms using data structures (CO3):

1. A hash table with hash function $H_1(k) = k \bmod 13$ is shown below.

0	1	2	3	4	5	6	7	8	9
10	11	12	26	38	17	33	48	35	25

Collision is resolved using the hash function $H_2(k) = (k \bmod 11) + 1$ (a) Analyze how many key comparisons occur in searching for key 35 in the given hash table? (b) If a new key 67 is inserted into the given hash table, what will be its address?
2. Sort the given values using Quick Sort. 65 70 75 80 85 60 55 50 45
3. The way a card game player arranges his cards as he picks them up one by one, is an example of 1. bubble sort 2. selection sort 3. insertion sort 4. merge sort
4. Given a string of characters (let us say there are about 100 characters or more in the string), what is the most efficient method to use for finding out the character that repeats itself the most?

Apply the operations of data structures in designing software procedures (CO4):

1. State the traversals a given tree using Inorder, Preorder and Postorder traversals.
2. Use linked list to design software procedures for a music player.
3. Convert the expression $((A + B) * C - (D - E) ^ (F + G))$ to equivalent Prefix and Postfix notations.
Draw a binary Tree for the expression : $A * B - (C + D) * (P / Q)$

Assess the applicability of given data structures and associated operations to real time computer applications (CO5):

1. If you have one million named objects and you want to store them in a data structure that lets you insert new objects quickly and search for an object by name quickly, what data structure should you use?

- Ram uses a binary search tree for storing values mostly in increasing order. Is it a right data structure to implement? Justify your answer.
- Find the applicability of stack in finding balancing paranthesis in an expression.

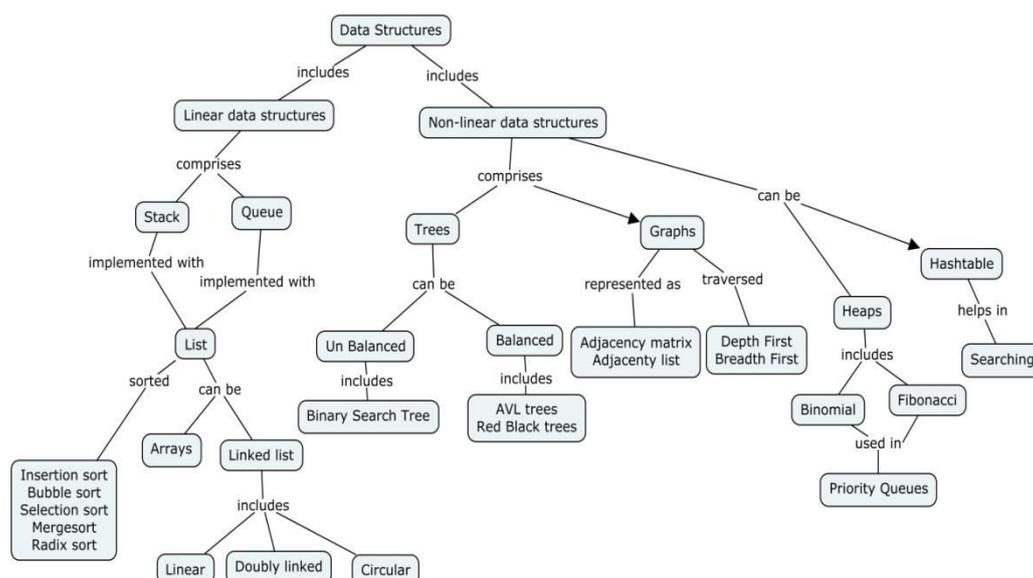
Identify suitable algorithms with appropriate data structures for real time software requirements (CO6)

- Given a graph G which connects 8 routers at different locations in a network. The cost of connecting the routers is given as weights in the graph G. Apply Prim's algorithm to find a way of connecting the 8 routers so that the cost of connecting them is low.
- A word processor has unique ids for all its functionalities (eg. Copy- c03, paste – c04 etc) and it wants to maintain the list of activities done on a document for undoing the activities. Choose a data structures for the purpose.
- An online shopping organization likes to store its product details in Binary Search Tree having product id as unique key. Frequent addition, deletion and search of products are mandatory in the process. Design algorithms for the given requirement.

Modify the existing operations of data structures for changing needs of the software requirements (CO7)

- Consider a game in which players are arranged in a circular linked list. The game has to be played in a way demonstrated as follows.
 - The game starts from first player as current player.
Until there is one player
 - Each time a random number (n) from 1 to 10 is generated
 - The count goes from the current player and deletes the nth player. After deleting the player, now the game starts from the player next to the deleted player.
The game is to be stopped if there is only one player and the player is declared as a winner. Design an algorithm for the game.
- Merge two linked list of records as a single doubly linked list
- Analyze how a circular queue be changed to store elements in decreasing order

Concept Map



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 Horowitz et al.," Fundamentals of Data Structures in C", Silicon press, Second edition, 2007.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	Introduction to Data structures	1
	Abstract data types	1
2	Linear Data Structures	
2.1	Stacks	2
2.2	Queues	2
2.3	Sparse matrices and their implementation	1
3	Linked lists	
3.1	Linear Linked Lists	2
3.2	Doubly Linked Lists	2
3.3	Circular Linked Lists	1
4	Trees	
4.1	Binary Search Trees	2
4.2	Red-Black Trees	2

4.3	AVL Trees	2
4.4	B-Trees	2
4.5	Huffman algorithm	1
5	Heaps	
5.1	Binomial Heap	1
5.2	Fibonacci Heap	1
5.3	Priority Queues using heaps	1
6	Data Search	
6.1	Linear Search and Binary search	1
6.2	Hash Table	1
6.3	Hashing techniques (Open, Closed, Collision)	1
7	Data Sorting	
7.1	Insertion Sort , Bubble sort	1
7.2	Selection Sort	1
7.3	Quick sorting	1
7.4	Merge sorting	1
7.5	Counting sort, Radix sort	2
8	Graphs	
8.1	Representation	1
8.2	Traversals	2
8.3	Minimal Spanning Trees	2
8.4	Shortest Path algorithm	2
	Case study	1
	Total	41

Course Designer:

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

Preamble

This course aims at facilitating the student to understand the various functionalities of DBMS software and perform many operations related to creating, manipulating and maintaining databases for Real-world applications and student to understand the various designing concepts, storage methods, querying and managing databases.

Prerequisite

None

Course Outcomes

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

CO1: Explain the structure and model of the relational database system	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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Explain the structure and model of the relational database system (CO1):

1. What is database management system?
2. Define schema?
3. Explain the structure of a DBMS.
4. Mention the types of constraint with an example for each type.
5. What is the use of having clause?
6. Mention the use of Commit and Rollback commands.
7. Define strong entity set with an example.
8. Define the term ACID properties.
9. How the database system is advantageous than file system?

Design multiple tables, and using group functions, sub queries (CO2):

1. For the following employee database
employee(employee-name, street, city)
works(employee-name, company-name, salary)
company(company-name, city)
manages(employee-name, manager-name)
Construct the appropriate tables along with the required constraints.
2. If you want to remove the primary constraints that you have created for the employee table, how will you do that?
3. If you want to change the city name of the company "TCS", what will you do?
4. Find those companies whose employees earn a higher salary, on average than the average salary at TCS.
5. Delete all the employees in TCS who earn less than Rs.10,000 .
6. If you want to get back the employees in TCS who earn less than Rs.10,000, what will you do?
7. You allow the user "A" to access the information regarding the employee's address along with the company in which they are working.
8. Consider a relational database with two relations
Course(course_name,room,instructor)
Entrollment(course_name, student_name, grade)
Create the instances of these relations for three courses, each of which enrolls five students.
9. Consider the following account relation and construct a bitmap index on the attributes

branch_name and balance, dividing balance values into 4 ranges – < 250, 250 ..<500, 500..<750 and >750.

Account_No	Branch_Name	Balance
A-217	Madurai	200
A-219	Chennai	600
A-117	Coimbatore	350
A-207	Madurai	800
A-317	Chennai	700

Design a database based on a data model considering the normalization to a specified level (CO3):

- Using the functional dependencies given $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$ Compute B^+ .
- Let relations $r_1(A,B,C)$ and $r_2(C,D,E)$ have the following properties: r_1 has 20,000 tuples, r_2 has 45,000 tuples, 25 tuples of r_1 fit on one block, and 30 tuples of r_2 fit on one block. Estimate the number of block transfers and seeks required using Hash join strategy for r_1 natural joined with r_2 .
- List out all the functional dependencies satisfied by the relation. Explain how they are satisfied.

A	B	C
a1	b1	c2
a1	b1	c2
a2	b4	c1
a3	b2	c3

Design a database for the Banking environment by following the various design phases including normalization.

Estimate the storage size of the database and design appropriate storage techniques (CO4):

- How does the remapping of bad sectors by disk controllers affect data retrieval rates?
- Draw the various levels of Redundant Arrays of Independent Disks and explain.
- Illustrate the Physical characteristics of Magnetic Disks?
- Illustrate Multitable Clustering File organization with suitable example

Analyze the requirements of transaction processing, concurrency control(CO5):

- Consider the following two transactions:

T1: read(A); read(B); if A=0 then B:=B+1; write(B)	T2: read(B); read(A); if B=0 then A:=A+1; write(A)
---	---

Let the consistency requirement be $A=0$ or $B=0$, with $A=B=0$ the initial values. Show that every serial execution involving these two transactions preserve the consistency of the database.

Explain the basic requirements for Backup and recovery (CO6)

1. Consider the following transactions

T1: read(A); read(B); if A=0 then B:=B+1; write(B)	T2: read(B); read(A); if B=0 then A:=A+1; write(A)
---	---

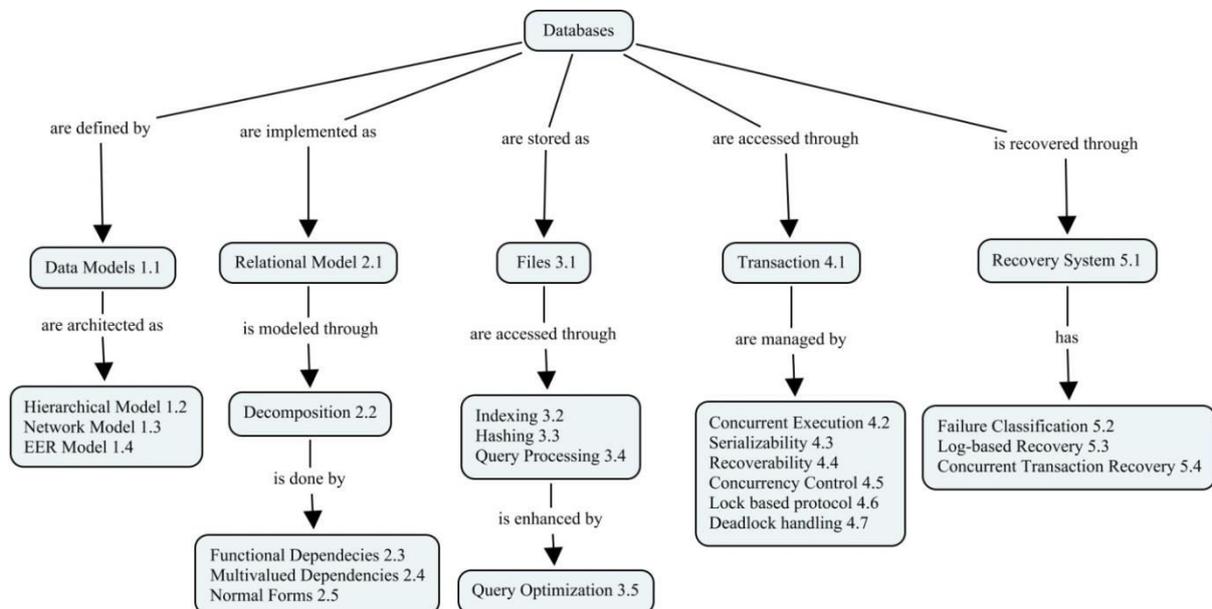
Add lock and unlock instructions to the above transactions and show that they observe two-phase locking protocol.

2. Compute the closure of the following set F of functional dependencies for relation schema $R=(A,B,C,D,E)$.

$A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$

List the candidate keys for R.

Concept Map



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, Complete Version – Second Edition - Addison Wesley Higher Education - 2010

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	Concepts	1
1.2	Relationships	1
1.3	System Architecture	1
1.4	Data Models	2
1.5	Relational languages	1
2.	Data Definition Language	
2.1	Tables creation	1
2.2	Constraints	1
2.3	Displaying table information	1
2.4	Altering and Renaming an existing table	1
2.5	Truncating and dropping the table	1
3.	Data management and Retrieval	
3.1	DML operations – Insert , Delete & Update	1
3.2	Basic queries – select	1
3.2.1	Arithmetic operations , where clause , Sorting	1
3.2.2	CASE structure , DEFINE command	1
3.3	Complex queries – Functions and Grouping	1
3.3.1	Multiple tables : JOINS and SET operators	1
3.3.2	Sub queries : Nested queries	1
4.	Database Design	
4.1	Relational model	1
4.2	Decomposition	1
4.3	Functional dependencies	2

Module No.	Topic	No. of Lectures
4.4	Multi valued dependencies	2
4.5	Normal Forms	2
5.	Data Storage and Querying	
5.1	Storage and File Structure	2
5.2	Indexing and Hashing	2
5.3	Query Processing – Measures of query cost	2
5.4	Evaluation of Expressions	1
5.5	Query Optimization – Estimation statistics of Expression Results	2
5.6	Evaluation Plans	1
6	Transaction and Concurrency control	
6.1	Transactions - concepts	1
6.2	Concurrent Execution	1
6.3	Serializability	1
6.4	Recoverability	1
6.5	Concurrency Control	1
6.6	Lock based protocol	1
6.7	Deadlock handling	1
	Total	42

Course Designers:

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

Preamble

This Laboratory course will enable students to identify, formulate and solve real world engineering problems that require usage of algorithms in C. The course serves as a foundation laboratory for improving the problem solving skills of students.

Prerequisite

None

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	L	L	M	M	-	-	-	-	-
CO2	S	S	S	L	M	M	M	-	-	-	-	-
CO3	S	S	S	L	M	M	M	-	-	-	-	-
CO4	S	S	S	L	M	M	M	-	-	-	-	-
CO5	S	S	S	L	M	M	M	-	-	-	-	-
CO6	S	S	S	M	L	M	M	-	-	-	-	-
CO7	S	M	M	L	L	M	L	-	M	-	-	-

S- Strong; M-Medium; L-Low

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.

Course Designers

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

Preamble

This course aims at giving adequate exposure to students on the Database design and E-R modelling. The course also facilitates students with hands on training on SQL and programming language extension to SQL within the RDBMS environment.

Prerequisite

None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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.

Course Designer:

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17CA210	ORGANIZATIONAL BEHAVIOUR	Category	L	T	P	Credit
		HSS	3	0	0	3

Preamble

Organizational behavior theories are used for human resource purposes to maximize the output from individual group members.

Prerequisite

None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Develop an Organisational Behaviour model for any type of Organization (CO1):

1. Define Organizational Behavior.
2. What are the disciplines that contribute to the Organizational Behaviour field?
3. What is meant by Contingency variable?
4. What are the main components of attitudes?
5. Define Personality.
6. Define JCM.
7. What is knowledge management?
8. What is the use of Path Goal Theory in organizational behavior?
9. What is a Positive Organizational Culture?
10. How does Globalization affect organizational structure?

Develop Managerial skills for Individual Behaviour (CO2):

1. Why individual differences are important?
2. The basis for understanding Work Behaviour?
3. Explain in detail about the Attitudes of the Employee?
4. Explain the various approaches and concept in motivation?
5. Evaluation of performance, feedback and innovation of reward system?

Develop the quality of Leadership (CO3):

1. Explain in detail about the personality, its factors and model.
2. Describe briefly about Equity Theory
3. Is socialization brainwashing? Explain.
4. Explain the job characteristics model and how does it motivate employees?
5. Explain with reasons for organizational structures differ and how it differs between a mechanic structure and an organic structure?

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

1. Develop and apply an OB model for Telecommunication Organization.
2. Compare and contrast downward, upward and lateral communication?
3. Identify a charismatic leader and a transformational leader. Compare the two Leaders. Give reason to support your answer
4. Apply a Matrix Structure for a College of Business Administration.
5. Can you identify a set of characteristics that describes your institution's Culture? Compare them with those of several of your peers. How closely do they agree?

Adapt to the organizational culture (CO5):

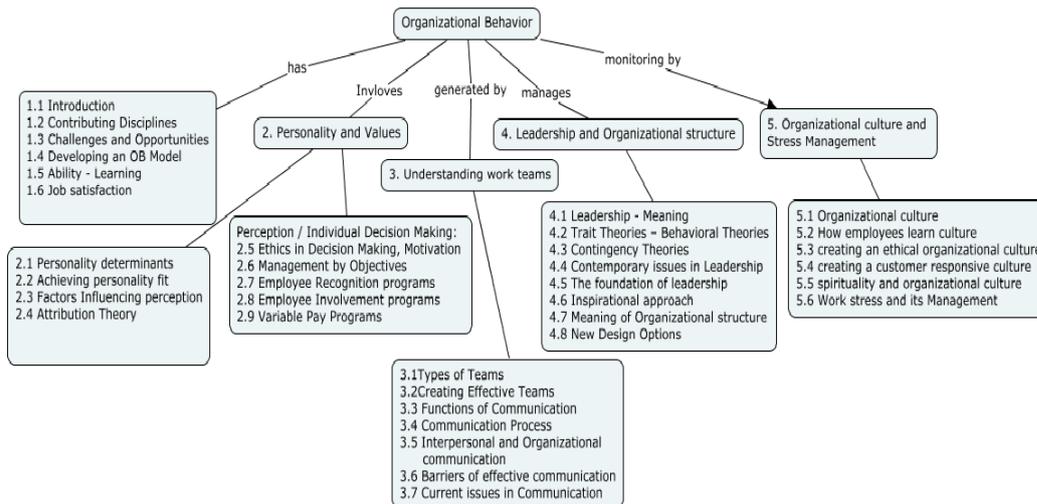
1. Analyze the social systems and organizational culture?.
2. How employees learn culture?
3. Analyze how Organization Culture Form managed in organisational Behaviour.
4. Evaluate how Organizational Culture has an impact on Employee Performance and Satisfaction.

Analyze how to manage the Stress during a job (CO6):

1. Analyze the challenges and opportunities for OB.
2. Analyze Maslow's hierarchy of needs theory.
3. Analyze how Fiedler's contingency model has been supported in research based activities.
4. Analyze the reasons for the growing interest in Spirituality
Employees form implicit models of organizational structure, "Do you agree?"

5. King fisher Airlines and Air Deccan merge.” “Corus accepts takeover bid by Tata steel.” “Mittal capture Arcelor.” “Vodafone acquires Essar.” Each of these is a recent example of large companies combining with other large companies. Does this imply that small isn't necessarily beautiful? Are mechanical forms winning the “Survival of the fittest” battle? What are the implications of this consolidation trend to organizational behavior?

Concept Map



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.
3. Sharma, R.A, "Organisational Theory and Behaviour", 2/e, Tata McGraw-Hill Ltd., New Delhi, 2007.

Course Contents and Lecture Schedule

Module No.	Topics	No. of Lectures
1	Organizational Behavior	
1.1	Introduction to (OB)Organizational Behavior	1
1.2	Contributing disciplines to OB Field	1
1.3	Challenges and opportunities for OB	1
1.4	Developing an OB Model	1
1.5	Foundation of Individual Behavior	1
1.6	Ability - Learning. Values, Attitudes and Types of Attitudes	
1.7	Job satisfaction	
1.7.1	Measuring Job satisfaction.	1
1.7.2	Effect of Job satisfaction on employee performance.	
2	Personality and Values	
2.1	Personality – Personality determinants	1
2.2	Achieving personality fit	1
2.3	Factors Influencing perception	1
2.4	Attribution Theory	1
	Perception / Individual Decision Making	
2.5	Ethics in Decision Making. Motivation	1
2.6	Management by Objectives	1
2.7	Employee Recognition programs	1
2.8	Employee Involvement programs	1
2.9	Variable Pay Programs	1
3	Understanding work teams	
3.1	Teams Vs Groups – Types of Teams	1
3.2	Creating Effective Teams – Turning Individuals into Team Players	1
	Communication	
3.3	Functions of Communication	1
3.4	Communication Process – Direction of communication	1
3.5	Interpersonal and Organizational communication	1
3.6	Barriers of effective communication	1
3.7	Current issues in Communication	1
4	Leadership	

4.1	Leadership – Meaning	1
4.2	Trait Theories – Behavioral Theories	1
4.3	Contingency Theories	1
4.4	Contemporary issues in Leadership	1
4.5	The foundation of leadership	1
4.6	Organizational structure	
4.6.1	Inspirational approach – Emotional intelligence. Foundations of Organization structure	1
4.6.2	Meaning of Organizational structure – Common organizational Designs	1
4.6.3	New Design Options – Organizational Designs and Employee Behavior.	1
5	Organizational culture and Stress Management	
5.1	Organizational culture: Meaning – Creating and sustaining culture	1
5.2	How employees learn culture	1
5.3	creating an ethical organizational culture	1
5.4	creating a customer responsive culture	1
5.5	spirituality and organizational culture	1
5.6	Work stress and its Management	1
	Total	36

Course Designer:

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

Preamble

The course facilitates the students to master all techniques of software development in C++ Programming Language and to demonstrate these techniques by implementing the solution for variety of problems spanning the breadth of the language.

Prerequisite

- 17CA120 : Programming in C
- 17CA140 : Data Structures

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	S	S	S	L	L	L	M	-	-	-	-	-
CO2	S	S	S	L	L	L	M	-	-	-	-	-
CO3	S	S	S	L	M	M	S	-	-	-	-	-
CO4	S	S	S	L	M	M	S	-	-	-	-	-
CO5	S	S	S	L	M	M	S	-	-	-	-	-
CO6	S	S	S	M	L	M	S	S	-	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Distinguish between Structured and Object Oriented problem solving approaches and apply them based on the problem given (CO1):

1. Suppose we have similar structured classes but with varying data types, how will you apply class templates to achieve the same.
2. Suppose that you have applied OO principle for your application. Analyze the drawbacks when compared to structured approach.
3. Differentiate between procedural paradigm and OO paradigm.
4. How top down approach is applied in conventional programming?

Identify classes and objects from the given problem description and able to create classes and objects using C++ (CO2):

1. Define: Class and Object.
2. What is a constructor? What are its types?
3. Write the purpose of a destructor?
4. Differentiate between procedural paradigm and OO paradigm.
5. What is the need for an explicit constructor in C++?
6. How namespaces reduces complexity? Explain.

Improve secured data processing by applying Abstraction, Encapsulation and Information hiding (CO3):

1. Differentiate static and dynamic binding?
2. Apply namespaces to achieve modularization in developing a complex application.
3. What is encapsulation?
4. Write a C++ code to do stack operations using interface and implementation separation.
5. What is information hiding?

Achieve code reusability and extensibility by means of Inheritance and Polymorphism. (CO4):

1. Consider a Client-Server application development – Banking Transaction System. Apply multiple inheritance to achieve the transaction and update the file for the same.
2. Consider a Stock Maintenance System. Do coding for Purchase and Sales and stock updating by applying virtual.
3. How C++ resolves the same method with different implementations in inheritance hierarchy?
4. Develop a program in C++ for calculating areas of different shapes by applying method overriding.
5. Apply method overloading to calculate incentives for different types of employees in an organization.

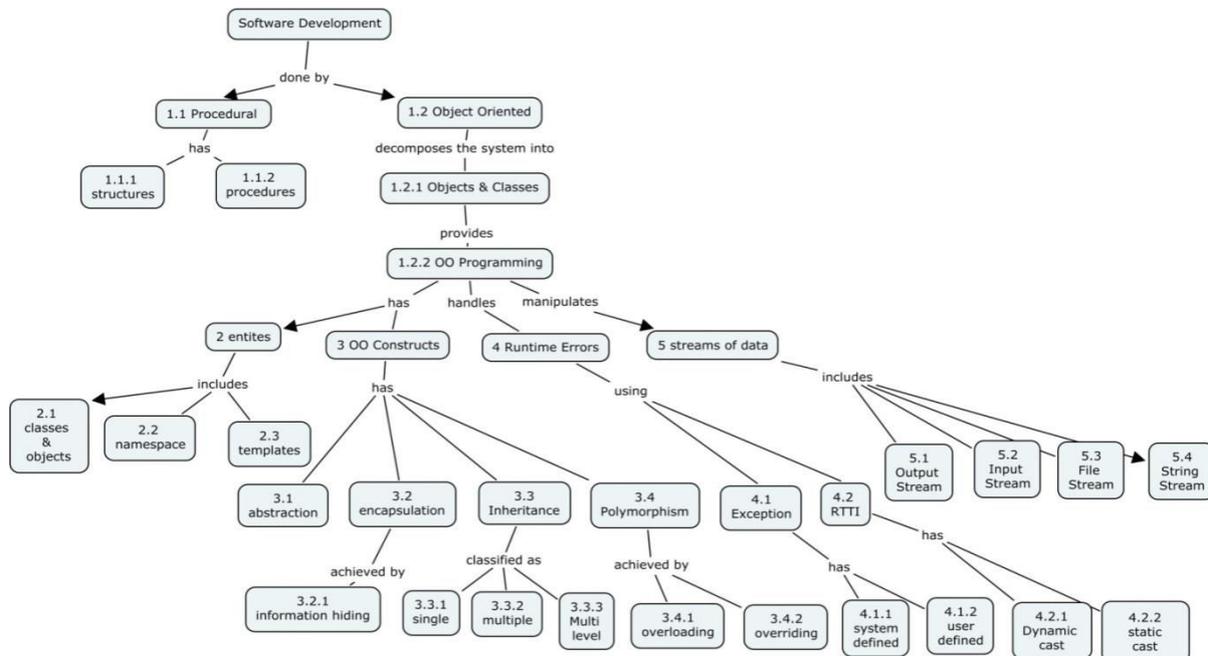
Handle errors by means of Exception Handling and Run Time Type Identification (RTTI) (CO5)

1. Differentiate Error and an exception?
2. Consider an Employee payroll system. Apply multiple inheritance to calculate the payroll and also apply RTTI to find out the current active object in the calculation.
3. Analyze the usage of RTTI?
4. Suppose that, a method doesn't have the ability to handle an exception, which may be the suitable way of handling it? Give an example.

Translate the informal description of an algorithm to solutions for problems in engineering, science and text processing using Object Oriented Programming (CO6)

1. Apply file stream classes to manage an Address Book.
2. What are File streams? Write a C++ program to create a file called "Item.txt" to have records being stored as objects of items.
3. What are string streams? Write a program of your own to manage streams of string data.

Concept Map



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
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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction to Programming Paradigms	
1.1	Procedural Programming Vs. Object-Oriented Programming	2
2	Entities	
2.1	Namespaces	2
2.2	Classes and Objects	1
2.3	Constructors	1
2.4	Destructors	1
2.5	Class Objects as Members	1
3.1	Abstraction	
3.1.1	Function Templates	1
3.1.2	Class Templates	2
3.2	Encapsulation	
3.2.1	Member data and Member function binding	1
3.2.2	Information hiding	1
3.3	Inheritance	
3.3.1	Base Class and Derived Class	2
3.3.2	Single, Multiple, Multi-level, Hybrid	2
3.3.3	Access Specifiers and Inheritance	1
3.4	Polymorphism	
3.4.1	Overloading	1
3.4.2	Operator Overloading	2
3.4.3	Method Overloading	1
3.4.4	Templates Overloading	1
3.4.5	Overriding	1
3.4.6	Method Overriding	1
3.4.7	Virtual Base Classes	1
3.4.8	Virtual Functions	1
3.4.9	Virtual Constructors	1
3.4.10	Friends	1
3.4.11	Abstract Classes	1
4	Streams	
4.1	Output Streams	1

4.2	Input Streams	1
4.3	File Streams	1
4.4	String Streams	1
5	Exception Handling	
5.1	System Defined Exceptions	1
5.2	User Defined Exceptions	1
5.3	catch-throw-rethrow	1
6	Runtime Type Information	
6.1	Dynamic Cast	1
6.2	Typeid	1
6.3	Uses and Misuses of RTTI	1
	Total	40

Course Designer:

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17CA230

DESIGN AND ANALYSIS OF ALGORITHMS

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

This course will enable students to solve a given problem using an algorithm. Also, it enables to mathematically analyze the algorithms for its efficiency and effectiveness.

Prerequisite

- 17CA140: Data Structures

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Understand the relevance of algorithms for computational problems solving and real time applications (CO1):

1. What kind of problems is solved by algorithms?
2. Give an example of an application that requires algorithmic content at the application level, and discuss the function of the algorithms involved.
3. Is it possible to compare the running times of algorithms?
4. List a few applications of algorithms.
5. How will you connect algorithms for problem solving?

Differentiate different algorithmic approaches, techniques and methods (CO2):

1. Name a few algorithmic approaches/techniques for problem solving.
2. Discuss the procedure used in Dynamic programming to solve problems.
3. Mention the steps in Greedy Method to arrive at optimal solution.
4. Suppose that instead of always selecting the first activity to finish, we instead select the last activity to start that is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields an optimal solution.
5. Prove that the fractional knapsack problem has the greedy-choice property.

Apply design and analysis techniques for a given algorithm (CO3):

1. Describe the steps in solving knapsack problem using Greedy method and Dynamic programming.
2. How will you apply Divide and Conquer method to arrive at an optimal solution for a given problem?
3. Consider the problem of making change for n rupees using the fewest number of coins. Assume that each coin's value is an integer. Describe a greedy algorithm to make change consisting of denominations 5, 10, 50 and 100.
4. Analyze the greedy strategy to the traveling salesman problem yields the following algorithm: "At each stage visit the unvisited city nearest to the current city".
5. What is the method used to find the solution in n -queen problem by symmetry?

Apply optimization techniques for improving the efficiency of algorithms (CO4):

1. Describe the potential advantage of Notation Ω , θ , O .
2. Establish the worst-case running time of heap sort is $\Omega(n \log n)$.
3. Suppose we perform a sequence of n operations on a data structure in which the i^{th} operation costs i if i is an exact power of 2, and 1 otherwise. Use aggregate analysis to determine the amortized cost per operation.
4. How can we modify almost any algorithm to have a good best-case running time?
5. Determine the optimal parenthesization of a matrix-chain produce whose sequence of dimension is {5,10,3,12,5,50,6}

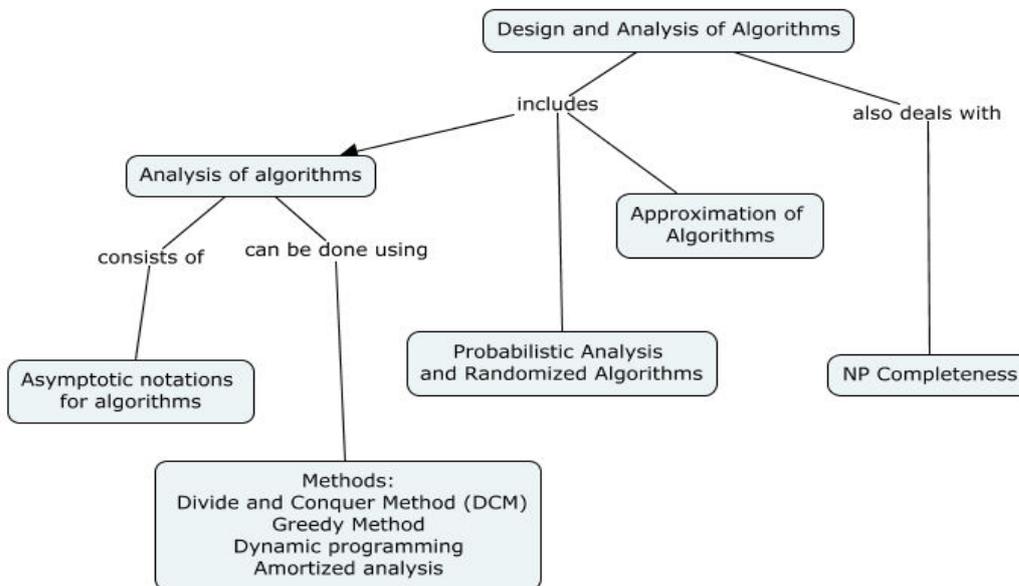
Analyze a given algorithm for its efficiency based on time and space it occupies (CO5):

1. Apply a recursive algorithm for solving Tower of Hanoi problem and analyze its efficiency for time complexity and space complexity.
2. How will you analyze a given algorithm for worst case, best case and average case analysis?
3. Write pseudocode for the brute-force method of solving the maximum sub-array problem.
4. Apply indicator random variables to compute the expected value of the sum of n dice.
5. Is it possible to improve the efficiency of an algorithm? Illustrate the steps involved in this process.

To evaluate any given problem with mathematical rigor to provide an algorithmic based solution (CO6):

1. Why do we analyze the expected running time of a randomized algorithm and not its worst-case running time?
2. Suppose that all element values are equal. What would be randomized quick-sort's running time in this case?
3. What is the smallest possible depth of a leaf in a decision tree for a comparison sort?
4. Evaluate the Reduction theorem $MT \leq MQ$
5. Evaluate NP-Complete problems, indicating the reductions typically used to prove their NP-Completeness.

Concept Map



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.

Course Contents and Lecture Schedule

Module. No	Topics	No. of Lectures
1	Algorithms	
1.1	Need for algorithms	1
1.2	Problem solving using algorithms	2
1.3	Role of algorithms in computing	2
1.4	Algorithms as a technology	1
1.5	Analysis of algorithms	1
1.6	Efficiency of algorithms	1
1.7	Algorithmic notations	2
2	Divide and Conquer Method (DCM)	
2.1	Introduction	1
2.2	Elements of DCM	1
2.3	Problem solving using DCM	2
3.	Probabilistic Analysis and Randomized Algorithms	
3.1	Introduction	2
3.2	Indicator random variables	1
3.3	Probabilistic analysis	1
3.4	Application of Indicator random variables	1
4.	Dynamic programming	
4.1	Elements of Dynamic programming	2
4.2	Matrix-chain multiplication	1
4.3	Optimization	1
5.	Greedy algorithms	
5.1	Elements of Greedy strategy	1
5.2	Matroids and greedy methods	2
5.3	Scheduling problem solving using Greedy method	2

6.	Amortized analysis	1
6.1	Aggregate analysis	1
6.2	Dynamic tables	1
7.	NP-Completeness	
7.1	Polynomial time	1
7.2	NP-Complete problems	2
8.	Approximation Algorithms	
8.1	The vertex-cover problem	1
8.2	The set-covering problem	1
8.3	Travelling-salesman problem	1
8.4	Randomization and linear programming	2
8.5	The subset-sum problem	1
Total		40

Course Designer

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

Preamble

An operating system is an essential part of any computer system. The major objective of this course are to introduce basic concepts and principles of Windows and Linux operating systems which include memory management, device management, process management, file management and security & protection mechanisms.

Prerequisites

- 17CA130: Computer Organization and Architecture
- 17CA140 : Data Structures

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

Mapping with Programme Outcomes

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

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	30	30	30
Apply	30	40	40	40
Analyze	0	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Describe the evolution, types, structure and functions of operating systems (CO1):

1. List out three main purposes of an operating system?
2. Differentiate operating systems for mainframe computers and personal computers?
3. List the four steps that are necessary to run a program on a completely dedicated machine.
4. State the purpose of system calls.

Explain techniques involved in process, memory, device and file management (CO2):

1. Mention the three major activities of an operating system in regard to memory management.
2. Assume an operating system maps user-level threads to the kernel using the many-to-many model and the mapping is done through LWPs. Furthermore, the system allows developers to create real-time threads. Is it necessary to bind a real-time thread to an LWP? Explain.
3. Consider a system that supports the strategies of contiguous, linked, and indexed allocation. Which strategy is best utilized for a file? Justify your answer
4. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests in FIFO order is
86, 1470, 913, 1774, 948, 1509, 1022, 1750, 150
5. Compare and contrast the following algorithms with respect to the total distance (in cylinders) that the disk arm moves to satisfy the entire pending request (Assume that the disk arm starts from the current head position)

Describe security and protection measures used in operating systems (CO3):

1. Explain the role of ACL in protection mechanism
2. Compare and contrast the security models of various popular operating systems.
3. Explain the value of fault tolerance for disaster recovery.
4. Explain the implications of virtualization for disaster recovery.

Execute Linux basic commands & shell scripts (CO4):

1. Shell script to print given numbers sum of all digits
2. Shell script to print contents of file from given line number to next given number of lines
3. Shell script to say Good morning/Afternoon/Evening as you log in to system
4. Adding 2 nos. supplied as command line arguments
5. Calculating average of given numbers on command line arguments
6. Finding out biggest number from given three numbers supplied as command line arguments

Implement processor scheduling, synchronization, deadlocks and disk allocation algorithms for a given scenario (CO5):

1. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process Burst Time Priority

1 P1 10 3

. P2 1 1

P3 2 3

. P4 1 4

. P5 5 2

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

a. Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, A non preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.

b. What is the turnaround time of each process for each of the scheduling algorithms in part a?

c. What is the waiting time of each process for each of the scheduling algorithms in Part a?

d. Which of the schedules in part a results in the minimal average waiting time (over all processes)?

2. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from the current head position, what is the total distance ((in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk scheduling a. FCFS b. SSTF c. SCAN d. LOOK e. C-SCAN

3. Analyze operating system requirements and recommend an appropriate operating system to meet the requirements.

4. Install several current operating systems and validate that the installations were successful.

5. Install a system with at least two virtual machines.

Analyze the code for resource allocation (CO6):

1. Would it be sensible to have a language that statically checks mutex correctness?

```
var m
var x guarded_by(m)

func f1() {
  lock(m)
  x = 42
  unlock(m)
}

func f2() {
  x = 42 // error, accessing x w/o holding its mutex
}

func f3() assumes_locked(m) {
  x = 42
}

func b1() {
  f3() // error
}

func b2() {
  lock(m)
  f3()
  unlock(m)
}
```

2. Two threads are trying to share a memory area. You are given a wrong code for establishing mutual exclusion between threads as below:

System:

2

3 int favoredThread = 1;

4 boolean t1WantsToEnter = true;

5 boolean t2WantsToEnter = true;

6 startThreads();

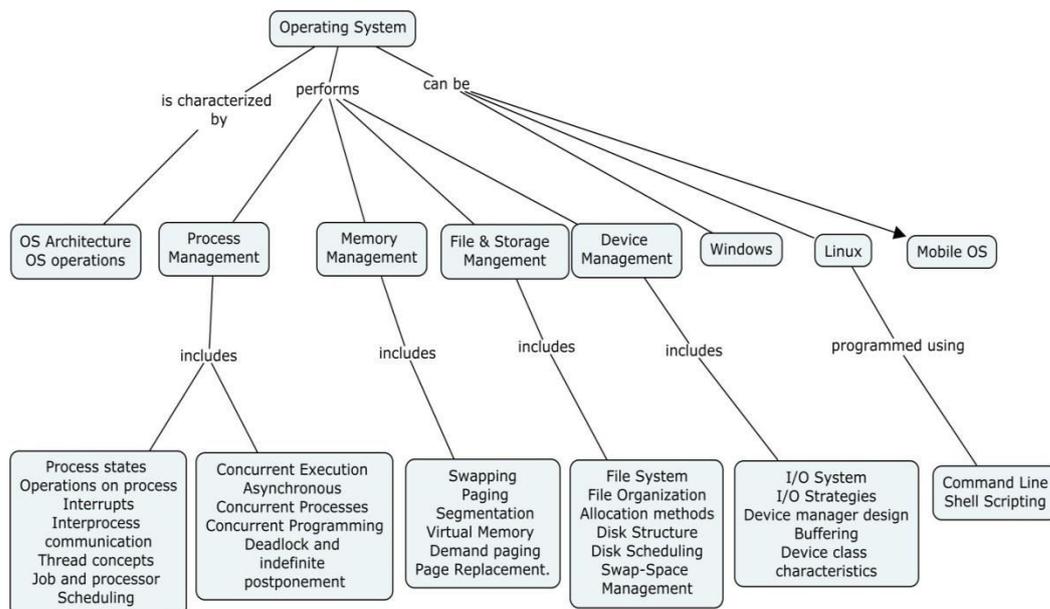
<p>Thread T1:</p> <pre> 11 void main() 12 { 13 while (!done) 14 { 15 t1WantsToEnter = false; 16 favoredThread = 2; 17 18 while (t2WantsToEnter or favoredThread == 2); 19 20 // critical section code 21 22 t1WantsToEnter = true; 23 24 // code outside critical section 25 26 } // end while 27 28 } // end Thread T1 29 </pre>	<p>Thread T2:</p> <pre> 32 void main() 33 { 34 while (!done) 35 { 36 t2WantsToEnter = false; 37 favoredThread = 1; 38 39 while (t1WantsToEnter or favoredThread == 1); 40 41 // critical section code 42 43 t2WantsToEnter = true; 44 45 // code outside c r i t i c a l section 46 47 } // end while 48 49 } // end Thread T2 </pre>
--	--

Scan each line of code and make necessary modifications. Explain the need for modifying the code by providing proper arguments in the given format. (10)

Modified Line number	Reason

Enhance the code so that indefinite postponement and deadlock are avoided and provide at least two case studies for proving the same. (10).

Concept Map



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/IIScBANG/Operating%20Systems/New_index1.html
8. <https://www.shellscript.sh/first.html>
9. <http://www.freeos.com/guides/lst/>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Operating System Introduction	
1.1	Basics, OS Architecture	2
1.2	OS Operations	1
2	Process Management	
2.1	Process states	1
2.2	Operations on Process	1
2.3	Interrupts	1
2.4	Inter process Communication	2
2.5	Thread concepts	1
2.6	Job and processor Scheduling	2

3	Concurrent Execution	
3.1	Asynchronous Concurrent Processes	2
3.2	Concurrent Programming	3
3.3	Deadlock and indefinite postponement	3
4	Memory Management	
4.1	Swapping	1
4.2	Paging	2
4.3	Segmentation	1
4.4	Virtual Memory – Demand paging	1
4.5	Page Replacement	2
5	File & Storage Management	
5.1	File System	1
5.2	File Organization	1
5.3	Allocation methods and free space	1
5.4	Disk Structure	1
5.5	Disk Scheduling	1
5.6	Swap-Space Management	1
6	Linux Programming	
6.1	Command Line	2
6.2	Shell Scripting Basics	3
7	Case Studies	
7.1	Linux	2
7.2	Windows	2
7.3	Mobile OS	2
	Total	43

Course Designer:

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

Preamble

Accounting and Financial Management is a discipline that deals with managing the monetary transactions in an organization. The field is related with relying on accounting and enables an engineer in taking useful financial and costing related decisions by providing scientific tools and techniques.

Prerequisite

None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Apply Financial Statement Analysis for the given Balance sheet (CO1):

1. What is Cost Volume Profit Analysis?
2. Define Risk.
3. Define capital Budgeting.
4. Define Cost of Capital.
5. Mention some financial institutions.

Summarize the concepts of Financial Planning (CO2):

1. What is the purpose of Balance Sheet?
2. What are the various types of Assets?
3. Define Working Capital?
4. What is Cost Volume Profit Analysis?

Describe the various sources of finance In Financial Management (CO3):

1. What are the objectives of Capital Budgeting? Explain.
2. Discuss the non-traditional methods of investment decision making.
3. Explain the various sources of finance.
4. Discuss the legal and the procedural aspects of dividend policies

Practice Journal, ledgers and Trial Balance for various Transactions (CO4):

1. Journalize the following business transactions :
 - a).Rahul brings in cash Rs.10,000 as the capital and purchases land worth Rs.2000.
 - b). He purchases goods worth Rs.5000.
 - c).He sells goods for Rs.7000
 - d).He incurs travelling expenses for Rs.200
2. Journalise the following transactions in the books of Kumar & co. and post them to ledger and prepare trial balance

1998

- | | |
|---------|--|
| June 1 | Karthik commenced business with Rs. 20,000 |
| June 2 | Paid into Bank Rs. 5000 |
| June 3 | purchased plant with Rs. 10000 from Modi & co. |
| June 4 | Purchased goods worth Rs. 5,000 from Anwar |
| June 6 | Goods worth Rs. 4,000 sold to Anbu |
| June 8 | Sold goods worth Rs.2,000 for cash |
| June 10 | Goods returned by Anbu Rs.50 |

June 15	Paid rent Rs. 250
June 18	Withdrawn from bank for office use Rs.2,500
June 20	Paid salaries Rs. 1,8000
June 25	withdrawn for personal use Rs. 250
June 26	Goods returned to Anwar Rs. 100
June 27	Paid for office furniture Rs. 1,500 by cheque
June 28	Received Rs.3900 cash from Anbu and discount allowed Rs. 50
June 29	Paid Anwar on account Rs. 48000 and discount allowed by him Rs. 100

3. Prepare Trading and Profit and Loss Account and Balance Sheet on 31.12.96 from the following trial balance extracted from the books of Mr.Kumar as on 31.12.96

Debit Balances	Rs.	Credit Balances	Rs.
Buildings	30000	Capital	4000
Machinery	31400	Purchase Returns	2000
Furniture	2000	Sales	280000
Motor Car	16000	Sundry creditors	9600
Purchases	188000	Discounts received	1000
Sales return	1000	Provision for bad and doubtful debts	600
Sundry debtors	30000		
General expenses	1600		
Cash at bank	9400		
Rates and taxes	1200		
Bad debts	400		
Insurance premium	800		
Discount allowed	1400		
Opening stock	20000		
Total	333200	Total	333200

4. The following are the balance extracted from the Books of Sri nayagam as on 31st March 2006.

Sri Nayagam's Capital	12500	Returns outwards	5000
Sri Nayagam's Drawing	6200	Returns Inwards	10000
Furniture and Fitting	1750	Carriage Outwards	8000
Type writer	1200	Salaries	11000
Purchases	180000	Advertisement	1200
Sales	235000	cycle	200
Lorry hire on purchase	12000	Opening Stock	21500
Travelling Expenses	900	Sundry Debtors	12000
Sundry creditors	10000	Reserve for Doubtful Debts	400
Insurance	500	Commission Earned	9000
General Expenses	600	Discount allowed	5000
Postage & Telegram	150	cash in hand	450
Bad Debts	500	over draft with banker	6500
Interest Paid	250	Rent and taxes	5000

The following adjustments are to be made :

- i) Stock on 31st march 2006 Rs. 17500
- ii) Provide the following outstanding : interest – Rs. 250, Salaries – Rs. 1000, Rent Rs. 500, Audit fees Rs. 500
Prepaid expenses : insurance Rs. 125, advertisement Rs. 200
- iii) Maintain Reserve for doubtful Debts at 5% on sundry Debtors.
- iv) Provide Depreciation : Furniture and fitting – 10% , cycle – 15%, Typewriter – 15%

Prepare Trading and Profit and Loss a/c for the year ending 31st march, 2006 and a Balance sheet as on that date.

5. From the following balance sheets of XYZ Ltd as on 31st Dec 2007 and 2008. You are required to prepare .

a.) Schedule of changes in working capital

b.) Fund flow statement

c.) Cash flow statement.

Liabilities	2007	2008	Assets	2007	2008
Share Capital	1,00,000	1,00,000	Goodwill	12,000	12,000
General Reserve	14,000	18,000	Buildings	40,000	36,000
Sundry creditors	16,000	13,000	Plant	37,000	36,000
P/L a.c	8,000	5,400	Investment	10,000	11,000
Bills payable	1,200	800	Stock	30,000	23,400
Provision for tax	16,000	18,000	Bill receivable	2,000	3,200
Provision for doubtful	400	600	Debtors	18,000	19,000
Debts			Cash at Bank	6,600	15,200
	1,55,6000	1,55,800		1,55,600	1,55,800

Additional Information :

Depreciation charge on plant was Rs. 4,000 and Building Rs. 4,000

Provision for taxation was Rs. 19,000 made during the year 2008

Interim dividend of Rs. 8,000 was paid during the year.

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

1. A chemical company is considering investing in a project that costs Rs.500000. The estimated salvage values is zero; tax rate is 55%. The company uses straight line depreciation and the proposed project ahs cash flows before tax (CFBT) as follows.

Year	CFBT (Rs.)
1	100000
2	100000
3	150000
4	150000
5	250000

Find the following

a) Pay Back Period b) ARR

2. SP Limited company is having two projects, requiring a capital outflow of Rs. 3,00,000. The expected annual income after depreciation but before tax is as follows:

Year	Rs.
1	9,000
2	80,000
3	70,000
4	60,000
5	50,000

Depreciation may be taken as 20% of original cost and taxation at 50% of net income:

You are required to calculated

(a) Pay-back period (b) Net present value (c) According rate of return (d) Net present value index. (e) Internal rate of return.

3. A company has to choose one of the following two actually exclusive machine. Both the machines have to be depreciated. Calculate NPV.

Year	Cash inflows	
	Machine X	Machine Y
0	-20,000	-20,000
1	5,500	6,200
2	6,200	8,800
3	7,800	4,300
4	4,500	3,700
5	3,000	2,000

Compute Trading account, Profit and Loss account and Balance Sheet for the given Trial Balance (CO6)

- Illustrate the various types of Assets and liabilities
- Prepare Trading a/c , profit and loss a/c and Balance sheet of Shri Ankur as on 31st March 2008 after taking into consideration following adjustments.

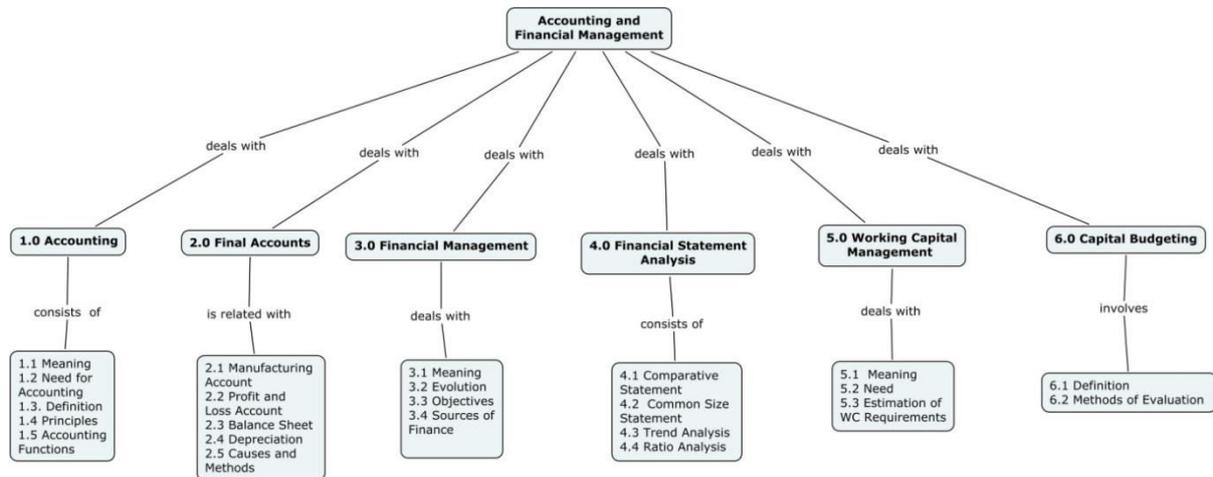
Trial Balance as on 31/3/2008

Particulars	Dr. (Rs.)	Cr. (Rs.)
Sundry Debtors	88,000	
Capital		3,16,300
Salaries	9,000	
Commission	800	
Furniture	90,000	
Creditors		81,000
Dividend		4,000
Machinery	1,56,000	
Bad debts	2,250	
Advertisement	1,000	
Investment	38,000	
Bills payable		18,000
Opening stock (01/04/2007)	32,000	
Insurance	11,000	
Drawings	17,000	
Cash in hand	35,000	
Cash at bank	51,000	
Interest		900
Purchases	1,34,500	
Sales return	1,800	
Wages	6,500	
Bills receivable	32,000	
Purchase return		2,300
Sales		2,10,000
Carriage inward	2,100	
Octroi	1,500	
Bank overdraft		76,950
	7,09,450	7,09,450

Adjustments

- Closing stock Rs. 33,000
- Wages outstanding Rs. 2,000
- Insurance Prepaid Rs. 2,500
- Depreciate machinery at the rate of 10 % and furniture 15%

Concept Map



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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	Accounting	
1.1	Meaning and Scope	1
1.2	Need for Accounting	2
1.3	Definition	1
1.4	Principles	1
1.5	Accounting Functions-Recording, Classifying, Summarizing, Analysis and Interpretations.	4
2.0	Final Accounts	
2.1	Manufacturing Account	2
2.2	Profit and Loss Account	2
2.3	Balance Sheet	2
2.4	Depreciation	1
2.5	Causes and Methods	2
3.0	Financial Management	
3.1	Meaning	1
3.2	Evolution	1
3.3	Objectives	1
3.4	Sources of Finance	2
4.0	Financial Statement Analysis	
4.1	Comparative Statement	2
4.2	Common Size Statement	2
4.3	Trend Analysis	2
4.4	Ratio Analysis	2
5.0	Working Capital Management (WC)	
5.1	Meaning	1
5.2	Need	1
5.3	Estimation of WC requirements	2
6.0	Capital Budgeting	
6.1	Definition	1
6.2	Methods of Evaluation	4
	Total	40

Course Designer

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

Preamble

This Laboratory course will enable students to identify, formulate all techniques of software development in the C++ Programming Language and demonstrate these techniques by the solution of a variety of problems spanning the breadth of the language.

Prerequisite

- 17CA120: Programming in C
- 17CA140: Data Structures
- 17CA220: Object Oriented Programming using C++

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

Mapping with Programme Outcomes

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

S-Strong;M-Medium;L-Low

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:**

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 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.

Course Designer:

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

Preamble

This Laboratory will enable students to identify, formulate and solve real world engineering problems that require usage of algorithms.

Prerequisite

- 17CA120: Programming in C
- 17CA140: Data Structures

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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.

Course Designers

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17CA290	PROFESSIONAL COMMUNICATION	Category	L	T	P	Credit
		HSS	0	1	1	2

Preamble

This course provides opportunities to students to develop and demonstrate basic communication skills in technical, professional and social contexts effectively.

Prerequisite

- None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Designers:

- | | | |
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17CA310**OPERATIONS RESEARCH**

Category	L	T	P	Credit
BS	3	1	-	4

Preamble

The course aims at exploring the various problems like linear programming, Integer programming, Transportation, assignment problem and the project network analysis. It covers the various inventory and queuing models

Prerequisite

None

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

Mapping with Programme Outcomes

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

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	10	10	10	10
Apply	60	60	60	60
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Identify the Transportation and Assignment problems and to optimize in engineering fields (CO1) :

- At the end of a cycle of schedules, a transport company has a surplus of one truck in each of the cities 1,2,3,4,5 and a deficit of one truck in each of the cities A,B,C,D,E and F. the distance between the cities with a surplus and cities with a deficit are given below.

		To city					
		A	B	C	D	E	F
From city	1	80	140	80	100	56	98
	2	48	64	94	126	170	100
	3	56	80	120	100	70	64
	4	99	100	100	104	80	90
	5	64	80	90	60	60	70

How should the truck be dispatched so as to minimize the total distance traveled ? which city will not receive a truck?

- Solve the assignment problem for maximization given the profit matrix,

	P	Q	R	S
A	51	53	54	50
B	47	50	48	50
C	49	50	60	61
D	63	64	60	60

- Define non existing feasible solution?
- State all the constraints in a transportation problem and how they are different from linear programming problem?
- What are assignment problems?

Apply the various sequencing techniques (CO2) :

- Calculate the total float, free float and independent float for the project whose activities are given below.

Activity	1-2	1-3	1-5	2-3	2-4	3-4	3-5	3-6	4-6	5-6
----------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Duration 8 7 12 4 10 3 5 10 7 4

Solve linear programming techniques to optimization problems arising in all Computer fields (CO3):

1. Solve by simplex method

$$\text{Max } Z = X_1 + 2X_2 + 3X_3 - X_4$$

Subject to,

$$X_1 + 2X_2 + 3X_3 = 15$$

$$2X_1 + X_2 + 5X_3 = 20$$

$$X_1 + 2X_2 + X_3 + X_4 = 10 \text{ and}$$

$$X_1, X_2, X_3, X_4 \geq 0$$

2. Solve the LPP.

$$\text{Min } Z = X_1 + X_2 + X_3$$

Subject to,

$$X_1 - 3X_2 + 4X_3 = 5$$

$$X_1 - 2X_2 \leq 3$$

$$2X_2 - X_3 \geq 4$$

$$X_1, X_2 \geq 0 \text{ and } X_3 \text{ is unrestricted.}$$

Solve Integer programming techniques to optimization problems arising in all Computer fields (CO4):

1. Solve the following mixed integer problem.

$$\text{Max } Z = -3X_1 + X_2 + 3X_3$$

Subject to,

$$-X_1 + 2X_2 + X_3 \leq 4$$

$$2X_2 - 3/2 X_3 \leq 1$$

$$-X_1 - 3X_2 + 2X_3 \leq 3$$

$$X_1, X_2 \geq 0 \text{ and } X_3 \text{ is non negative integer.}$$

Summarize the inventory and queuing models (CO5):

1. A branch of a National bank has only one typist. Since the typing work varies in length. The typing rate is randomly distributed. Approximating Poisson distribution with mean rate of 8 letters per hour, the letters arrive at the rate of 5 per hour. During the entire 8 hour work day if the PC is valued at Rs. 15.0/- per hour. Determine
- Equipment utilization.
 - The percent time an arriving letters has to wait.
 - Average system time.
 - Average idle time cost of the type writer per day.

Classify the various scheduling techniques in mini Project (CO6) :

1. Construct the network for the project whose activities are given below and calculate the total float, free float and independent float for the project.

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7	
Duration		3	8	12	6	3	3	8	5	3	8

Determine the critical path and project duration of the project.

2. A maintenance foreman has given the following estimate of times and cost of jobs in a maintenance project.

Normal

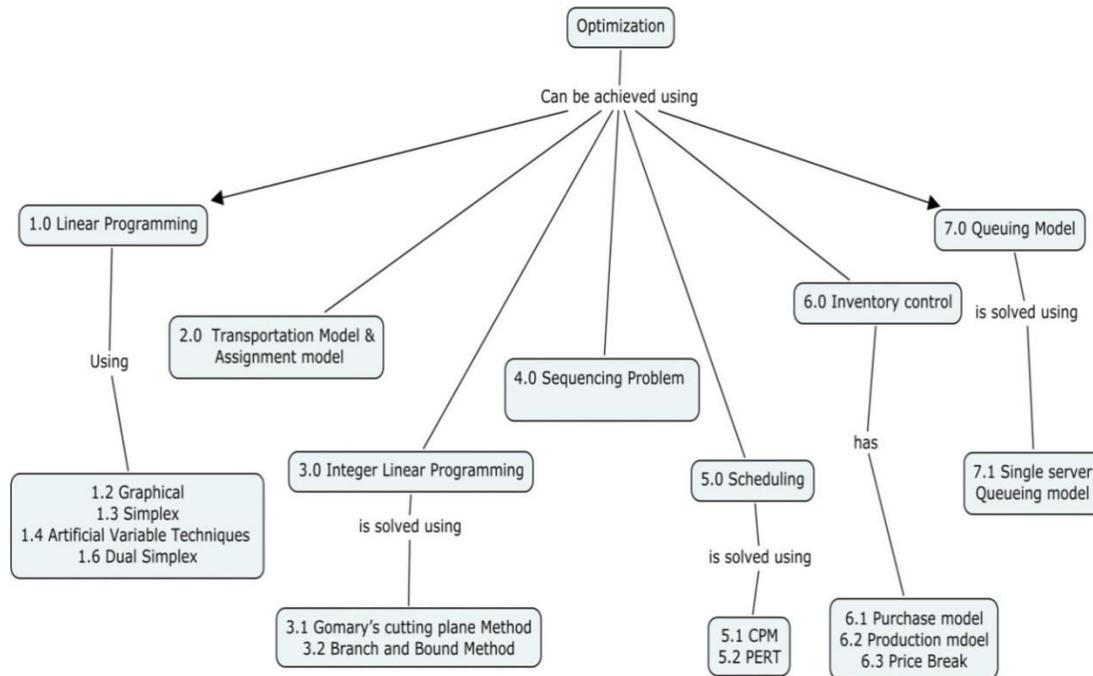
Crash

Job	Predecessor	Time	Cost	Time	Cost
A	-	8	80	6	100
B	A	7	40	4	94
C	A	12	100	5	184
D	A	9	70	5	102
E	B,C,D	6	50	6	50

Overhead cost is Rs. 23 per hour. Find

- the normal duration of the project and the associated cost
 - the minimum duration of the project and associated cost
 - the least duration of the project and its cost
 - if all the activities are crashed what will be the project duration and the correspond cost
3. Analyze the practical steps involved in solving PERT problem.

Concept Map



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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.0	Linear Programming	
1.1	Formulation	1
1.2	Graphical Solution	1
1.3	The Simplex algorithm	2
1.4	Artificial Variable Techniques	2
1.5	Variants of the simplex methods	2
1.6	Duality-Dual Simplex	2
2.0	Transportation Model	
2.1	Initial Basic Feasible Solution methods	2
2.2	Test for optimality-Variants of the Transportation problem	2
	Assignment Model	
2.3	Hungarian Algorithm	2
2.4	Variants of the Assignment Problem	2
2.5	Travelling Salesman problem	1
3.0	Integer Linear Programming	
3.1	Gomary's cutting plane method	3
3.2	Branch and Bound method	2
4.0	Sequencing Problem	
4.1	N jobs through 2 machines, N Jobs through 3 machines, N jobs through m machines	2
4.2	Processing Two jobs through m machines	2
5.0	Scheduling	
5.1	Critical path Method	2

5.2	Project Evaluation and Review Techniques	2
6.0	Inventory control	
6.1	Purchase model with and without shortage	2
6.2	Production model with and without shortage	1
6.3	Price Break	1
7.0	Queuing Model	
7.1	Single server Queueing model	3
7.2	Multi channel model	2
	Total	42

Course Designer

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

Preamble

This course aims at facilitating the student to understand the basic internet programming concepts and the programming concepts of JAVA towards developing Java based applications and hands on practices by applying the concepts for implementing internet applications.

Prerequisite

- 17CA220: Object Oriented Programming using C++

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

Mapping with Programme Outcomes

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

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	30	30	30	30
Apply	40	50	50	50
Analyze	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions**Use the object oriented concepts of java for the given problem (CO1):**

1. Write a Java Program to implement multilevel inheritance for a university-college database management system.
2. Implement method overloading for calculating the area of different shapes.
3. Write a program to define a class for a student result processing system.

Use exceptions, threads, collections, logs of Java for the given problem (CO2):

1. Write a Java Program to print the numbers 1 to 50 alternatively by Threads (Use Multithreading).
2. Illustrate with an example how collections are manipulated using array list

Apply events through swing, RMI, JAR operations for the given application (CO3):

1. Write a simple registration form for any event using swing.
2. Illustrate action event using button.
3. Write a code segment to give feedback for a course using swing.
4. Write a sample Java program using adjustment event.
5. List the listeners in java.
6. Write an RMI based Application Program for addition of two complex numbers.

Select the proper library classes in Java based on the need of a problem (CO4):

1. Design an application for Library Management System
2. Implement Railway Reservation system
3. Implement a Quiz application

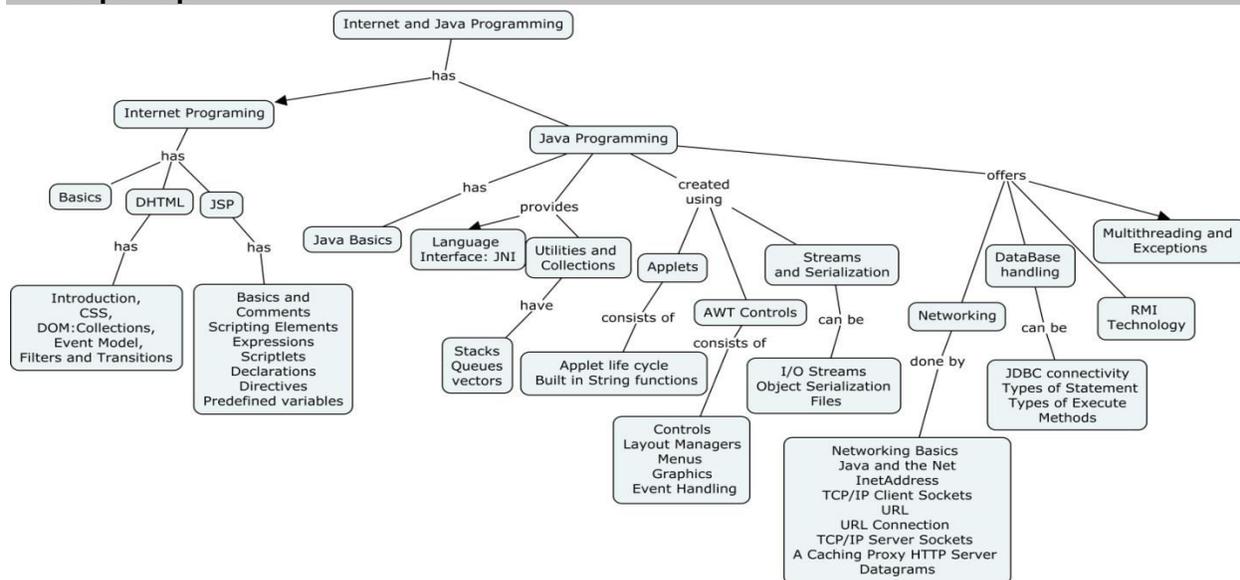
Apply different Java technologies to solve Internet applications (CO5):

1. Develop a sample client/server application using sockets and datagram packets.
2. Develop an Applet for 'Online Job Portal' by applying the event handlers to handle the events.
3. Develop a user defined exception for handling a negative number or zero during age validation in a Voter Management System using Exception base class.

Design an application using HTML/DHTML and JSP (CO6):

1. Develop an application for online shopping
2. Develop an application for online cab booking
3. Design an application for online Ticket reservation system for air bus.

Concept Map



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 - Scriptlets - 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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Internet Programming	
1.1	Internet Basics,DHTML,CSS	1

Module No.	Topic	No. of Lectures
1.2	DOM:Collections	1
1.3	Event Model	1
1.4	Filters and Transitions	1
2	Java Programming	
2.1	Java Basics:Java features	1
2.2	Array and Strings	1
2.3	Object Oriented Features	1
3	Language Interface	
3.1	JNI	2
4	Utilities and Collections	
4.1.	Stacks, Queues and vectors	3
5	Multithreading and Exceptions	
5.1	Multithreaded Programming	2
5.2	Exception Handling	2
6	Applets	
6.1	Applet life cycle	1
6.2	Built in String functions	1
7	Streams and serialization	
7.1	I/O Streams	1
7.2	Object Serialization	1
7.3	Files	1
8	AWT Controls	
8.1	Controls	1
8.2	Layout Managers	1
8.3	Menus	1
8.4	Graphics	1
8.5	Event Handling	2
9	Database Handling	
9.1	JDBC connectivity	1
9.2	Types of Statement	1
9.3	Types of Execute Methods	1
10	JSP	
10.1	Basics and Comments	1
10.2	Scripting Elements	1
10.3	Expressions - Scriptlets	1
10.4	Declarations- Directives	1
10.5	Predefined variables	1
11	Networking	
11.1	Networking basics	1
11.2	Socket Programming	3
11.3	RMI Technology	1
	Total	40

Course Designer:

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

Preamble

This course aims at facilitating the student to learn the object orientation on real world problems; analyze and design the problem domain using the principles and practices followed in object oriented problem solving by applying object technology with UML modelling.

Prerequisite

- 17CA220 : Object Oriented Programming using C++

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	S	S	S	M	M	L	L	L	L	-	-	-
CO2	S	S	S	M	M	L	L	L	L	-	-	-
CO3	S	S	S	M	M	S	S	L	L	-	-	-
CO4	S	S	S	M	L	S	S	L	L	-	-	-
CO5	S	S	S	M	L	S	S	L	L	-	-	-
CO6	S	S	S	M	L	S	S	L	L	-	-	-

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	30
Apply	40	40	20	30
Analyse	20	20	40	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Understand the complexity of Industrial Strength software and the application of Unified Process Model. (CO1):

1. Write the reasons of Software Crisis? How to avoid it?
2. Why software is inherently complex? List the reasons.
3. How OO based decomposition differs from algorithmic decomposition.
4. What is Unified Process Model?
5. Explain the different life cycle phases of Rational Unified Process Model.

Identify classes and objects from the given problem domain by applying the different Object Oriented Analysis (OOA) based classification techniques (CO2):

1. What is OOA?
2. Which tasks are involved in the OOA process?
3. Explain the different ways of classifying the objects and classes in OOA?
4. How CRC card based analysis helps in identifying classes and objects?
5. Companies may employ many people, and people may work for many companies. Every employee in a company has a manager to manage many subordinate employees. One work role is assigned to each employee and each job requires and desired credentials. The credentials are composed of qualifications. Identify the classes from this scenario

Develop new classes from the problem domain by applying object oriented design principles. (CO3)

1. What are design principles? How the various types of it are used in OOD? Explain it with an example for each.
2. What is LSP?
3. What is OCP?
4. When will you apply Common Closure Principle (CCP)?
5. What is Release Reuse Principle?

Incorporate design patterns to create classes with reusability and extensibility. (CO4)

1. What are design patterns? Analyze the creational based design patterns in classes and objects representation in OOD.
2. What are structural design patterns? Analyze how the different types of it are applied in OOD?
3. How behavioral patterns are used in representing the functionality in OOD?
4. What is the purpose of Memento? Give an example.
5. What is a framework? Distinguish it from design patterns.

Design different UML design documents to show logical view by applying Object Oriented Design (OOD) in various software domains.(CO5)

1. What is the difference between use case diagram and use cases?
2. What are the standard class stereotypes available in UML 2.0?
3. List the purposes of sequence diagrams.
4. How object creation, deletion, life line of an object and life time of a method are represented in a sequence diagram? Draw its notations.
5. What are the types of links supported by collaboration diagrams?

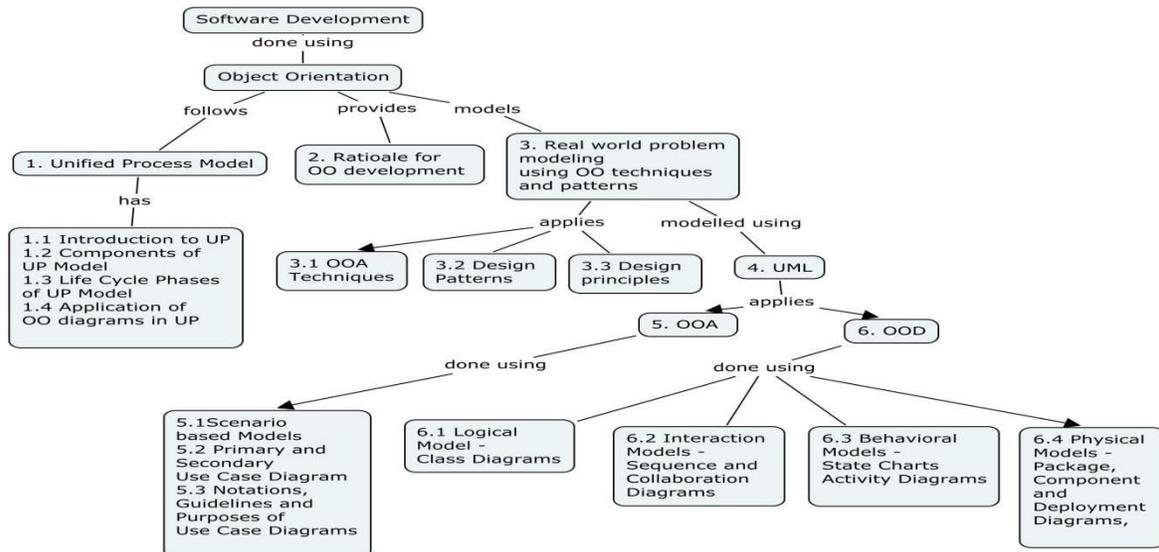
Develop different design documents to show physical view using UML for any given application. (CO5)

Consider a 'Transport Management System'. This system proposes an efficient method for handling the transport operations. It provides an efficient record maintenance system.

The main feature is it provides automatic intimation of expired date of driving license, complaints and suggestions to the RTO office, fix appointment for LLR test and get bus information. This information will maintain details of all employees, contacts, bus details etc. and provides an option for reports generation.

1. Draw a package diagram by grouping the classes identified from the above application.
2. Draw a component diagram to show the components interaction for the above system.
3. How a deployment diagram shows the layered architecture implementation of the system given above.

Concept Map



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).

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Unified Process in Object Oriented Software Development	
1.1	Basics of Software Development Process	1
1.2	Introduction to UP	1
1.3	Components of Unified Process Model	1
1.4	Life Cycle Phases of Unified Process Model	1
1.5	Application of OO diagrams in UP	1
	Tutorial	
2	Rationale for OO development	
2.1	Object Orientation in Software development process	1
2.2	Flavours of Object Orientation	2
2.3	Basic Entities and Constructs of Object Orientation	1
2.4	Structured Approach Vs. Object Orientated Approach	1
	Tutorial	
3	Modelling the real world problems using OO techniques and Design Patterns	
3.1	OOA Techniques for Classes and Objects Identification	2
	Tutorial	2
3.2	OOD Techniques - Design Principles in Class Design	2
3.3	OOD Techniques - Design Patterns in Classes and Objects Identification and Refinement	2
	Tutorial	

Module No.	Topic	No. of Lectures
4	Modelling with UML	
4.1	Problem Domain Understanding	1
4.2	Traditional Analysis Methods and Models	2
4.3	Characteristics of Good Analysis	1
4.4	Deficiency with the traditional approaches	1
4.5	UML - Introduction	1
4.6	UML diagrams for OOA and OOD	1
5	Object Oriented Analysis	
5.1	Scenario based Models - Use Case Analysis	1
5.2	Primary and Secondary Use Case Diagram	2
5.3	Notations, Guidelines, Purposes of Use Case Diagrams	2
	Tutorial	
6	Object Oriented Design	
6.1	Logical Model -UML Class Diagram basic and advanced concepts	2
6.2	Interaction Models – Sequence and Collaboration Diagrams	2
6.3	Behavioral Models – State Charts and Activity Diagrams	1
6.4	Physical Models – Package, Component and Deployment Diagrams	1
6.5	Case Study - Tutorial	
	Total	36

Course Designer:

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17CA340**SOFTWARE ENGINEERING**

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

This course aims at introducing to the students about the product that is to be engineered and the process that provides a framework for the engineering technology. The course facilitates the students to analyze risk in software design and quality and to plan, design, develop and validate the software project.

Prerequisite

None

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

Mapping with Programme Outcomes

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

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	40	20	20	30
Apply	20	40	40	30
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Explain a process model for a software project Development. (CO1):

1. Define: Software Engineering.
2. Define: Metric, Measure and Indicator
3. Who are called as Stakeholders?
4. How learning is performed in ASD process model?
5. How extreme programming helps in modern software product development scenario? Explain the various activities involved in it with neat diagram
6. How requirements elicitation process is carried out during requirements analysis using QFD? Explain it in detail.
7. Consider a scenario of a customer's organization in need of a faster product development and the requirements are well understood. Apply RAD model helps in developing software product in this scenario? Explain it with a neat diagram.
8. Consider a system in which the developer has to add a new functionality based on changing customers' requirements. This has to be tested before and after by the tester. How Extreme Programming works in this situation? Explain it in detail.
9. Draw a Software process framework.
10. Quote an example of software projects that would be amenable to the waterfall model.

Prepare the SRS, Design document, Project plan of a given software system (CO2):

1. Consider an 'Online Vehicle Purchase System'. Apply requirements analysis and design to draw primary use case diagram, swimlane activity diagram and State Diagram for it.
2. Apply flow-oriented modelling to develop a DFD with level 0 and 1 and state diagram for a University Admission System.
3. Apply Control Flow based testing in White box testing to generate the test cases and independent paths in a sample piece of code.
4. Prepare a data dictionary by creating entries for all the data objects for an 'Online Vehicle Purchase System'
5. Construct a Structure chart from a DFD for your own application.
6. For a 'Students Attendance Monitoring System', create a primary use case diagram.

7. Apply the basic guidelines for conducting a collaborative requirement gathering meeting and prepare a SRS document for Online Shopping cart management system

Apply Project Management and Requirement analysis, Principles to S/W project development. (CO3):

1. Define QFD and show its different types of requirements.
2. Show the Seven distinct functions of Requirement Engineering Task.
3. Develop a complete use case for the following activities.
 - i. Making a withdrawal at an ATM,
 - ii. Searching for the books (on a specific topic) using an online book store.
4. Consider a system that has aspects A01, A02, A03 and A04. The system has been analyzed and it has been identified that there are requirements R01, R02, R03, R04 and R05. During the analysis it has been identified that, Req. R01 covered A01 and A03; R02 covered A04; R03 covered A01, A02 and A04; R04 covered A03 and A04; R05 covered A02 and A03. Draw a Requirements Traceability Table for the above and identify which requirements are sufficient to construct the system.
5. Discuss some of the problems that occur when requirements must be elicited from three of four different customers.

Analyze the cost estimate and problem complexity using various estimation techniques (CO4):

1. Analyze the effort calculated using COCOMO II model for semi detached and organic models for the same KLOC and provide your conclusion.
2. Evaluate the Cost estimate for a system having 10KLOC lines of code and is of 'Semi Detached Type' with average complexity metrics of all the attributes, using COCOMO II model.
3. Use the COCOMO-II model to estimate the effort required to build software for a simple E-Shopping application that provides 18 screens (simple), 15 reports (medium) and will require approximately 60 software components (difficult). Assume the developer's experience/capability is high and environment maturity/capability is very high. Use the application composition model with object points.
4. Evaluate the Complexity measure using FP based estimation for a system in which the following data exists:
 - i. No.of User Inputs – 20
 - ii. No.of User Outputs – 12
 - iii. No.of Enquiries - 8
 - iv. No.of Internal Logic Files – 4
 - v. No.of External Interfaces – 5
- b. Assume your own complexity level for each of the categories and you're your own values for the 14 questions raised to the customers.
5. Evaluate the developers' efficiency in Delphi Cost estimation model.
6. Using the risk projection table evaluate the highest priority risks in a given software.

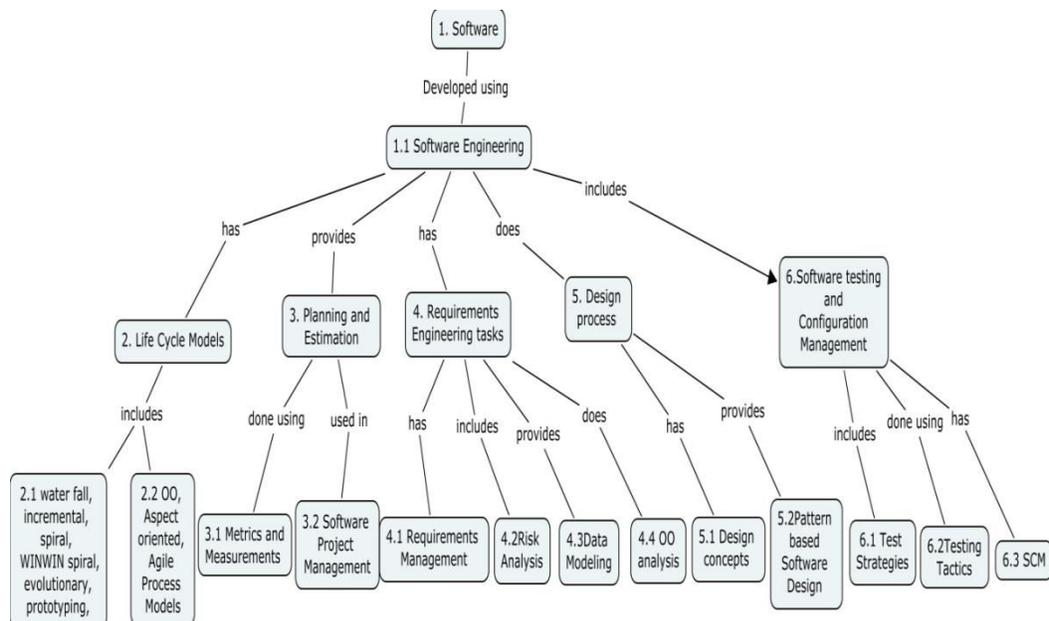
Generate test cases using the techniques involved in selecting: (a) White Box testing (b) Block Box testing (CO5):

1. What is White Box testing? Draw the notations of a CFG and derive independent paths and test cases for a given source code using it.
2. Explain the following testing techniques to derive test cases (a) Equivalence Partitioning (b) Boundary Value Analysis (c) Random testing for OO classes.
3. Apply Control Flow based testing in White box testing to generate the test cases and independent paths in a sample piece of code.
4. Suppose a test group was testing a mission critical software system. The group has found 85 out of the 100 seeded defects. If you were the test manager, would you stop testing at this point?
5. Consider the “Withdraw” module in an ATM application. The module reads the amount the user wishes to withdraw from his/her account. The amount must be multiple of 100 and less than 10000. Develop black box test cases using Equivalence class partitioning and boundary value analysis. List out any assumptions that you make in deriving these test cases.

Explain the advantages of configuration management and risk management activities (CO6):

1. Explain the role, contents and features of SCM repository in detail.
2. How risk mitigation, monitoring and management is done in software development process with RMMM plan? Explain.
3. How version control and change control are done in SCM process.
4. Using the risk projection table evaluate the highest priority risks in a given software.
5. Construct a sample risk projection table and assess the risk impact for any one risk.
6. Create a RMMM plan for any two risks identified during risk analysis.

Concept Map



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 Sommerville, Software Engineering, 9th edition, Addison Wesley, 2011

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Software	
1.1	Software Engineering	3
2	Life Cycle Models	
2.1	Water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping	4
2.2	Object oriented, Aspect oriented and Agile Process Models	3
3	Planning and Estimation	
3.1	Metrics in Software Project Management	3
4	Requirements Engineering tasks	
4.1	Requirements Management	3
4.2	Risk Management	3

Module No.	Topic	No. of Periods
4.3	Data Modeling	2
4.4	OO analysis	3
5	Design process	
5.1	Design concepts	3
5.2	Data design elements	3
5.3	Pattern based Software Design	3
	Tutorial	2
6	Software testing and Configuration Management	
6.1	Test Strategies for conventional and OO software	2
6.2	Testing Tactics	2
6.3	Software Configuration Management	1
	Total	40

Course Designer:

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

Preamble

This course aims at facilitating the student to understand the concepts of data warehousing and data mining. Students to understand the various techniques involved in mining the data from the databases.

Prerequisite

- 17CA150 : Database management systems
- 17CA180 : RDBMS Laboratory

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions**Identify data mining tools and techniques in building intelligent machines (CO1):**

1. List the various data sources for the data warehouse.
2. Distinguish between Data Mart and Data Warehouse?
3. What do you mean by strong association rule?
4. How to select an attribute for classification?
5. What is cluster analysis?
6. Mention the purpose of correlation analysis

Analyze various data mining algorithms in various logic and developing a real time applications (CO2):

1. What type of processing take place in a data warehouse? Describe.
2. Compare and contrast the clustering and the classification techniques.
3. In what way "Over Fitting" can be avoided?
4. Illustrate the significance of candidate set generation step of level wise algorithm.
5. Describe the importance of pruning in decision tree construction with an example.
6. Given the two vector objects $X=(1,1,0,0)$ and $Y=(0,1,1,0)$ identify the similarity between these objects.

Analyze unsupervised and supervised naive algorithms in real world applications (CO3):

1. What are the types of learning?
2. Compare Supervised neural networks with unsupervised neural networks.
3. As the data warehouse administrator, performance enhancement is high on your list. Highlight the techniques you plan to adopt. For each technique, indicate tasks necessary to implement the technique.
4. Analyze the various Data mining techniques?

Apply data mining algorithms to combinatorial optimization problems (CO4):

1. Define: optimization
2. Suppose a group of 12 sales price records has been stored as follows:
5, 10, 11, 13, 15, 35, 50, 55, 72, 92, 204, 215. Partition them into 3 bins by equal width binning.
3. Illustrate the apriori algorithm for the single dimensional transaction database.

Apply the mining techniques like association, classification and clustering on transactional databases (CO5):

1. For the given database find all the frequent item sets using Apriori method and list all the strong association rules that match the metarule

$$\forall x \in \text{transaction}, \text{buys}(X, \text{item1}) \wedge \text{buys}(X, \text{item2}) \Rightarrow \text{buys}(X, \text{item3}).$$

<i>TID</i>	<i>Items bought</i>	
100	{f, a, c, d, g, i, m, p}	Minimum Support = 30%
200	{a, b, c, f, l, m, o}	
300	{b, f, h, j, o, w}	Minimum Confidence = 70%
400	{b, c, k, s, p}	
500	{a, f, c, e, l, p, m, n}	

2. For the following Database use ID3 algorithm to construct the decision tree and partition the database based on the classification rules obtained from the decision tree.

Name	Rank	Years	Turned
Mike	Purchase Manager	3	No
Mary	Purchase Manager	7	Yes
Bill	Sales Manager	2	Yes
Jim	Production Manager	7	Yes
Dave	Purchase Manager	6	No
Anne	Production Manager	3	No

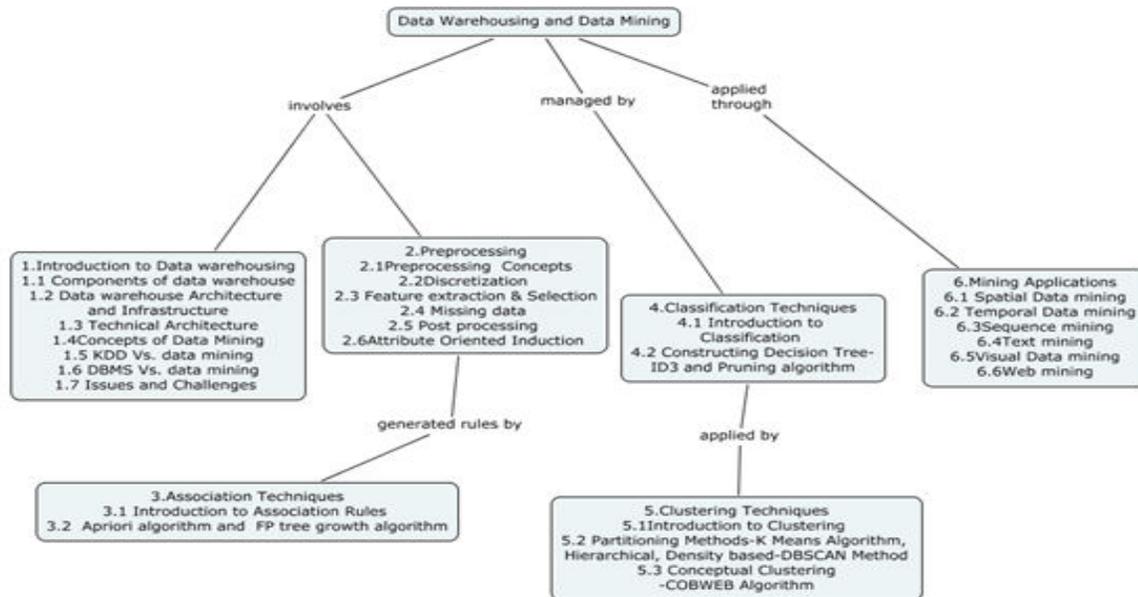
3. For the following Database, apply the entropy-based discretization for the numerical attribute and find the best split.

S.NO	Age	Credit rating
1.	25	Fair
2.	29	Excellent
3.	35	Fair
4.	42	Excellent
5.	47	Fair
6.	49	Excellent
7.	32	Fair
8.	34	Fair
9.	37	Excellent
10.	40	Fair
11.	44	Fair
12.	45	Excellent

Analyze various supervised and unsupervised learning techniques in data mining (CO6)

Given two objects $A_1(22,1,42,10)$ and $A_2(20,0,36,8)$ compute the distance by Euclidean measure. The data mining task wants to Cluster the following eight points (with (x,y) representing locations) into 3 clusters $A_1(2,10)$, $A_2(2,5)$, $A_3(8,4)$, $B_1(5,8)$, $B_2(7,5)$, $B_3(6,4)$, $C_1(1,2)$, $C_2(4,9)$. The distance function is Euclidean distance. Initially assign A_1 , B_1 and C_1 as the center of each cluster respectively. Use K-Means algorithm to show the final three clusters.

Concept Map



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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction to Data Warehousing	
1.1	Components of data warehouse	2
1.2	Data warehouse Architecture and Infrastructure	2
1.3	Technical Architecture and OLAP	1
1.4	Data mining – basic concepts	1
1.5	Knowledge Discovery in Databases Vs. data mining	2
1.6	Database Management Systems Vs. data mining	1
1.7	Issues and Challenges	1
2.	Processing	
2.1	Preprocessing Basics	1
2.2	Discretization	1
2.3	Feature extraction & Selection	1
2.4	Missing data	1
2.5	Post processing Basics	2
2.6	Attribute Oriented Induction	1
3.	Association Techniques	
3.1	Introduction to Association Rules	1
3.2	Association Algorithms (Apriori, FP tree)	3
4	Classification Techniques	
4.1	Introduction to Classification	1
4.2	Classifiers (Decision tree, Pruning)	3
5	Clustering Techniques	
5.1	Introduction to Clustering	1
5.2	Algorithms (Partitioning, Hierarchical, Density based)	4
6	Mining Applications	
6.1	Spatial Data mining	1
6.2	Temporal Data mining	2
6.3	Sequence mining	3
6.4	Text mining	1

Module No.	Topic	No. of Lectures
6.5	Visual Data mining	2
6.6	Web mining	1
	Total	40

Course Designer:

Dr. S. Vijayalakshmi

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

Preamble

To enable the students practice the concepts of java programming language and develop solutions for real world problems.

Prerequisite

- 17CA320:Internet and Java Programming

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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.

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

Preamble

In this laboratory, students will implement the various Data Warehousing and Data Mining concepts using Oracle and WEKA / R tool

Prerequisite

- 17CA180 : RDBMS Laboratory

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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.

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.

Course Designers:

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Dr. A. John Sanjeev Kumar ajscse@tce.edu

17CA410**ELECTRONIC COMMERCE AND
ELECTRONIC BUSINESS**

Category	L	T	P	Credit
PC	3	0	0	3

Preamble

To enable the students to gain knowledge in information systems such as Electronic Commerce and provide a customer specific software solution.

Prerequisite

- None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Identify current management issues associated with electronic commerce strategies (CO1):

1. Define E- Commerce.
2. State the definition of EDI.
3. What is Credit Transaction Trade Cycle?
4. State any two advantages of Electronic Markets.
5. What is Business to Consumer electronic commerce?

Analyze the Internet's role in the decision process (CO2):

1. Explain the following terms:
 - (i) Supply Chain
 - (ii) Value Chain
 - (iii) Competitive Advantage
 - (iv) Business Strategy
2. Explain in detail Electronic Data Interchange and how it is useful in implementation of E-Commerce.
3. Explain Business to Business E-Commerce in detail with one example.
4. State the advantages and disadvantages of Electronic market.
5. Explain different kinds of Threats in E-Security

Demonstrate the functionality of Electronic Markets and different threats (CO3):

1. Explain the Web Site Evaluation Model in detail and how do you apply it.
2. Explain in detail E- Security and how it will apply for an e-business.
4. Explain the following Concepts with one example: Internet Book Shop, Virtual Auction, Online Share Dealing and Electronic Newspaper
6. Explain in detail Strategy formulation, Implementation Planning, Implementation and evaluation of E-Commerce.

Develop Business models for Intranet and Extranet (CO4):

1. Show the Architecture of Intranet, Internet and Extranet.
2. Give some applications of Internet.
3. Explain the basic concepts of Extranets.
4. How do you connect business customers to sell parts? Give a case study.
5. Develop a business model for tracking shipping status.

Explain the electronic payment systems (CO5):

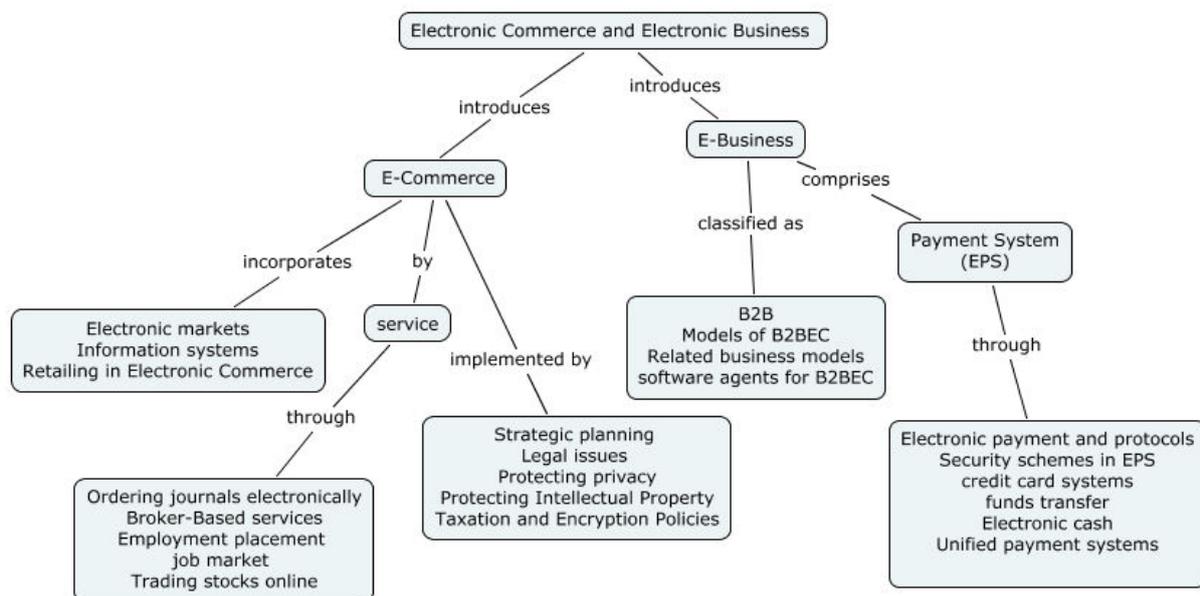
1. Elucidate secure electronic Transaction protocol for credit card payment.
2. Electronic Fund Transfer. Show the merits and Demerits.
3. Show the Security Schemes in Electronic Payment systems.

4. Who are all the Players in Credit card systems?
5. Differentiate Debit and Credit Card.
6. Define Smart card.

Summarize public policy, Taxation, Infrastructure for EC (CO6):

1. What are the ethical issues in EC?
2. How is Private information collected?
3. Say something about FTC audit.
4. Define Gambling.
5. Show the uses of TCP / IP Protocol.
6. What is the purpose of using HTTP?
7. Define Webcasting.

Concept Map



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

Course Contents and Lecture Schedule

Module. No	Topics	No. of Lectures
1	Foundations of Electronic Commerce	
1.1	The EC field, Electronic markets	2
1.2	Information systems, Benefits and limitation of EC	1
1.3	Driving forces of Electronic Commerce, Impact of EC.	1
1.4	Retailing in Electronic Commerce	1
1.5	Overview-Forecast of the B2C Electronic markets, Business models of Electronic marketing	1
1.6	Online customer service, Procedure for internet shopping	1
1.7	Aiding comparison shopping, Impact of EC on traditional retailing systems.	1
2	Electronic Commerce for service industries	
2.1	Ordering journals electronically, Broker-Based services	1
2.2	Travel and tourism services, Employment placement	1
2.3	Job market , Trading stocks online	1
2.4	Cyber banking and personal finance	1
2.5	Electronic Auctions-Types of Auctions-Benefits and limitations	1
2.6	Business to business Auction-Managerial issues.	1
2.7	Case Studies	1
3	Business-to-Business Electronic Commerce (B2BEC)	
3.1	Overview, Characteristics of B2BEC	2
3.2	Models of B2BEC, Traditional EDI-Internet based EDI-Roll of software agents for B2BEC Electronic marketing in B2BEC-Solutions of B2BEC-Managerial issues.	2
3.3	Intranet and Extranet-Architecture of the Internet	1
3.4	Intranet, Extranet-Applications, Related business models.	1
3.5	Mobile Commerce in B2B and B2C	1

3.6	Technical aspects of M-Commerce and Case Studies	1
3.6	Electronic Payment Systems (EPS)-Overview	
3.7	Electronic payment and protocols, Security schemes in EPS-Authentication, Authorization and Access Rights	1
3.8	Electronic credit card systems, Electronic funds transfer, Prospects of EPS	1
3.9	Case Studies	2
4	Electronic Commerce strategy and implementation-	
4.1	Electronic Business's strategy, Strategic planning for Electronic Commerce	1
4.2	Competitive intelligence on the internet, Legal issues to Privacy in Electronic Commerce (EC)	1
4.3	Ethical issues-Protecting privacy, Protecting Intellectual Property-	1
4.4	Taxation and Encryption Policies, Consumer and Seller protection in EC.	1
4.5	Infrastructure for EC-Internet protocols, Client/Server technology-	1
4.6	Internet Security, Selling on the web-Multimedia delivery	1
4.7	Webcasting, Challenges and Opportunities	1
4.8	Case Studies	2
	Total	36

Course Designer:

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17CA420**COMPUTER NETWORKS**

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

The course aims to provide an understanding of computer networks architecture, various technologies available to build a network and protocols in use at different levels of network layers stack. An overview of global Internet, Internet applications and introduction to Network simulation is also provided.

Prerequisite

- 17CA140 : Data Structures

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 |

Mapping with Programme Outcomes

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

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	40	40	40	40
Apply	40	30	20	20
Analyze	0	10	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Describe the building blocks of Computer Networks (CO1):

1. Mention the physical devices operating at various layers of TCP/IP protocol Suite.
2. What is the difference between communication and transmission?
3. Discuss the differences in the functionalities of switches and routers.
4. Discuss the difference between hubs and bridges.

Explain the functionalities and protocols of various layers in ISO/OSI Network model (CO2):

1. Distinguish between LAN and WAN.
2. Describe various types of networks.
3. Explain the schemes prescribed in Ethernet for collision Detection.
4. Discuss the functionalities of all layers in Frame relay network.
5. Describe how ATM combines benefits of both circuit switching and packet switching.

Implement suitable routing strategies for a given network (CO3):

1. Write short notes on VoIP and discuss the suitable transport protocol for the same.
2. Differentiate Interdomain routing protocols and Intradomain routing protocols.
3. Compare various email protocols like SMTP, IMAP and POP and Outline when it is appropriate to use each.
4. Explain how TCP and IP complement each other's functionalities. And bring out the dependencies between the two.

Use suitable transport/application layer protocol based on application requirements (CO4):

1. Compare the functionalities of all layers in OSI architecture
2. Describe multibackbone internet structure
3. Explain how the Network layer and Transport layer complements each other's functionalities. And bring out the dependencies between the two

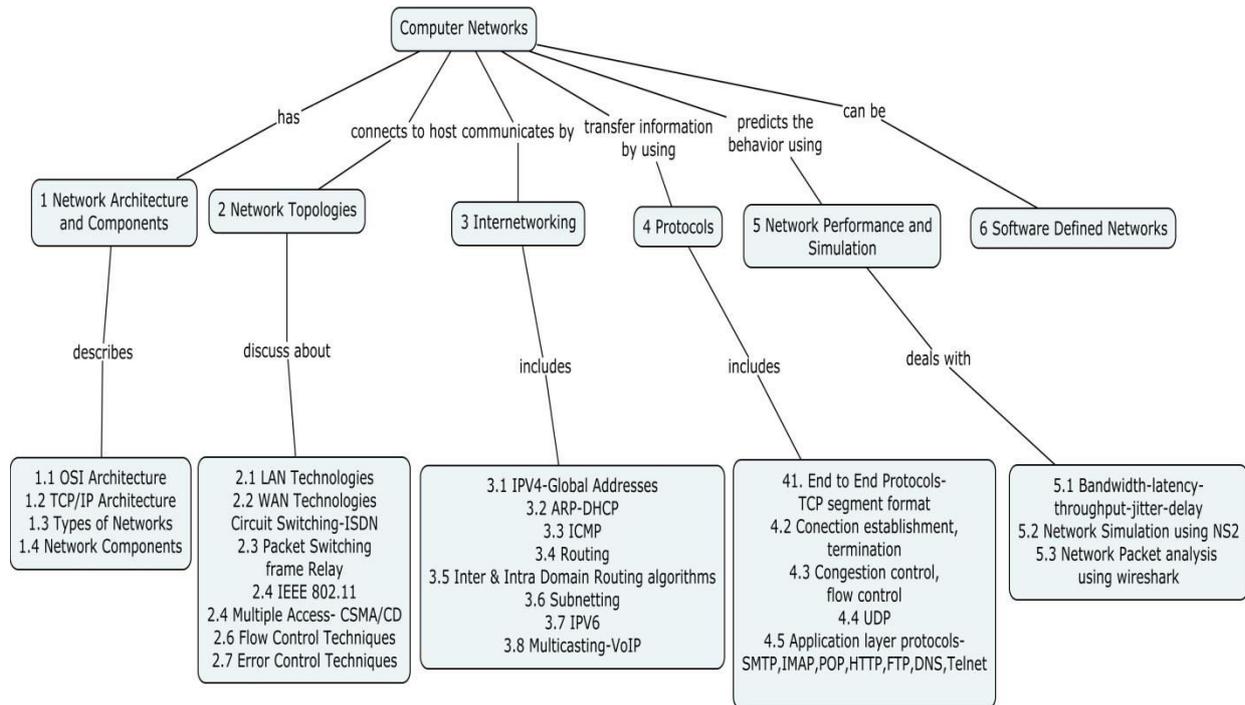
Suggest an appropriate access control, congestion control and congestion avoidance technique for a given traffic scenario (CO5):

1. Suppose a host wants to establish the reliability of a link by sending packets and measuring the percentage that is received; routers for example do this. Explain the difficulty doing this over TCP connection.
2. How do routers determine that an incoming IP packet is to be multicast?
3. How can a wireless node interfere with the communications of another node when the two nodes are separated by a distance greater than the transmission range of either node?

Examine performance analysis for a network using tools like NS2, Wireshark (CO6):

1. Analyze the resources needed to effectively apply micro simulation?
2. How should the project scope and physical limits be established to monitor the network?
3. What security risks are introduced by the use of Network Monitor?

Concept Map



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. Behrouz A. Forouzan, "Data Communication and Networking", Tata McGraw Hill, Fifth Edition, 2013
2. William Stallings, "Data and Computer Communications", Pearson Education Ninth Edition 2013
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>

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Computer network architecture	
1.1	ISO/OSI architecture	2
1.2	Functionalities of OSI layers	
1.3	TCP/IP architecture	1
1.4	Types of networks(LAN,WAN,VPN,VLAN)	1
1.5	Network components (NIC,Bridges,Switches,Routers,Hubs,Gateways)	1
2	Network Technologies to connect hosts	
2.1	LAN Technologies (Ethernet, Token Ring)	1
2.2	WAN Technologies - Circuit switching- ISDN	1
2.3	Packet Switching-Frame relay	1
2.4	IEEE802.11	3
2.5	Multiple access – CSMA/CD	1
2.6	Flow control techniques	2
2.7	Error control techniques	2
3	Internetworking	
3.1	IPv4-Global Addresses	1
3.2	ARP-DHCP	1
3.3	ICMP	1
3.4	Routing	1
3.5	Intra domain routing algorithms(RIP,OSPF)	2
3.6	Subnetting – Classless addressing	1
3.7	Inter domain routing-Ipv6	1
3.8	Multicasting – VOIP	1
4	Protocol Stack	
4.1	End to end protocols (TCP-segment format)	1
4.2	Connection establishment, Termination	1
4.3	Congestion control, Flow control	1
4.4	UDP	1

Module No.	Topic	No. of Lectures
4.5	Application layer protocols-SMTP,IMAP	1
4.6	POP,HTTP,FTP,DNS,TELNET	3
5	Network Performance and Simulation	
5.1	Bandwidth, Latency, Throughput, Jitter, Delay	1
5.2	Network simulation using NS2	2
5.3	Wireshark	2
6	Fundamentals of Software Defined Networks	1
	Total Lectures	40

Course Designer:

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

Preamble

This course aims at facilitating the student to learn the best practices followed in industries to do effective software testing and quality management activities.

Prerequisite

- 17CA330 : Object Oriented Modeling and Design Patterns
- 17CA340 : Software Engineering

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	S	S	S	M	M	-	S	-	-	-	-	-
CO2	S	S	S	S	L	-	M	-	-	-	-	-
CO3	S	S	S	S	L	-	M	-	-	-	-	-
CO4	S	S	S	M	L	-	M	S	-	-	-	-
CO5	S	S	S	S	S	-	M	S	-	-	-	-
CO6	S	S	S	S	S	-	M	S				

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	30
Apply	40	40	20	30
Analyse	20	20	40	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Understand the basic concepts and the processes that lead to software quality and testing (CO1):

1. Define: Quality and Software testing.
2. What are the phases involved in PDCA life cycle in continuous quality improvement? Explain.
3. List the various types of products based on their criticality.
4. What are software quality audits?
5. Define: Error, Defect and Failure.
6. What are the challenges involved in developers becoming testers?
7. Discuss the factors affecting the cost of testing.

Design test cases by analyzing the given requirements using Black box testing techniques (CO2):

1. An application takes two inputs x and y where $x \leq y$ and $-5 \leq y \leq 4$. Apply Equivalence partitioning to (i) Partition the input domain using uni-dimensional and multidimensional partitioning. (ii) Derive test sets based on the partitions created in (i)
2. Consider an 'Online Product Purchase System'. Apply Category Partition method in it to derive test cases.
3. Illustrate cause-effect graphing by constructing a CE-Graph and a Decision table for the following requirement: (8)

Consider a Income Tax Calculation System. The employee's income tax is calculated based on two constraints: (i) Gender (ii) Gross Pay / Annum

There are two genders : Male, Female

If the Gender is Male and the Gross Pay/Annum $< 1,50,000$ then No Tax

If the Gender is Male and the Gross Pay/Annum $> 1,50,000$ and $< 2,50,000$ then 12% Tax

If the Gender is Male and the Gross Pay/Annum $> 2,50,000$ and $< 3,50,000$ then 18% Tax

If the Gender is Male and the Gross Pay/Annum $> 3,50,000$ then 20% Tax

If the Gender is Female and the Gross Pay/Annum $< 1,90,000$ then No Tax

If the Gender is Female and the Gross Pay/Annum $> 1,90,000$ and $< 3,00,000$ then 10% Tax

If the Gender is Male and the Gross Pay/Annum $> 3,00,000$ and $< 4,50,000$ then 12% Tax

If the Gender is Male and the Gross Pay/Annum $> 4,50,000$ then 18% Tax.

4. Consider the "Withdraw amount" module in an ATM application. Analyze this scenario and generate test cases by using BVA.

Identify the test cases from Source code by means of whitebox testing techniques (CO3):

1. What is white box testing? Consider the following program code. Construct a control flow chart and a control flow graph for it and list down all the independent paths in it. Also, identify infeasible paths in it.

```
begin
    int x, y,z;
    input(x,y);
    if(x>0)  && (y>0)
        z=pow(x,y)
    else    if (x<0) && (y>0)
        z=pow((-x),y);
    else    if(x>0) && (y<0)
        z=pow(x,(-y));
    else if(x<0) && (y<0)
        z=0;
    while(y>0){ z+=1;y--;}
    if(z>0) {z-=1;}
```

Know about user acceptance testing and generate test cases for it (CO4):

1. What is alpha testing?
2. Define: Beta Testing.
3. Generate test cases from the UI design.

Examine the test adequacy criteria to complete the testing process (CO5):

1. Consider the following code and which test adequacy criteria are satisfied by the given test set : Test set T={t1:<x= -3, y= -2>, <x=2, y= -4>}

```
begin
    int x,y;
    if(x<0) && (y<0)
        printf("Both x and y are 0");
    else
        printf("x or y is 0 or non zero");
    end;
```

2. Consider the following code. Given that, the test suite T contains {n=3 for all test cases t1:<a=2,b=3,c=2>, t2:<a=1,b=2,c=-1>, t3:<a=-1,b=2,c=-4>}. Find out the MC/DC percentage of T by considering feasible and infeasible conditions in the code:

```
void main()
{
    int a, b, c,d, n;
    scanf("%d",&n);
    while(n>0)
    { scanf("%d,%d,%d", &a,&b,&c);
      if (a>b) && (b>c) d=a+b;
      else if(a>c) && (c>b)
          { d=a+c;
            if (c>a && (b>c) d+=b;
          }
      else d=0;
      n-=1;
    }
    printf("Calculated Value is %d",d);
}
```

3. Given that, the test suite T contains {n=3 for all test cases t1:<a=2,b=3,c=2>, t2:<a=1,b=2,c=-1>, t3:<a=-1,b=2,c=-4>} find the code coverage %.

```
void main()
{
    int a, b, c,d, n;
    scanf("%d",&n);
    while(n>0)
    {
        scanf("%d,%d,%d", &a,&b,&c);
        if (a>b) && (b>c) d=a+b;
        else if(a>c) && (c>b)
            { d=a+c;
              if (c>a && (b>c)) d+=b;
            }
        else d=0;
        n-=1;
    }
    printf("Calculated Value is %d",d); }
```

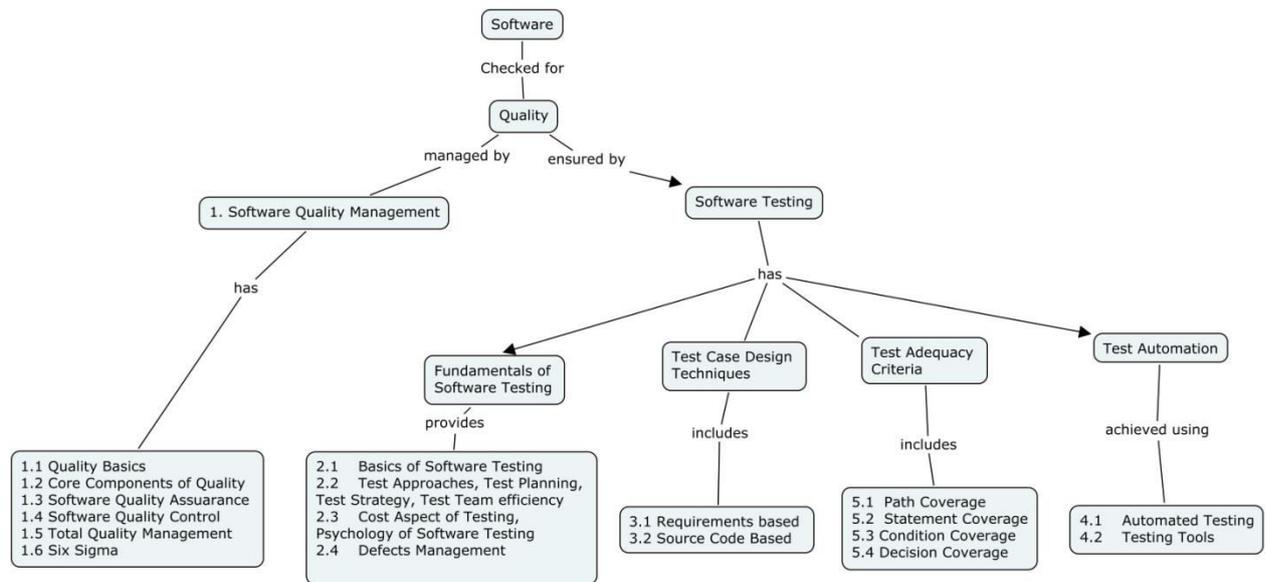
4. Calculate the block coverage and condition coverage for the Test set T={t1:<y= -3, n= -2>, <y=2, n= -4>, <y=2, n=2> }

```
main()
{
    int x,y,n,prod;
    read y,n;
    x=1; prod=y;
    while(n>0)
    {
        prod=x*y;
        display (x,y,prod);
        x+=1;
        n-=1;
    }
    if (prod<1) display("Error in input");
    else display("Final Value=",prod);
}
```

Develop test cases and test suite using automated testing tools (CO6)

1. What is test automation?
2. What is a test script?
3. How unit test cases are generated using JUnit?
4. Generate test case using NUnit.
5. Generate at least two test cases one for positive and one for negative for "Login" screen that has userid and password as its components using JUnit.
6. How Selenium could be used to test a website?

Concept Map



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/PHPUnit/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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Software Quality Management	
1.1	Basics of Quality	1
1.2	Core Components of Quality	1
1.3	Software Quality Assurance	1
1.5	Software Quality Control	1
1.6	Total Quality Management	1
1.7	Six Sigma	1
2	Fundamentals of Software Testing	
2.1	Basics of Software Testing	2
2.2	Test Approaches, Test Planning, Test Strategy,	2
2.4	Defects Management	1
3	Requirements based Test Case Design Techniques	
3.1	Requirements based test case generation introduction	2
3.2	Equivalence Class Portioning	2
3.3	Boundary value analysis	2
3.4	Cause effect graphing	2
3.5	Tutorial	
4	Source Code Based Test Case Generation	
4.1	CFG Creation	1
4.2	Cyclomatic Complexity	2
4.3	Test Paths Generation	1
4.4	Test Cases Generation	2
4.5	Tutorial	
5	Test Adequacy Criteria	
5.1	Path Coverage, Statement Coverage	2
5.2	Condition Coverage	2
5.3	Decision Coverage	2
	Tutorial	
6.	Automated Software Testing	
6.1	Automated Software Testing	2
6.2	JUnit /NUnit / PhUnit /Selenium	4
6.3	Case Study: Cloud Testing	2
6.4	Tutorial	
	Total	40

Course Designer:

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

Preamble

With a dynamic learn-by-doing focus, the laboratory course encourages the students to explore the designing of web application by implementing the relevant and recent techniques. This course challenges the students to exercise their creativity in both programming and designing.

Prerequisite

- 17CA180 : RDBMS Laboratory
- 17CA370 : Java Programming Laboratory

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Designers:

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Prof. E. Vinoth Kumar	vinothrs@tce.edu

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

Preamble

This course aims at facilitating the student to practice the Software Development Life Cycle (SDLC) phases for a given application

Prerequisite

- 17CA320: Internet and Java Programming
- 17CA330 : Object Oriented Modeling and Design Patterns
- 17CA340 : Software Engineering

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	S	S	S	-	-	-	-	-	-	-	-	-
CO2	-	-	-	S	S	S	-	-	-	-	-	-
CO3	-	-	-	S	S	S	-	-	-	-	-	-
CO4	-	-	S	S	-	-	-	-	-	-	-	-
CO5	S	S	S	S	S	S	-	-	-	-	-	-
CO6	-	-	S	S	S	S	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

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

Course Designers:

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Prof. E. Vinoth Kumar	vinothrs@tce.edu

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

Preamble

To facilitate the students to strengthen their mathematical and programming skill by developing programs using a language C / C++ / JAVA to solve a given problem using discrete structures, optimization and statistical techniques.

Prerequisite

- 17CA110 : Mathematical foundations of Computer Science
- 17CA120 : Programming in C
- 17CA220 : Object Oriented Programming using C++
- 17CA310 : Operations Research
- 17CA320 : Internet and Java Programming

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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 Gomory'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.

Course Designers

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

Preamble

To provide a sound understanding of the software project management concepts. Also, to help the students understand the challenges and issues in software projects from project managers perspectives. To learn as how to incorporate leadership and management qualities in software product development.

Prerequisite

- 17CA340 : Software Engineering

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions**Identify suitable software process model for software projects (CO1):**

1. Define the term: software process.
2. List the various software process models.
3. Mention the challenges and issues in software projects.
4. Outline the activities in software project planning.
5. How will you classify software projects?

Differentiate different software product development techniques (CO2):

1. How will you choose a software process model for a given project?
2. Distinguish between traditional and agile software development techniques.
3. How will measure the impact of formal verification and validation techniques?
4. What are the top 10 software management principles in modern project profile?
5. Outline the different levels of software process.

Apply appropriate software cost estimation technique for a given project (CO3):

1. How will you select a suitable cost estimation model for a given project?
2. Is it possible to measure the accuracy of software cost estimation?
3. How will you adjust software cost estimation drivers/parameters according to schedule?
4. Mention the risks associated with software cost estimation models.
5. How will you perform cost/benefit analysis for different cost models?

Apply software project management principles for a software project (CO4):

1. Analyze software project planning activities for a project with a neat diagram.
2. Elaborate the various software project management principles.
3. How is software project management viewed from a managerial perspective and a technical perspective?
4. How are resources optimization handled by project managers?
5. Discuss the various activities at the time of project completion.

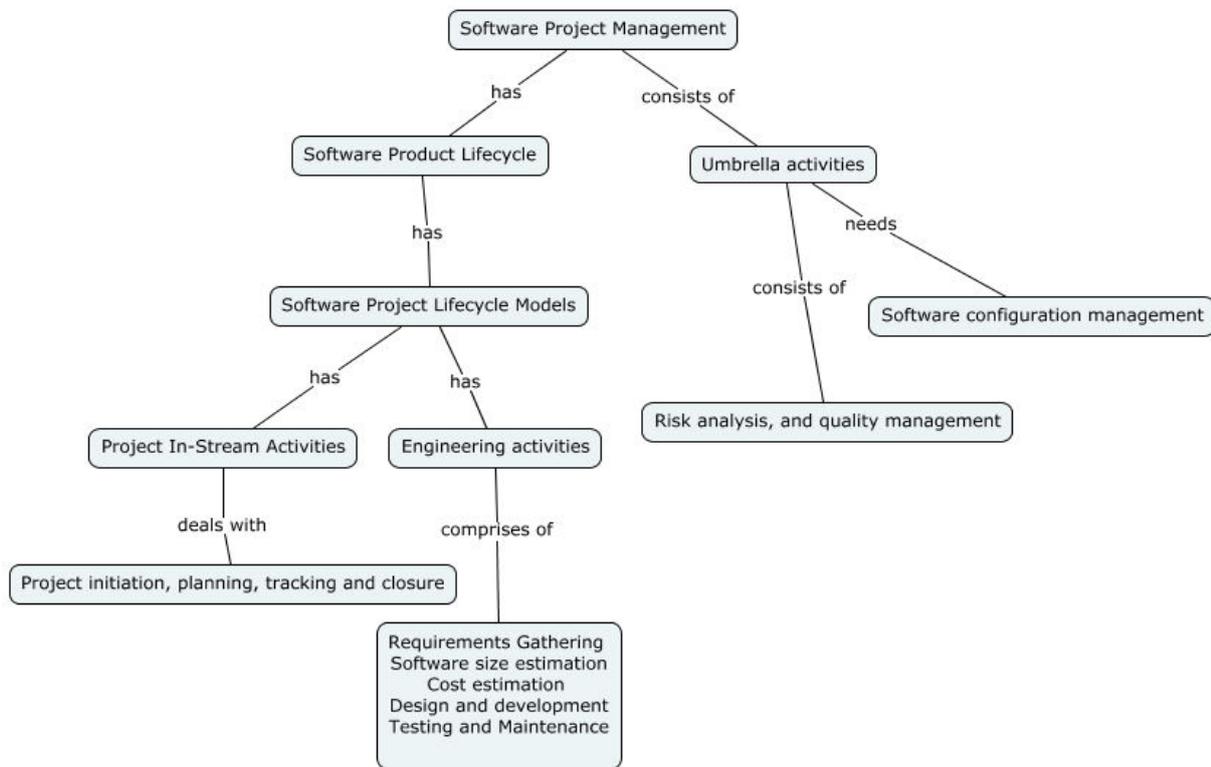
Develop software metrics for measuring and managing software processes (CO5):

1. Present various direct and indirect software metrics used in a software project.
2. How will you apply and analyze software processes using metrics?
3. How will you manage software risks using metrics?
4. Discuss the various quality management metrics.
5. Evaluate the cost of quality management in a software project.

To assess the software product for quality standards (CO6):

1. Present the various software quality attributes for a software project.
2. Why do you require Quality Function Deployment (QFD)?
3. How will you apply and analyze quality standards such as CMM or TQM for a software project?
4. Describe the features of various quality models and its significance to project management.
5. How will you evaluate the performance of one project with another?

Concept Map



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. Gopaldaswamy 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, Mikecortterell, "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.

Course Contents and Lecture Schedule

Module. No	Topics	No. of Lectures
1	Project Management	
1.1	Software project management - Issues and Challenges	2
1.2	Principles of Software Project Management	2
1.3	Role of Project Managers	1
1.4	Defining Project Scope	1
1.5	Software Product Lifecycle	2
1.6	Software Processes	1
1.7	Process Models and software development	1
1.8	Software Project Lifecycle Models	2
2	Umbrella Activities	
2.1	Software metrics	2
2.2	Software configuration management	1
2.3	Software quality assurance	2
2.4	Risk Identification	1
2.5	Risk analysis	1
2.6	Risk management	1
2.5	Case studies	1
3	Project In-Stream Activities	
3.1	Project Initiation	2
3.2	Project Planning	1
3.3	Project Tracking	1
3.4	Project Closure	1
3.5	Case studies	1
4	Engineering Activities	
4.1	Requirements Gathering	2
4.2	Software size and cost estimation techniques	2
4.3	Design and development	1
4.4	Testing	1
4.5	Maintenance	1
4.6	Case studies	2
	Total	36

Course Designer

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BOS meeting approved: 27-04-2017

Approved in 54th Academic Council meeting on 17-06-2017

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

Preamble

To enable the students to make or influence decisions related to the selection, design and support of management information systems (MIS).

Prerequisite

- None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Explain the business applications in MIS (CO1):

1. How are information systems transforming business, and what is their relationship to globalization?
2. Why are information systems so essential for running and managing a business today?
3. What exactly is an information system? How does it work? What are its management, organization, and technology components?
4. What are complementary assets? Why are complementary assets essential for ensuring that information systems provide genuine value for an organization?

Explain the Changing Business Environment for Information Technology (CO2):

1. Classify the features of organizations do managers need to know about to build and use information systems successfully? What is the impact of information systems on organizations?
2. How does Porter's competitive forces model help companies develop competitive strategies using information systems?
3. Differentiate value chain and value web models and show how it help businesses identify opportunities for strategic information system applications?
4. Define businesses use synergies, core competencies, and network-based strategies to achieve competitive advantage?
5. What are the challenges posed by strategic information systems and how should they be addressed?

Illustrate the Computer Hardware and Software Work Service Level Agreements (CO3):

1. Define IT infrastructure and name its components.
2. Explain the stages and technology drivers of IT infrastructure evolution.
3. Illustrate the current trends in computer hardware platforms.
4. Examine the current trends in software platforms.
5. Predict the challenges of managing IT infrastructure and management solutions.

Analyze the Challenges in Knowledge Management Systems (CO4):

1. Describe about the role of knowledge management and knowledge management programs in business.
2. Identify the systems are used for enterprise-wide knowledge management and how do they provide value for businesses.
3. Analyze the major types of knowledge work systems and how do they provide value for firms.
4. Outline the business benefits of using intelligent techniques for knowledge management.

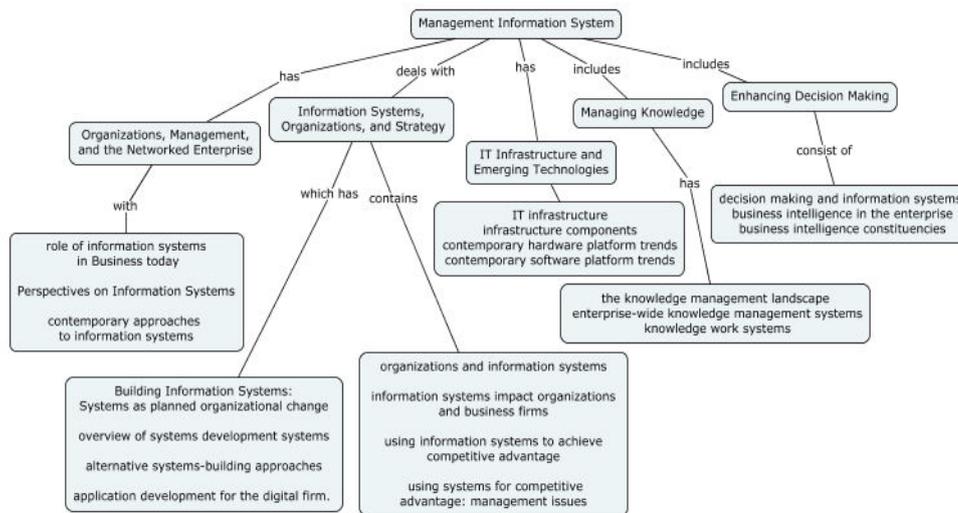
Use Pivot Tables for digital firm functions (CO5):

1. Show the different types of decisions and how does the decision-making process work.
2. How do information systems support the activities of managers and management decision making?
3. Explain how business intelligence and business analytics support decision making?
4. Analyze different decision-making constituencies in an organization use business intelligence.
5. What is the role of information systems in helping people working in a group make decisions more efficiently?

Demonstrate the core activities in the systems development process (CO6):

1. Identify the core activities in the systems development process.
2. Name the principal methodologies for modeling and designing systems.
3. What are the alternative methods for building information systems?
4. What are new approaches for system building in the digital firm era?
5. Explain major factors are driving the internationalization of business.
6. What are the alternative strategies for developing global businesses?
7. Analyze can information systems support different global business strategies.
8. Interpret the issues and technical alternatives to be considered when developing international information systems.

Concept Map



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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of hours
1.	Organizations, Management, and the Networked Enterprise	
1.1	The role of information systems in Business today	1
1.2	Perspectives on Information Systems	1
1.3	Contemporary approaches to information systems	2
2.	Information Systems, Organizations, and Strategy	
2.1	Organizations and information systems	1
2.2	Information systems impact organizations and business firms	2
2.3	Using information systems to achieve competitive advantage	2
2.4	Using systems for competitive advantage: management issues	2
3.	IT Infrastructure and Emerging Technologies	
3.1	IT infrastructure, infrastructure components	1
3.2	Contemporary hardware platform trends	2
3.3	Contemporary software platform trends	2
4.	Managing Knowledge	
4.1	The knowledge management landscape	2
4.2	Enterprise-wide knowledge management systems	2
4.3	Knowledge work systems	2
5.	Enhancing Decision Making	
5.1	Decision making and information systems	2
5.2	Business intelligence in the enterprise	2
5.3	Business intelligence constituencies	1
6.	Building Information Systems	
6.1	Systems as planned organizational change	2
6.2	Overview of systems development systems	1
6.3	Alternative systems-building approaches	1
6.4	Application development for the digital firm	2
7	Managing Global Systems	
7.1	The growth of international information systems	1
7.2	Organizing international information	2
	Total	36

Course Designer

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17CA530**DATA ANALYTICS**

Category	L	T	P	Credit
PC	3	1	0	4

Preamble

This course is designed to introduce the basics of data analytics and apply them in the real time analysis of data. The course is intended to facilitate the students to apply statistical methods of exploring data and introduce machine learning methods for data analytics.

Prerequisite

- None

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	L	L	M	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	-	-	-	-	-
CO6	S	S	S	M	L	-	S	-	-	-	-	-
CO7	S	L	L	-	S	L	L	-	-	-	-	-

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	30	20	30	20
Apply	30	30	30	40
Analyse	20	30	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Explain the nature, source and uses of data (CO1):

1. Write a brief note on the different sources of data in any Engineering application.
2. List few modes of availability of data for a management information system.

Analyze the correlation between various parameters of a data set using suitable techniques (CO2):

1. An employee has a rating of 5.7 on a measure of job performance. The mean for employees at that company is 5.5 and the standard deviation is .4. What is that employee's percentile score for job performance? What is their T-Score?
2. An investigator predicts that individuals that fit the Type A Behavior Pattern (highly competitive and time conscious) will have higher scores on a questionnaire measure of need for achievement than individuals that fit the Type B Behavior pattern (a absence of Type qualities). The investigator collects need for achievement scores from 10 Type A subjects and 10 Type B subjects. Higher scores reflect greater levels of need for achievement. Write the null and alternative hypotheses for testing this prediction. Test the null hypothesis stated above. Please provide a sentence for a results section that states the conclusion the investigator is entitled to draw.

Type A	Type B
-----	-----
12	8
10	10
8	5
11	7
15	8
12	5
9	4
16	7
11	8
8	10

3. If the null hypothesis for a study is that aerobic instructors do not have faster metabolisms than bodybuilders, choose the appropriate research hypothesis among the given list.
 - A. Bodybuilders do not have faster metabolisms than aerobic instructors.
 - B. Bodybuilders and aerobics instructors have the same metabolism rate.
 - C. Aerobics instructors have slower metabolisms than bodybuilders.
 - D. Aerobics instructors have faster metabolisms than bodybuilders

Apply statistical learning using various regression techniques in analytics (CO3):

1. Illustrate the sequential steps in Ridge regression.
2. Explain in detail about Lasso regression with an example.
3. Demonstrate Multiple linear regression with suitable illustrations.

Apply supervised learning techniques for data analytics (CO4):

1. What is the relation between Linear Discriminant analysis and Quadratic discriminant analysis?
2. Show that the difference of the two linear discriminant functions is

$$D(z) := \delta_1(z) - \delta_0(z) = (z - \mu)^T \Sigma^{-1/2} \delta - \frac{1}{2} \delta^T \delta$$

and that LDA classification is obtained by predicting G equal to 0 if $D(z) < 0$ and 1 if $D(z) > 0$.

3. Assume everything else remains same, which of the following is the right statement about the predictions from decision tree in comparison with predictions from Random Forest?

- A. Lower Variance, Lower Bias
- B. Lower Variance, Higher Bias
- C. Higher Variance, Higher Bias
- D. Lower Bias, Higher Variance

Apply Unsupervised learning techniques for data analytics (CO5):

1. Consider the following data set consisting of the scores of two variables on each of seven individuals:

3. Subject	4. A	5. B
6. 1	7. 1.0	8. 1.0
9. 2	10. 1.5	11. 2.0
12. 3	13. 3.0	14. 4.0
15. 4	16. 5.0	17. 7.0
18. 5	19. 3.5	20. 5.0
21. 6	22. 4.5	23. 5.0
24. 7	25. 3.5	26. 4.5

This data set is to be grouped into two clusters. Apply k-means algorithm.

2. Demonstrate Hierarchical clustering with an example scenario.
3. Explain Principal component analysis with an example.

Identify suitable technique for various stages of data analytics (CO6):

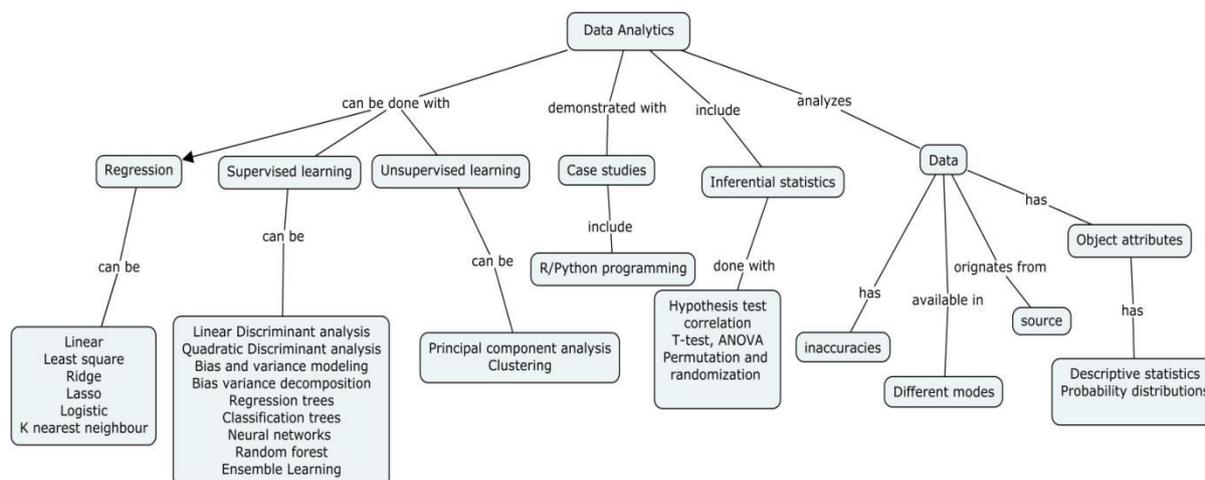
1. Can a random forest be used for feature selection in multiple linear regression? Analyze.
2. The data scientists at “BigMart Inc” have collected 2013 sales data for 1559 products across 10 stores in different cities. Also, certain attributes of each product based on these attributes and store have been defined. The aim is to build a predictive model and find out the sales of each product at a particular store during a defined period. Which learning problem does this belong to?
 1. Supervised learning
 2. Unsupervised learning
 3. Reinforcement learning
3. We want to find which feature would be better for splitting root node (where root node represents entire population). For this, we will set “Reduction in Variance” as our splitting method.

Outlet_Location_Type	Item_Fat_Content	Item_Outlet_Sales
Tier 1	Low Fat	3735.1380
Tier 3	Regular	443.4228
Tier 1	Low Fat	2097.2700
Tier 3	Regular	732.3800
Tier 3	Low Fat	994.7052

The split with lower variance is selected as the criteria to split the population. Among Between Outlet_Location_Type and Item_Fat_Content, which was a better feature to split?

- A. Outlet_Location_Type
- B. Item_Fat_Content
- C. will not split on both

Concept Map



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.
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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lecture hours
1.	Introduction	
1.1	Intelligent data analysis – changing data	1
1.2	Nature of data – Modern data analytic tools	1
2.	Statistical concepts	
2.1	Probability – Probability distribution	1
2.2	Random sampling	1
2.3	Statistical inference	2
2.4	Prediction and prediction errors	2
2.5.	Resampling	1
3	Statistical learning	
3.1	Introduction - Assessing model accuracy	2
3.2	Regression techniques	
3.2.1	Simple linear regression	2
3.2.2	Multiple linear regression	2
3.2.3	Logistic regression	2
3.3	Case study	2
4	Supervised learning Techniques	
4.1	Logistic regression	2
4.2	Linear Discriminant Analysis	2
4.3	Quadratic Discriminant Analysis	1
4.4	Comparison of classification methods	1
4.5	Subset selection	2
4.6	Shrinkage methods	2
4.7	Dimension reduction methods, Considerations in high dimensions	2
4.8	Basics of decision tree	2
4.9	Bagging – Random forests – Boosting	1
4.10	Case study	2
5	Unsupervised Learning Techniques	
5.1	Principal component analysis	2
5.2	Clustering	1
5.2.1	K-means clustering for analytics	1
5.2.2.	Hierarchical clustering – An analytical perspective	1
5.2.3.	Case study	2
	Total	43

Course Designer

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

Preamble

This course provides knowledge and skill on recent technologies in native mobile application development frameworks such as Android, iOS, Windows Mobile and hybrid mobile app development frameworks such as PhoneGap, RhoMobile.

Prerequisite

- 17CA320: Internet and Java Programming
- 17CA370: Java Programming Laboratory

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

Explain the features and challenges of mobile devices, native app development frameworks, hybrid app development frameworks (CO1):

1. Write the highlights of hybrid application development environment
2. Demonstrate the three golden paths of Mobile app development.
3. Differentiate mobile with web and hybrid environment.
4. Mobile Device Management (MDM) software secures monitors, manages and supports mobile devices deployed across mobile operators, service providers and enterprises. Justify.
5. List the challenges of using mobile devices in the public sector.

Apply the UI components, multimedia usage, location based services, data storage mechanisms for the given problem (CO2):

1. Write an Android application to display the exam results in a table layout.
2. Define an intent object and invoke the components of Android platform.
3. Tell the procedure to add sound and vibrate in your application using Android platform
4. Show an user interface to demonstrate the various features of a product "car" using android components.
5. Produce a service named "MyService" to provide time service and define its life cycle. Create an Activity to interact with the created Service.

Apply HTML5 in UI design for the given problem (CO3):

1. There are 20 staffs in the IT department. When a meeting is scheduled, a message "Meeting" is to be sent to all staffs. Implement a Broadcast Receiver in Android platform.
2. Create a Location Based Service in Android.
 - a. Get the source location and destination Location.
 - b. Display the Changes in Latitude and Longitude values.
3. Make an Interactive interface to collect the information from a user in the registration form by using Alert Dialog and Progress Dialog components. Create an interface to perform the following tasks
 - Enter the Name of the book and ISBN number and click on Add Book.
 - Data will be added to Sqlite database.
 - Add multiple entries into database.
 - Click on Show Books to view the contents added so far.
 - Click on Delete All Books button to delete the contents of database

Design an application based on the user requirements (CO4):

1. Design a registration form using HTML5
2. Design a feedback form of a course using HTML5
3. Design a bookshop purchase activity using HTML5

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

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

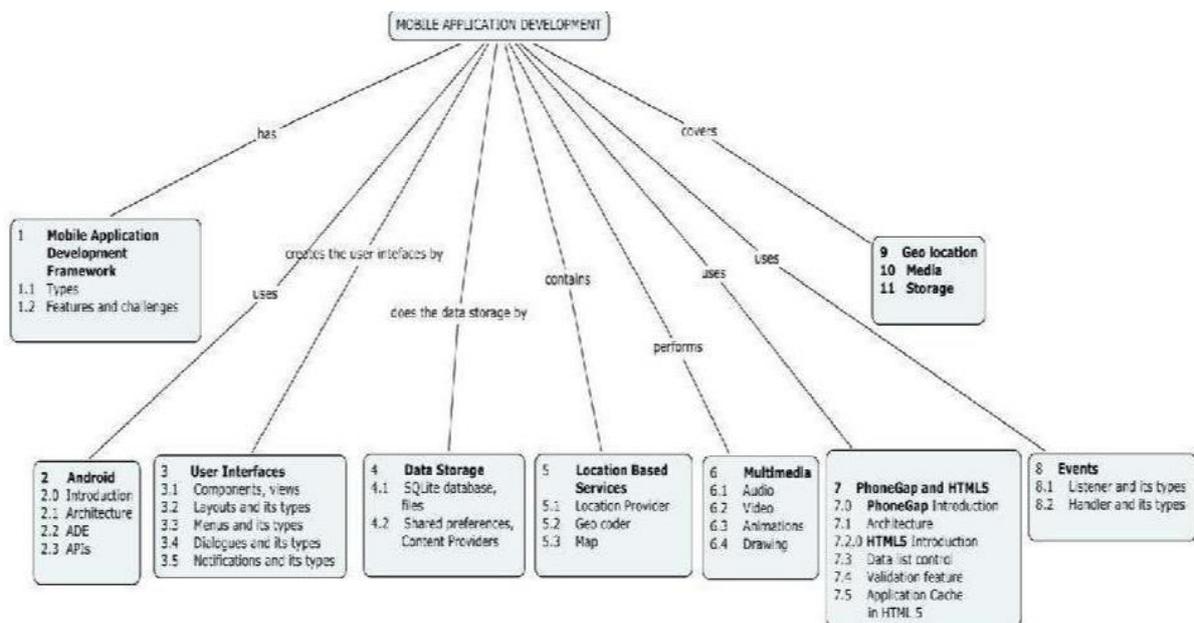
Phase – II

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

Phase – III

- Integrate the modules and show the demo in a team
- Test the app with the users, improve accordingly and conclude the results
- Document the above process as a report

Concept Map



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

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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1.	Mobile Application Development Framework	
1.1	Types	
1.2	Features and challenges	1
2	Android	
2.0	Introduction	1
2.1	Architecture	
2.2	ADE	1
2.3	APIs	
3	User Interfaces	
3.1	Components, views	1
3.2	Layouts and its types	1
3.3	Menus and its types	1
3.4	Dialogues and its types	1
3.5	Notifications and its types	1
4	Data Storage	
4.1	SQLite database, files	1
4.2	Shared preferences, Content Providers	1
5	Location Based Services	
5.1	Location Provider	1
5.2	Geo coder	1
5.3	Map	
6	Multimedia	
6.1	Audio	1
6.2	Video	1
6.3	Animations	1
6.4	Drawing	1
7	PhoneGap and HTML5	
7.0	PhoneGap Introduction	1
7.1	Architecture	
7.2	HTML5 Introduction	
7.3	Data list control	1
7.4	Validation feature	1
7.5	Application Cache in HTML 5	1
8	Events	
8.1	Listener and its types	1
8.2	Handler and its types	1
9	Geo location, media, storage	2
	Total	24

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

Course Designers:

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

Preamble

This course emphasizes on developing an automated enterprise application that increases data access, efficiency and visibility across the organization to achieve the goal of an organization.

Prerequisite

- 17CA320 : Internet and Java Programming
- 17CA410 : Electronic Commerce and Electronic Business

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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™ Platform, Second Edition, Addison Wesley, 2011 (Reprint)
3. John Kanakakis, "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/>

Course Designers:

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

Preamble

This course focuses on the software development process by using various Agile practices such as Scrum, Extreme Programming, Lean, and Kanban.

Prerequisite

- 17CA330: Object Oriented Modelling and Design Patterns
- 17CA340 : Software Engineering

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	S	S	S	L	S	-	S	M	M	-	-	-
CO2	S	S	S	L	M	-	S	M	M	-	-	-
CO3	S	S	S	M	M	-	M	M	M	-	-	-
CO4	S	S	S	M	M	-	M	M	M	-	-	-
CO5	S	S	S	M	M	-	M	M	M	-	-	-
CO6	S	S	S	M	M	-	M	S	S	-	-	-

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	20	30
Analyse	20	20	40	30
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Learn the fundamental principles and practices associated with each of the agile development methods (CO1):

1. What is agile?
2. Define: Agility.
3. List the agile principles.
4. List the disadvantages of plan-driven approach.
5. List the advantages of Agile software development.
6. What is Lean software development?

Describe the origins and motivations of the Agile Manifesto (CO2):

1. Which software development methods are applicable in agile manifesto?
2. What is waste management?
3. Define: Kanban Board.
4. List the items placed in the Kanban board.
5. At which time intervals Scrum meeting has to be held?
6. Explain in detail Scrum model in agile software development.
7. How Kanban model focuses towards change control and change adoption in software development? Explain.
8. How lean software development could achieve waste management in agile software development?

Practice the collection of user stories and pair programming (CO3):

1. What are initial user stories?
2. What is pair programming?
3. List the skills required for an agile team.
4. Which factors need to be considered while writing user stories?
5. Explain the role of user stories throughout Agile life cycle.

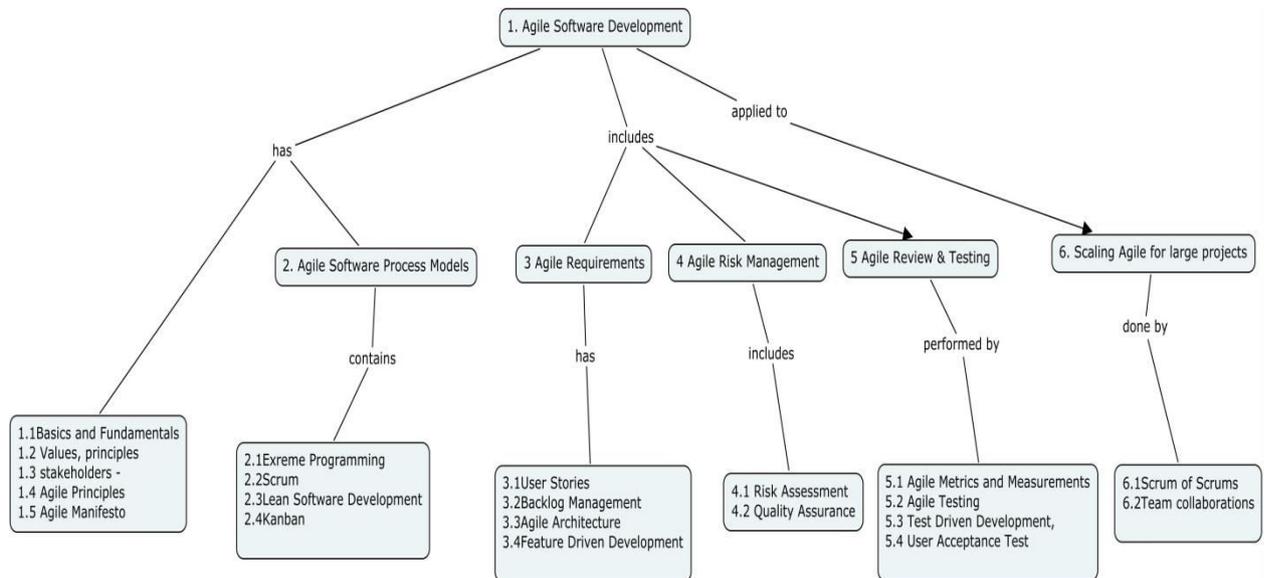
Refactor code as well as tests to meet changing needs (CO4):

1. What is refactoring?
2. How code complexity is reduced using refactoring?
3. Show how refactoring helps reuse the existing code.
4. What is the manifesto for agile testing?
5. How user acceptance testing is done in Agile?
6. What is test driven development?

Present a software project by following agile principles that best fit the technical and market demands. (CO5)

1. Apply Extreme programming in an industrial strength software to meet changing demands of market.
2. Experience the impact of frequent meeting in Scrum Model to achieve required software.
3. Analyze the impact of agile over traditional models to fit the software product according to the technology changes.
4. Elaborate the application of Kanban in a manufacturing industry transforms its performance level using JIT.
5. According to Lean, how one should visualize waste from software development perspective?
6. What is scrum of scrums?
7. How team collaborations could be achieved in Agile?

Concept Map



Syllabus

Agile Software Development: Basics and Fundamentals-Values, principles, stakeholders - Agile Principles-Agile Manifesto – **Agile Software Process Models** - **Extreme 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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Agile Software Development	
1.1	Basics and Fundamentals	1
1.2	Values, principles	1
1.3	Stakeholders	1
1.4	Agile Principles	1
1.5	Agile Manifesto	1
2	Agile Software Process Models	
2.1	Extreme Programming	3
2.2	Scrum	3
2.3	Lean Software Development	3
2.4	Kanban	3
3	Agile Requirements	
3.1	User Stories	1
3.2	Backlog Management	1
3.3	Agile Architecture	1
3.4	Feature Driven Development	1
	Iteration I-Project Presentation and Retrospective Analysis	1
4	Agile Risk Management	
4.1	Risk Assessment	1
4.2	Quality Assurance	1
	Iteration II-Project Presentation and Retrospective Analysis	2
5	Agile Review & Testing	
5.1	Agile Metrics and Measurements	2
5.2	Agile Testing	2
5.3	Test Driven Development,	2
5.4	User Acceptance Test	1
6	Scaling Agile for large projects	
6.1	Scrum of Scrums	2
6.2	Team collaborations	1
	Iteration III-Project Presentation and Retrospective Analysis	1
	Total	35

Course Designers:

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

Preamble

The course facilitates the students to understand the syntactical features of C# language and use the design of the language to develop robust software.

Prerequisite

- 17CA120 : Programming in C
- 17CA220 : Object Oriented Programming in C++

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

Mapping with Programme Outcomes

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

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	30	20	20	20
Apply	40	50	50	50
Analyse	10	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Explain the .NET framework (CO1):

1. List new features that are unique to c# language
2. Explain name any 4 applications that are supported by .Net framework.
3. Discuss string and string builder in C#
4. Outline the role of Common Language Runtime (CLR) in .NET
5. Explain how to use primitive data types in code and understand Boxing- Unboxing.

Apply the general programming structure of C# in developing software solutions based on user requirements (CO2):

1. Structures and enumerations concepts to Create an array of 10 integers. Populate the array by having the user enter integers at the console (Console Readline) Output the integers sorted from the greatest to least.
2. The methods available for window based applications and build an application to accept the reservation details of a train ticket and to store the details in a database table. Use drop down list box to choose the train number and name. Accept source and destinations in text boxes. Allow the user to enter the date of journey one month in advance. Assume that in each train, there are thirty tickets and every booking should have a unique number.
3. Implement Guest Book with name, email and comment textboxes and necessary controls to validate these fields. It should be able to view the guests using datagridview

Develop windows application and web applications in .NET framework analyzing user requirements (CO3):

1. Analyze array list differ from array
2. Analyze a C# program that assigns the value 25 to variable x and 5 to variable y. Output the sum, difference, quotient, product and modulus of x and y. What will be the output of the following method? Why?

```

Static void Main ()
{
intvarA = 5;
intvarB = ++varA;
intvarC = varB++;
Console.WriteLine("A:{0}, B:{1}, C:{2}",varA, varB, varC); }

```
3. Analyze the building blocks of an XML web service.

Demonstrate working advanced features of .NET programming (CO4):

1. Explain the methods to compare two objects in C#.
2. Discuss in detail about the activities of CLR
3. Discuss the distributed application in which marshalling and assembling finds their usage.
4. Explain about interfaces in C#

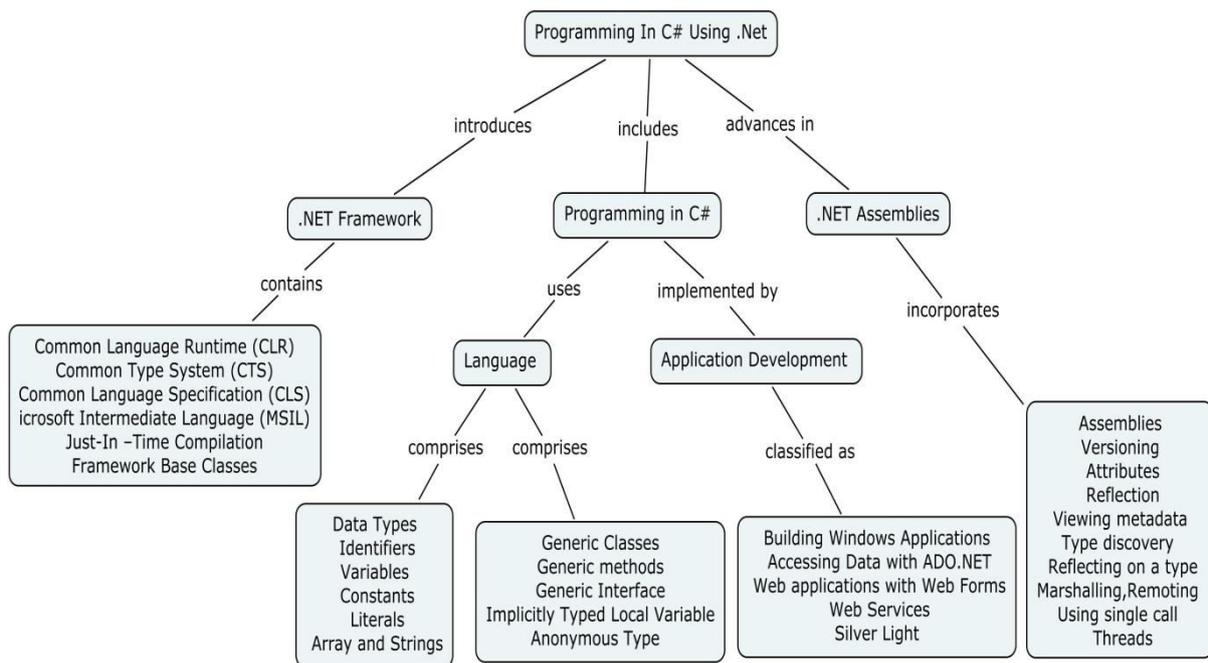
Design a document for GUI applications (CO5):

1. Develop a C# program to write student database in a flat file and read from the same file and print the 'marklist' of students.
2. Apply the features of .NET web forms and Web Pages and design an application
3. Concept of inheritance and polymorphism to find area of various shapes rectangle, circle and triangle

Develop Assemblies and Deployment in .NET for Mobile Application Development based on requirements (CO6):

1. Justify your argument over using .NET frame work for a distributed application.
2. Write a C# code for Exception Handling.
3. Create an abstract 'Animal; class that has private members weight and name abstract methods Speak(),Move() and ToString().derive from Animal a 'Cat' and a 'dog' class that override the methods appropriately.Create an Animal array,Populate it with Dogs and cats and then call each member's overridden virtual methods.

Concept Map



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.

Course Contents and Lecture Schedule

Module No	Topic	No. of Lectures
1	The .Net framework	
1.1	Introduction, The Origin of .Net Technology,.	1
1.2	Common Language Runtime (CLR), Common Type System (CTS), Common Language Specification (CLS)	1
1.3	Microsoft Intermediate Language (MSIL), Just-In –Time Compilation	2
1.4	Framework Base Classes	2
2	C –Sharp Basics	
2.1	Data Types, Identifiers, Variables, Constants, Literals	2
2.2	Introduction-Boxing - Unboxing,	1
2.3	Interfaces – Properties – Indexes - Namespace	2
2.4	Method parameter modifiers- out - ref- params	2
2.5	Decision constructs - Iteration constructs	2
3	C# Types Construction	
3.1	Array and Strings, OOPS concepts	1
3.2	Delegates and Events	2
3.3	Generic Classes-Generic methods-Generic Interface	3
3.4	Implicitly Typed Local Variable- Anonymous Type, Object Initializers	1
3.5	LINQ-Introduction	1
4	Application Development on .NET	
4.1	Building Windows Applications	1
4.2	Accessing Data with ADO.NET	1
4.3	Web applications with Web Forms	2
4.4	Web Services	2
5	C# Advanced Concepts	
5.1	Assemblies-Introduction	1
5.2	Versioning, Attributes	2
5.3	Reflection- Viewing metadata Type discovery – Reflecting on a type	2
5.4	Marshalling – Remoting	1
5.5	Using single call – Threads	1
5.6	SilverLight	1
	Total	36

Course Designer:

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17CAPC0 STORAGE MANAGEMENT TECHNIQUES

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

The course on Information Storage and Management aims at emphasizing the need for Information storage, provides an in depth coverage of technologies in the various phases of designing, building and sustaining an Information Storage System and to provide an overview of various management techniques.

Prerequisite

17CA 420 Computer Networks

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 Storage for data center environment	Apply
CO6: Develop Storage Virtualization, technologies and process	Apply

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

Explain basics Of Information Storage (CO1):

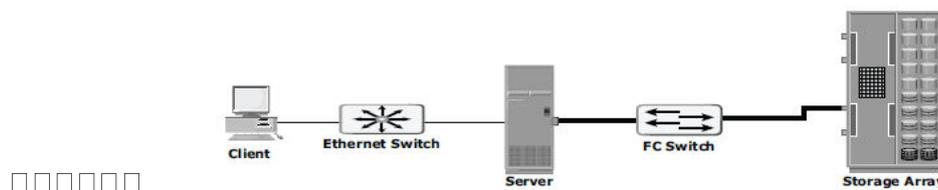
1. List out the data creation types.
2. Explain value of data to a business, challenges in data storage and data management
3. Challenges in data storage and data management,
4. Discuss Cache –its structure, operations, management and protection

Apply the Data Center Environment for storing the data (CO2):

1. Apply different RAID levels and their suitability for Web application environments following user requirements
2. An application has 4000 heavy users at a peak of 4 IOPS each and 1000 typical users at a peak of 2 IOPS each, with a read/write ratio of 3:1. It is estimated that the application also experiences an overhead of 10% for other workloads. Calculate the IOPS requirement for RAID1, RAID 3, RAID 5 and RAID 6.
3. The average I/O size of a database is 16KB, 32KB, and 64KB. The following specifications are available from the disk manufacturer: averages seek time = 5 ms, 7,200 rpm, transfer rate = 40 MB/s. Determine the maximum IOPS that could be performed with the disk for this application. Taking this case as an example, explain the relationship between disk utilization and IOPS

Develop Data Protection from Raid analyzing user requirements (CO3):

1. Analyze Evolution of networked storage
2. Formulate a checklist for auditing the security of a storage environment with SAN, NAS and iscsi implementations. Explain the audit process by assuming that you have discovered least five loopholes during the process
3. Consider the following figure depicts a system setup in which an application running on the server provides an interface to the client and performs I/O operations. The client is connected to the server through an IP network, the server is connected to the storage array through a FC connection, an HBA installed at the server sends or receives data to and from a storage array, and an FC switch connects the HBA to the storage port. Invent the types of failure in the client and storage array communication and propose the fault tolerance behaviour to perform IT solution.



A Manufacturing Corporation uses tape as its primary backup storage media throughout the organization:

- Full backups are performed every Sunday.
- Incremental backups are performed Monday through Saturday.
- The environment contains many backup servers, backing up different groups of servers.
- The e-mail and database applications have to be shut down during the backup process. Due to the decentralized backup environment, recover-ability is often compromised. There are too many tapes that need to be mounted to perform a full recovery in case of a complete failure. The time needed to recover is too lengthy. The company would like to deploy an easy-to-manage backup environment. They want to reduce the amount of time the e-mail and database applications are unavailable, and reduce the number of tapes required to fully recover a server in case of failure. Propose a backup and recovery solution to address the company's needs. Justify how your solution ensures that their requirements will be met.

Demonstrate the Fiber Channel Storage Area Networks (CO4):

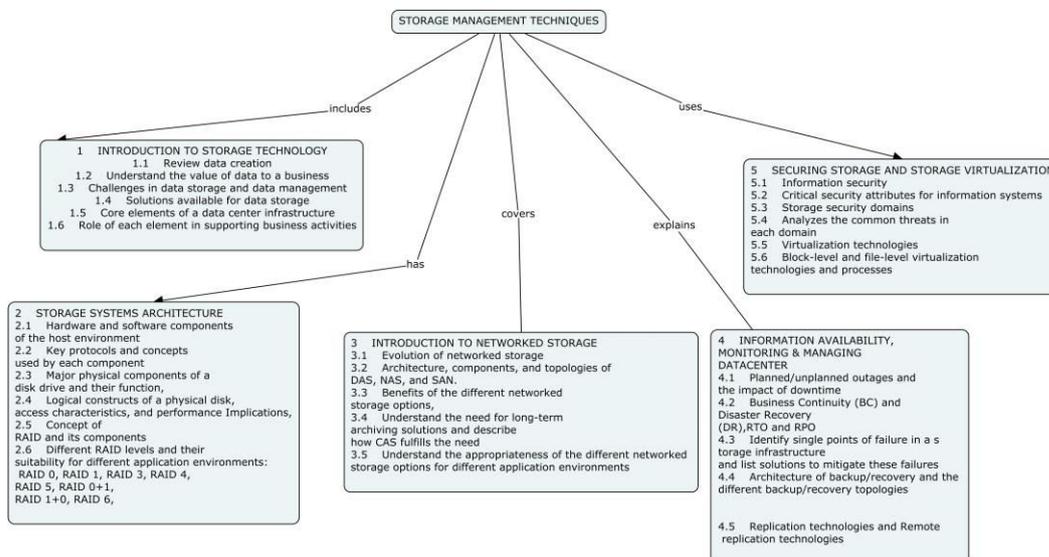
1. List reasons for planned/unplanned outages and the impact of downtime
2. Create a Business Continuity (BC) Plan guidelines for HDFC Bank
3. Differentiate between Business Continuity (BC) and Disaster Recovery(DR),RTO and RPO
4. Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures
5. Different Type of backup/recovery topologies

Apply Network-Attached, Object Based & Unified Storage for data center environment (CO5):

1. Apply Information security, Critical security attributes for information systems in industrial Environment
2. Various business/technical considerations for implementing a backup Solution, and how do these considerations impact the backup solution/implementation?
3. Core elements of a data center infrastructure, role of each element in supporting business activities in an institution.

Develop Storage Virtualization, technologies and process (CO6):

1. Analyze Architecture, components, and topologies of DAS
2. Appropriateness of the different networked storage options for different application environments.
3. Security implementation on SAN Environment based on user requirements analyze the solution

Concept Map

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

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.

Course Contents and Lecture Schedule

Module No	Topic	No. of Lectures
1	INTRODUCTION TO STORAGE TECHNOLOGY	
1.1	Review data creation	1
1.2	Understand the value of data to a business	1
1.3	Challenges in data storage and data management	1
1.4	Solutions available for data storage	1
1.5	Core elements of a data center infrastructure	2
1.6	Role of each element in supporting business activities	1
2	STORAGE SYSTEMS ARCHITECTURE	
2.1	Hardware and software components of the host environment	1

2.2	Key protocols and concepts used by each component	1
2.3	Major physical components of a disk drive and their function,	2
2.4	Logical constructs of a physical disk, access characteristics, and performance Implications,	2
2.5	Concept of RAID and its components	1
2.6	Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6,	2
3	INTRODUCTION TO NETWORKED STORAGE	
3.1	Evolution of networked storage	1
3.2	Architecture, components, and topologies of DAS, NAS, and SAN.	2
3.3	Benefits of the different networked storage options,	1
3.4	Understand the need for long-term archiving solutions and describe how CAS fulfills the need	2
3.5	Understand the appropriateness of the different networked storage options for different application environments	1
4	INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTER	
4.1	Planned/unplanned outages and the impact of downtime	1
4.2	Business Continuity (BC) and Disaster Recovery (DR),RTO and RPO	2
4.3	Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures	1
4.4	Architecture of backup/recovery and the different backup/recovery topologies	2
4.5	Replication technologies and Remote replication technologies	1
5	SECURING STORAGE AND STORAGE VIRTUALIZATION	
5.1	Information security	1
5.2	Critical security attributes for information systems	1
5.3	Storage security domains	1
5.4	Analyzes the common threats in each domain	1
5.5	Virtualization technologies	1
5.6	Block-level and file-level virtualization technologies and processes	1
	Total	36

Course Designer:

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

Preamble

The course aims to provide an understanding of enterprise structure, policies, accountability mechanisms and monitoring practices in place to achieve cyber security. Also, knowledge on security mechanisms and cyber law to ensure confidentiality, integrity and availability of information assets is provided.

Prerequisite

- 17CA420 Computer Networks

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

Mapping with Programme Outcomes

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

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	30	30	30
Analyze	0	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Recognize the cyber security policies, standards and procedures for completeness and alignment with generally accepted practices (CO1):

1. Identify the cyber security policies, standards and procedures for completeness
2. Why cyber security is needed
3. What are the practices followed?

Explain the functionalities of cyber security (CO2):

1. What are the functionalities of cyber security
2. Explain the Cyber security techniques
3. List down the objectives of cyber security

Describe E governance and IT Act (CO3):

1. List down the legal recognition of electronic records
2. List down the legal recognition of digital signatures

Analyze the root causes of cyber crime (CO4):

1. How to tamper the computer source documents
2. Write down offences related with digital signatures

Implement suitable security techniques for a given problem (CO5):

1. Convert the message “**Crypto**” by applying

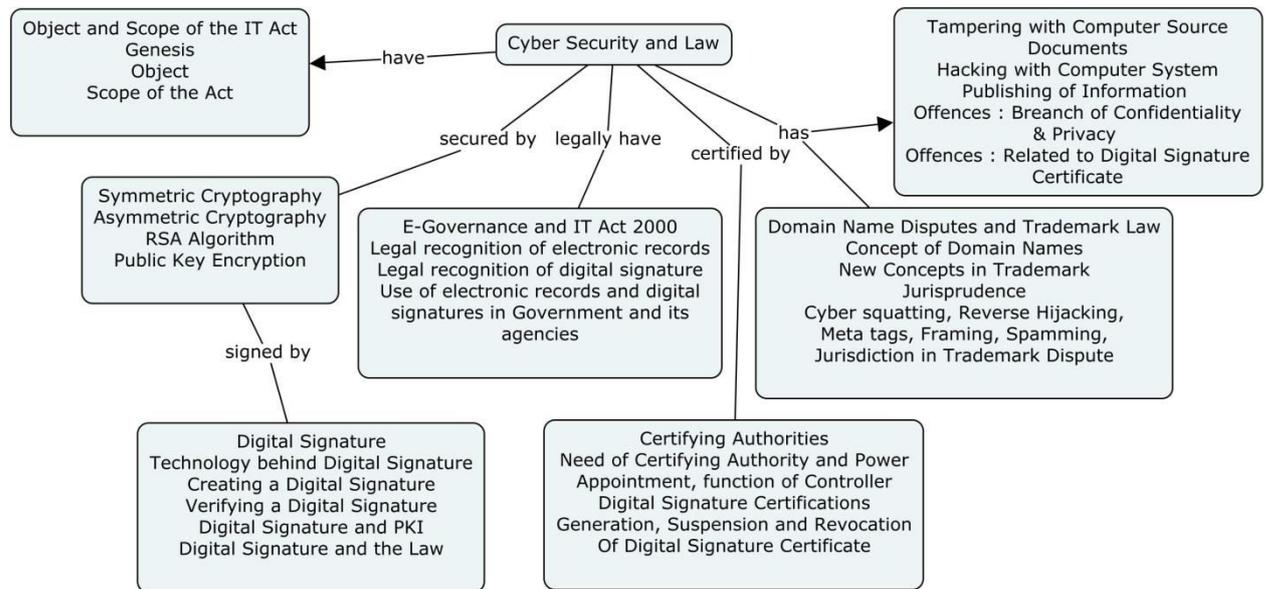
Hill cipher with $K = \begin{pmatrix} 17 & 17 & 5 \\ 21 & 18 & 21 \\ 2 & 19 & 24 \end{pmatrix}$ & $K^{-1} = \begin{pmatrix} 4 & 9 & 15 \\ 15 & 17 & 6 \\ 24 & 0 & 17 \end{pmatrix}$

2. Do One round **DES** encryption for the given Plaintext **012...F** and Key **ABCDEF0123456789**
3. Analyze the Cipher text for the given Plain text “**THIAGARAJAR COLLEGE OF ENGINEERING**” with the Key **6 3 2 5 4 7 1** by performing 2 stages of **Transposition** techniques.

Suggest appropriate security counter measures for the given scenario (CO6):

1. Discuss the Disaster Recovery Plan Tests and Drill.
2. Describe how to Provide assurance that the processes for information systems operations, maintenance and support meet the organization’s strategies and objectives
3. Predict the finest way of conducting periodic reviews of information systems.

Concept Map



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 Education Asia,2016.
4. https://onlinecourses.nptel.ac.in/noc15_cs03
5. [nptel.ac.in/courses/106105031/](https://onlinecourses.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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Object and Scope of the IT Act	
1.1	Genesis	1
1.2	Object	1
1.3	Scope of the Act	1
2	Encryption	
2.1	Symmetric Cryptography	2
2.2	Asymmetric Cryptography	2
2.3	RSA Algorithm	1
2.4	Public Key Encryption	1
3	Digital Signature	
3.1	Technology behind Digital Signature	1
3.2	Creating a Digital Signature	1
3.3	Verifying a Digital Signature	1
3.4	Digital Signature and PKI	1
3.5	Digital Signature and the Law	2
4	E-Governance and IT Act 2000	
4.1	Legal recognition of electronic records	1
4.2	Legal recognition of digital signature	1
4.3	Use of electronic records and digital signatures in Government and its agencies	1
5	Certifying Authorities	
5.1	Need of Certifying Authority and Power	1
5.2	Appointment, function of Controller	2
5.3	Digital Signature Certifications	2
5.4	Generation, Suspension and Revocation	1
6	Domain Name Disputes and Trademark Law	
6.1	Concept of Domain Names	1
6.2	New Concepts in Trademark Jurisprudence	1
6.3	Cyber squatting, Reverse Hijacking, Meta tags, Framing, Spamming	2
6.4	Jurisdiction in Trademark Dispute	1
7	The Cyber Crimes (S-65 to S-74)	
7.1	Tampering with Computer Source Documents	1
7.2	Hacking with Computer System	1
7.3	Publishing of Information	1
7.5	Offences : Breach of Confidentiality & Privacy	1
7.6	Offences : Related to Digital Signature Certificate	1
	Total Lectures	36

Course Designer:

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

Preamble

The course aims at exploring the concepts of wireless adhoc networks, functionalities and protocols of various layer, architectures and applications of framework creation, Qos and security implementation.

Prerequisite

- 17CA230 : Design and Analysis of Algorithms
- 17CA420 : Computer Networks

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P11	PO12
CO1	S	L	L	S	M	L	L	L	L	-	-	-
CO2	S	L	L	S	M	L	L	L	L	-	-	-
CO3	S	L	L	S	M	L	L	L	L	-	-	-
CO4	S	S	S	S	L	L	L	L	L	-	-	-
CO5	S	S	S	S	L	L	L	L	L	-	-	-
CO6	S	S	S	S	L	L	L	L	L	-	-	-

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions**Define the basic principles of wireless ad hoc networks (CO1):**

1. List the three important radio propagation phenomena at high frequencies.
2. Identify and list the limitation of Table driven routing protocols.
3. State the advantages of TORA.
4. Define confidentiality.
5. State the different classifications of energy management schemes.

Explain the functionalities and protocols of various layers (CO2):

1. Distinguish between wired network and Wireless Network.
2. Describe various types of routing protocol.
3. Explain the schemes prescribed in power management.
4. Discuss the functionalities of all layers in Qos achievement.
5. Describe how TCP combines benefits of both wired and wireless protocol.

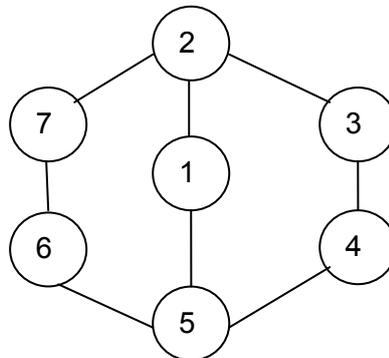
Describe the different issues and working concepts of

wireless Ad hoc networks based on different layers. (CO3):

1. Summarize the different issues in Ad hoc wireless networks.
2. Explain the RTS –CTS Mechanism involved in CSMA/CA.
3. Explain the concept of location aided routing.
4. Explain the working of source initiated protocols.
5. Explain the concept of security aware AODV protocol.

An ability to apply different algorithms and techniques based on the layer wise problem solving. (CO4)

1. Assume that when the current size of congestion window is 48 KB, the TCP sender experiences a timeout. What will be the congestion window size if the next three transmission bursts are successful? Assume that MSS is 1 KB. Consider TCP Tahoe and TCP Reno.
2. For the network shown in figure construct the fisheye routing table for nodes 7 and 5.



3. Calculate the probability of a path break for an eight-hop path, given that the probability of line break is 0.2.
4. In a military vehicular ad hoc wireless network using PRTMAC, formed by 500 nodes distributed uniformly in a battlefield area of 1000 m x 1000 m, calculate the number of
5. nodes contending for the data channel and for control channel. The transmission range of data channel is 250 m.

In a military vehicular ad hoc wireless network using PRTMAC, formed by 500 nodes distributed uniformly in a battlefield area of 1000 m x 1000 m, calculate the number of nodes contending for the data channel and for control channel. The transmission range of data channel is 250 m. Also find the probability that a beacon gets collided, when the beacons are generated periodically with a period of 10 seconds. Assume the beacon length to be equal to 1 ms.

Analyze the better problem solving approaches based on the layer wise issues (CO5):

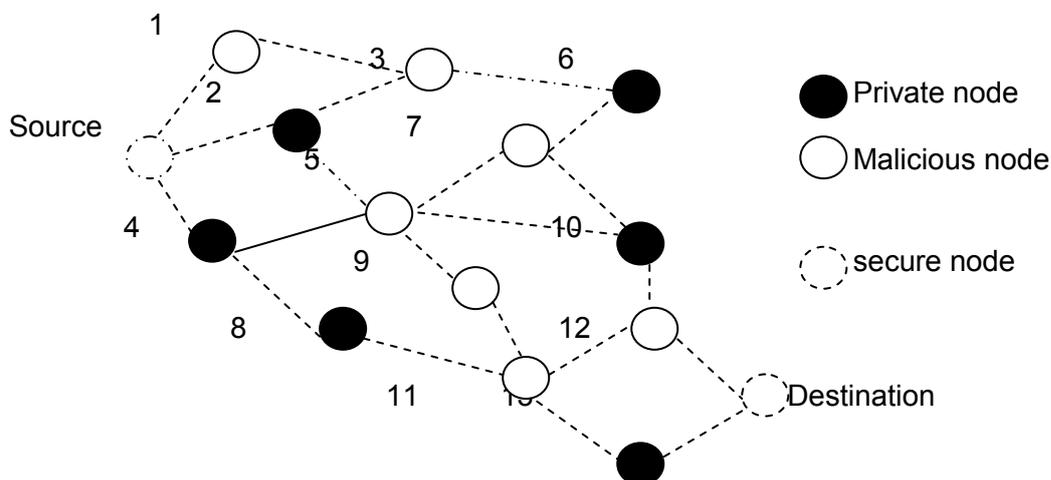
1. Compare the different TCP solutions for Ad hoc wireless networks.
2. Examine the different phases of Associativity- Based Ad hoc Multicast routing.
3. Compare the various secure routing methods used in Ad hoc networks.
4. Examine the system power management schemes.
5. With A neat block diagram explain the concept of INSIGNIA Qos framework.

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

1. Nodes A and B want to establish a secure communication, and node A generates a random key 11001001. Suppose the functions used by both the nodes A and B for encryption is XOR, and let node A generate a random transport key 10010101 and let node B generate 00101011. Sketch the three pass Shamir protocol exchanges.

2. Predict the possible steps of the algorithms executed at the source and the intermediate nodes of an ad hoc wireless network that follow the following strategies: a) random energy b) pay-for-it strategy. Assume a session between source s and destination d. let $R(s,d)$ be the set containing available routes between s and d, $\text{sympathy}(k,r)$ be the kth node in route r, and $\text{credit}(k,r)$ and $\text{debit}(k,r)$ be the credit and debit of kth node in route r respectively.

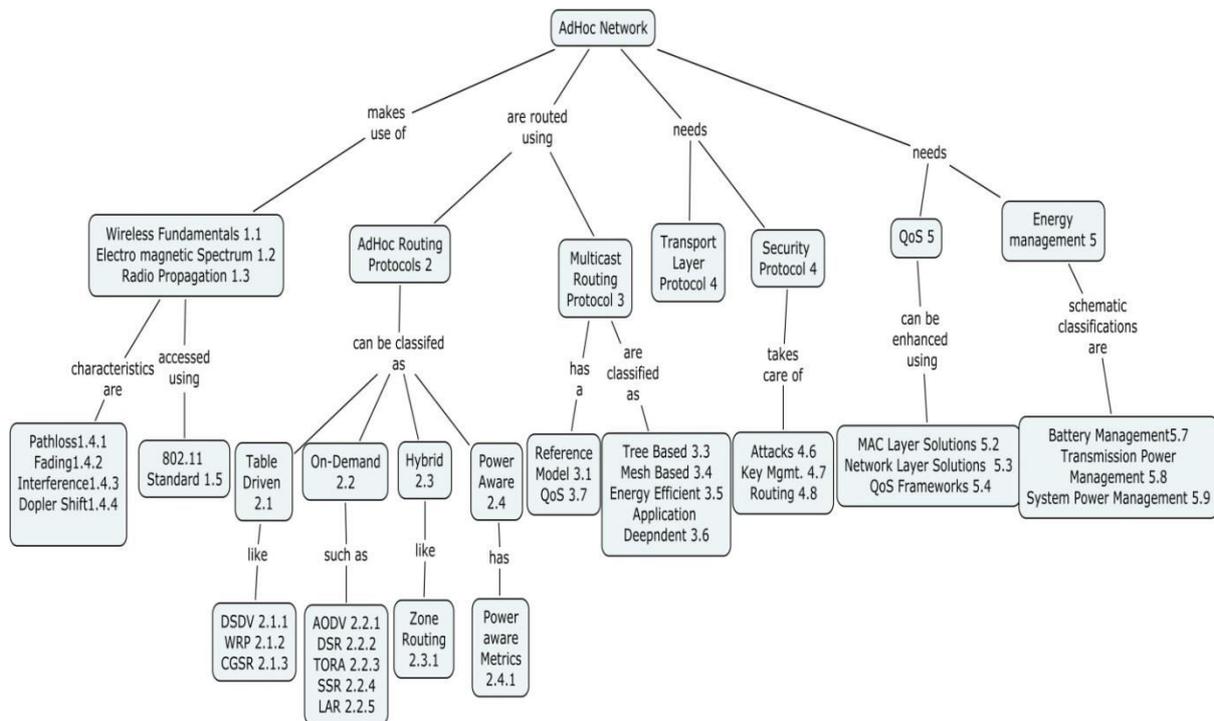
3. Mark the paths chosen by the following secure-routing protocols for the network topology shown in figure: a) Shortest path routing and b) SAR protocol. Assume that node 2 is secure node. C) If node 2 (which lies in the path chosen by SAR protocol) is suddenly attacked and becomes a malicious node, then mark an alternative path chosen by SAODV protocol.



4. Estimate the approximate control overhead for the ODMRP protocol over a 200 second time period. Assume that all nodes are stationary. Number of nodes: 50 . Time period for sending a JoinReq : 2 secs.

5. Estimate the approximate control overhead for the DCMP protocol over a 200 second time period. Assume that all nodes are stationary. S1 is a active source and S2 is a passive source. Number of nodes: 50 . Time period for sending a JoinReq : 2 secs.

Concept Map



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.

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

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	AdHoc Networks Introduction	
1.1	Fundamentals of Wireless Communication	1
1.2	The Electromagnetic Spectrum	1
1.3	Radio Propagation Mechanisms	1
1.4	Characteristics of the Wireless Channel	1
1.5	IEEE 802.11 Standard	1
2	Ad Hoc Routing Protocols	
2.0	Issues and Challenges	1
2.1	Table-Driven Routing Protocols	1
2.2	On Demand Routing Protocols	1
2.3	Hybrid Routing Protocols	1
2.4	Power-Aware Routing	1
3	Multicast routing In Ad Hoc Networks	
3.1	An Architecture Reference Model for Multicast Routing Protocols	1
3.2	Classifications of Multicast Routing Protocols	1
3.3	Tree-Based Multicast Routing Protocols	1
3.4	Mesh-Based Multicast Routing Protocols	1
3.5	Energy Efficient Routing Protocols	1
3.6	Application Dependent Protocols	1
3.7	Multicasting with QoS Gurantee	1
4	Transport Layer, Security Protocols	
4.1	Designing a Transport Layer Protocol	1
4.2	Design Goals of a Transport Layer Protocol	1
4.3	TCP Over Ad Hoc Wireless Networks	1
4.4	Other Transport Layer Protocols	1
4.5	Security Requirements - Issues and Challenges in Security Provisioning	1
4.6	Network Security Attacks	1
4.7	Key Management	1
4.8	Secure Routing	1
5	Qos and Energy Management	
5.1	Classifications of QoS Solutions	1
5.2	MAC Layer Solutions	1
5.3	Network Layer Solutions	1

5.4	QoS Frameworks	1
5.5	Energy Management	1
5.6	Classification of Energy Management Schemes -	1
5.7	Battery Management Schemes -	1
5.8	Transmission Power Management Scheme	1
5.9	System Power Management Schemes	1
5.10	Case Study	1
	Total	36

Course Designer:

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14CAPF0**SUPPLY CHAIN MANAGEMENT**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

Students will learn the basic concepts in supply chain management (SCM) and its related technologies to design an integrated software solution for manufacturing industries.

Prerequisite

- None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Explain the Supply Chain (CO1):

1. Define supply chain.
2. What are the objectives of supply chain?
3. Identify the three key supply chain decision phases.
4. What types of distribution networks are typically best suited for commodity items?
5. Give example of products that displays seasonality of demand.
6. What is the difference between lot size-based and volume-based quantity discounts?
7. When are quantity discounts justified in supply chain.

Demonstrate the different phases in supply chain (CO2):

1. Describe the cycle and push/pull view of a supply chain.
2. Explain why achieving strategic fit is critical to a company's overall success.
3. How do you understand the role of network design decision in a supply chain?
4. What is the major cost categories needed as input for aggregate planning?
5. What are the operational parameters to identify in aggregate plan?

Identify the drivers of supply chain performance (CO3):

1. Define and apply the key metrics that track the performance of the supply chain in terms of each driver.
1. Is e-business likely to be more beneficial in the early part or the mature part of a product's life cycle? Why?
3. Develop a framework for making network design decisions.
4. A super market has experienced weekly demand of milk of 120,127,114 and 122 gallons over the last four weeks. Forecast demand for period 5 using a four –period moving average. What is the forecast error if demand in period 5 turns out to be 125 gallons.
5. Identify the managerial levers that reduce lot size and cycle inventory in a supply chain without increasing cost.

Build supply chain models (CO4):

1. Analyze the major drivers of supply chain performance.
2. How do static and adaptive forecasting methods differ?
3. Demand for the Deskpro computer at best buy is 1000 units per month. Best buy incurs a fixed order placement, transportation, and receiving cost of \$4000 each time an order is placed. Each computer cost best buy \$500 and the retailer has a holding cost of 20 percent. Evaluate the no of computers that the store manager should order in each replenishment lot.
4. Discuss key drivers that may be used to tailor transportation. How does tailoring help?
5. Discuss why the high-tech industry has been the leader in adopting supply chain IT systems.

Analyze demand forecasting (CO5):

1. Understand the role of forecasting for both an enterprise and a supply chain.
2. Identify the components of a demand forecast.
3. Forecast demand in a supply chain given historical demand data using time-series methodologies.
4. Analyze demand forecasts to estimate forecast error.

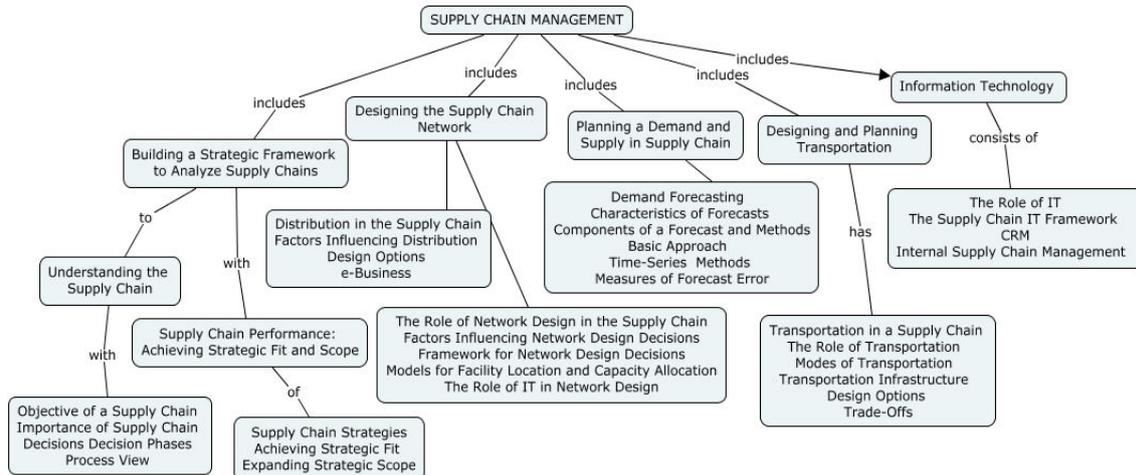
Interpret the strengths and weakness of various transportation network processes (CO6):

1. Understand the role of transportation in a supply chain.
2. Evaluate the strengths and weaknesses of different modes of transportation.
3. Discuss the role of infrastructure and policies in transportation.
4. Identify the relative strengths and weaknesses of various transportation network design

options.

- Identify trade-offs that shippers must consider when designing a transportation network.

Concept Map



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

- 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.

Course Contents and Lecture Schedule

Module .No	Topics	No.of Lectures
1.	Understanding the Supply Chain:	
1.1	The Objective and Importance of Supply Chain	1
1.2.	Decisions Decision Phases in a Supply Chain	1
1.3.	Process View of a Supply Chain	1
2.	Supply Chain Performance: Achieving Strategic Fit and Scope:	
2.1.	Competitive and Supply Chain Strategies	1
2.2.	Achieving Strategic Fit	2
2.4.	Supply Chain Drivers and Metrics: Drivers of Supply Chain Performance	1
2.5.	Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing	1
2.6.	Obstacles to Achieving Fit	1
3.	Designing the supply chain network:	
3.1.	The Role of Distribution in the Supply Chain	1
3.2.	Factors Influencing Distribution Network Design	1
3.3.	Design Options for a Distribution Network	2
3.4.	e-Business and the Distribution Network	1
4.	Network Design in the Supply Chain:	
4.1.	The Role of Network Design in the Supply Chain	1
4.2.	Factors Influencing Network Design Decisions	1
4.3.	Framework for Network Design Decisions	2
4.4.	Models for Facility Location and Capacity Allocation	1
4.5.	The Role of IT in Network Design	1
5.	Demand Forecasting in a Supply Chain:	

5.1.	The Role of Forecasting in a Supply Chain	1
5.2.	Characteristics of Forecasts, Components of a Forecast and Forecasting Methods	2
5.3.	Basic Approach to Demand Forecasting	1
5.4.	Measures of Forecast Error	1
6.	Transportation in a Supply Chain:	
6.1.	The Role of Transportation in a Supply Chain	1
6.2.	Modes of Transportation and Their Performance Characteristics	1
6.3.	Transportation Infrastructure and Policies	1
6.4.	Design Options for a Transportation Network	2
6.5.	Trade-Offs in Transportation Design	1
7.	Information Technology in a Supply Chain:	
7.1.	The Role of IT in a Supply Chain	1
7.2.	The Supply Chain IT Framework	1
7.3.	Customer Relationship Management	1
7.4.	Internal Supply Chain Management	1
	Total	35

Course Designer

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17CAPG0

MANAGERIAL ECONOMICS

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

Managerial economics is concerned with the application of economic concepts and economic analysis to the problems of formulating rational managerial decisions. The course deals with the integration of economic theory with business practice for the purpose of facilitating decision making and forward planning by management.

Prerequisite

- None

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								M				
CO2						M	M	S		S		S
CO3		M					M	S		S		S
CO4	M			S				M		L		L
CO5	L							L				
CO6			S			M	L	M		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	50	50	50	50
Analyse	10	10	10	10
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Compute the relevant costs of any decision (CO1):

1. What is Managerial Economics?
2. Elucidate on the characteristics and scope of managerial economics?
3. What is monopoly?
4. List the various types of Demand?
5. Define Break even analysis?

Explain the concept of managerial economics, market and firm (CO2):

1. Understand the different sub-markets making up an economy?
2. Explain Surplus and Shortage in a market?
3. Define and give business examples of opportunity cost?
4. Explain the distinction between an irrelevant cost and a relevant one?

Explain the concept of Demand, Supply and Elasticity in economics (CO3):

1. What why supply-demand analysis is needed?
2. State the law of demand?
3. Understand how to think of Supply separately?
4. Understand how to think of Demand separately?
5. Define and measure elasticity?
6. Define cross price and income elasticity?

Analyze the Estimation of Production and Estimate of cost (CO4):

1. Distinguish between short run and long run situations?
2. Establish the linkage between production function and cost function?
3. Explain the Concepts of relevant costs?
4. Uses and Limitations of Break-Even Analysis?
5. What is Degree of Operating Leverage?

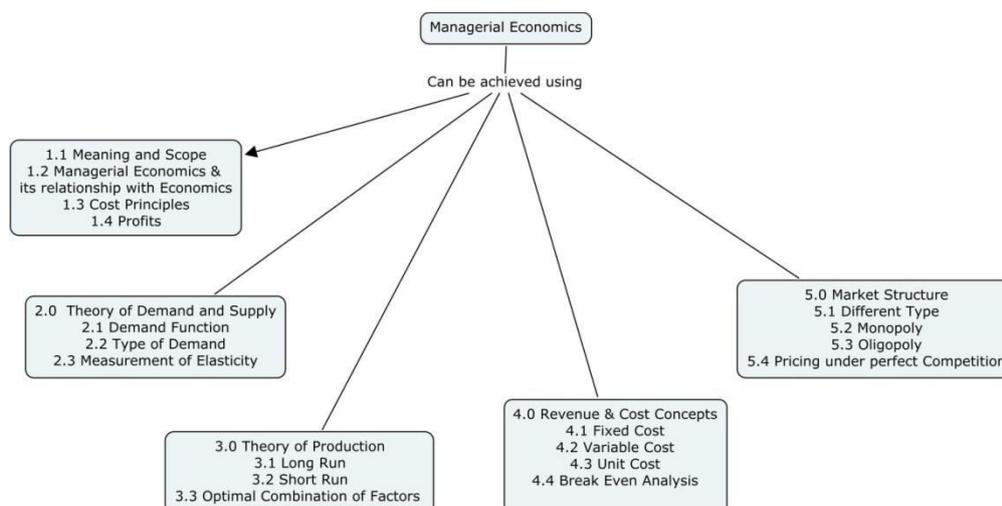
Assume the marginal analysis to make extent(how much) decisions(CO5):

1. Using relevant examples, explain the distinction between macroeconomics and Microeconomics?
2. When effort and productivity are not directly observable, it is more likely that a firm will be charged with discrimination?
3. Why do economies of scale affect the horizontal boundaries of an organization?
4. Why Production function is needed in long run?

Explain investment decisions that increase firm value (CO6):

1. "Managerial economics uses less than completely realistic models." Is this necessarily Bad?
2. What is the own price elasticity when P_x is Rs150: Is the demand elastic or In-elastic?
3. What will happen to the revenue if we were to increase the price?
4. Apply Elasticity of Demand for Business Applications?

Concept Map



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, 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

Course Contents and Lecture Schedule

Module. No	Topics	No. of Lectures
1.1	Meaning and scope of Managerial Economics	1
1.2	Managerial Economics & its relationship with Economics	2
1.3	Fundamental Concepts, Opportunity	2
1.4	Cost Principle – Equi-marginal Principle	1
1.5	Marginal & Incremental Principle - Discounting Principle	1

1.6	Economic Profit & Accounting Profit	1
2.1	Theory of Demand & Supply: Law of Demand	1
2.2	Demand Function- Demand Curves	2
2.3	Types of Demand - Elasticity of Demand	2
2.4	Measurement of Elasticity	1
2.5	Business applications –	2
2.6	Law of Supply – Elasticity of Supply	2
3.1	Theory of Production: Production Function	1
3.2	Short run & Long run, Optimal Combination of Factors of Production.	1
4.1	Revenue & Cost Concepts: Fixed Costs	1
4.2	Variable Costs - Unit Costs -	1
4.3	Cost Curves	1
4.4	Decision Making Costs	1
4.5	Break Even Analysis	2
4.6	Case Study	1
5.1	Market Structure: Different types of Markets	1
5.2	Different types of Markets	2
5.3	Pricing under Perfect Competition	1
5.4	Monopoly	1
5.5	Monopolistic competition and Oligopoly	1
5.6	Case Study	2
	Total	36

Course Designer

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17CAPH0**BUSINESS ANALYTICS**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

The course is designed to gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making. The course familiarizes the students with the processes needed to develop, report, and analyze business data.

Prerequisite

None

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 |

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		L						
CO2		S	M			S						
CO3				S		L		M				
CO4	S		L		S				S			
CO5	M		S			L						
CO6		S		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	20	20	20	20
Apply	40	40	20	30
Analyse	20	20	40	30
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

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

1. Discuss how business analytics can be used in sports, such as tennis, cricket, football, and so on. Identify as many opportunities as you can for each.
2. Suggest some metrics that a hotel might want to collect about their guests. How might these metrics be used with business analytics to support decisions at the hotel?
3. A bank developed a model for predicting the average checking and savings account balance as $\text{Balance} = -17,732 + 367 * \text{age} + 1,300 * \text{years education} + 0.116 * \text{household wealth}$.
 - a. Explain how to interpret the numbers in this model.
 - b. Suppose that a customer is 32 years old, is a college graduate (so that years education = 16), and has a household wealth of \$150,000. What is the predicted bank balance?
4. A survey handed out to individuals at a major shopping mall in a small Florida city in July asked the following:
 - gender
 - age
 - ethnicity
 - length of residency
 - overall satisfaction with city services (using a scale of 1–5, going from poor to excellent)
 - quality of schools (using a scale of 1–5, going from poor to excellent)

What types of data (categorical, ordinal, interval, or ratio) would each of the survey items represent and why?

5. A firm installs 1500 air conditioners which need to be serviced every six months. The firm can hire a team from its logistics department at a fixed cost of \$6,000. Each unit will be serviced by the team at \$15.00. The firm can also outsource this at a cost of \$17.00 inclusive of all charges.
 - a. For the given number of units, compute the total cost of servicing for both options. Which is a better decision?
 - b. Find the break-even volume and characterize the range of volumes for which it is more economical to outsource.

Apply relative and absolute addressing in Excel formulas. (CO2):

1. The Excel file *Firm Data* shows the prices charged and different product sizes. Prepare a worksheet using VLOOKUP function that will compute the invoice to be sent to a customer when any product type, size, and order quantity are entered.
2. The Excel file *Store and Regional Sales Database* provides sales data for computers and peripherals showing the store identification number, sales region, item number, item description, unit price, units sold, and month when the sales were made during the fourth quarter of last year. Modify the spreadsheet to calculate the total sales revenue for each of the eight stores as well as each of the three sales regions.
3. The following exercises use the *Purchase Orders* database. Use MATCH and/or INDEX functions to find the following:
 - a. The row numbers corresponding to the first and last instance of item number 1369 in column C (be sure column C is sorted by order number).
 - b. The order cost associated with the first instance of item 1369 that you identified in part (a).
 - c. The total cost of all orders for item 1369. Use the answers to parts (a) and (b) along with the SUM function to do this. In other words, you should use the appropriate INDEX and MATCH functions within the SUM function to find the answer.

Validate your results by applying the SUM function directly to the data in column G.

4. Use INDEX and MATCH functions to fill in a table that extracts the amounts shipped between each pair of cities in the Excel file *General Appliance Corporation*. Your table should display as follows, and the formula for the amount should reference the names in the From and To columns:

From	To	Amount
Marietta	Cleveland	0
Marietta	Baltimore	350
Marietta	Chicago	0
Marietta	Phoenix	850
Minneapolis	Cleveland	150
Minneapolis	Baltimore	0
Minneapolis	Chicago	500
Minneapolis	Phoenix	150

Compute the range, interquartile range, variance, and standard deviation of a set of data (CO3):

1. In the Excel file Facebook Survey, find the average and median hours online/week and number of friends in the sample using the appropriate Excel functions. Compute the midrange and compare all measures of location.
2. Define Arithmetic Mean. Give example.
3. Show the difference between median and mode. Illustrate with example.
4. Explain the measures of Dispersion.
5. How do you apply the Coefficient of Variation?
6. How Empirical Rules are used to Measure the Capability of a Manufacturing Process.

7. Give the formula for finding Co-variance.
8. Computing the Correlation Coefficient. Discuss in detail.

Explain the purpose and procedures of hypothesis testing, ANOVA tool. (CO4):

1. Show the Hypothesis-Testing Procedure with example.
2. Exhibit one-sample hypothesis test.
3. How β depends on the True Population Mean.
4. Illustrate a Two-Tailed Hypothesis Test for the Mean.
5. The manager of a store claims that 60% of the shoppers entering the store leave without making a purchase. Out of a sample of 50, it is found that 35 shoppers left without buying. Is the result consistent with the claim?
6. The director of human resources for a large bank has compiled data on about 70 former employees at one of the bank's call centers. For each of the following, assume equal variances of the two populations.
 - a. Test the null hypothesis that the average length of service for males is the same as for females.
 - b. Test the null hypothesis that the average length of service for individuals without prior call center experience is the same as those with experience.
 - c. Test the null hypothesis that the average length of service for individuals with a college degree is the same as for individuals without a college degree.
 - d. Now conduct tests of hypotheses for equality of variances. Were your assumptions of equal variances valid? If not, repeat the test(s) for means using the unequal variance test.
7. A survey of college students determined the preference for cell phone providers. The following data were obtained:

Gender	Provider			
	T-Mobile	AT&T	Verizon	Other
Male	12	39	27	16
Female	8	22	24	12

Can we conclude that gender and cell phone provider are independent? If not, what implications does this have for marketing?

8. A college is trying to determine if there is a significant difference in the mean GMAT score of students from different undergraduate backgrounds who apply to the MBA program. The data Scores contain data from a sample of students. What conclusion can be reached using ANOVA?

Explain the purpose of regression analysis and provide examples in business (CO5):

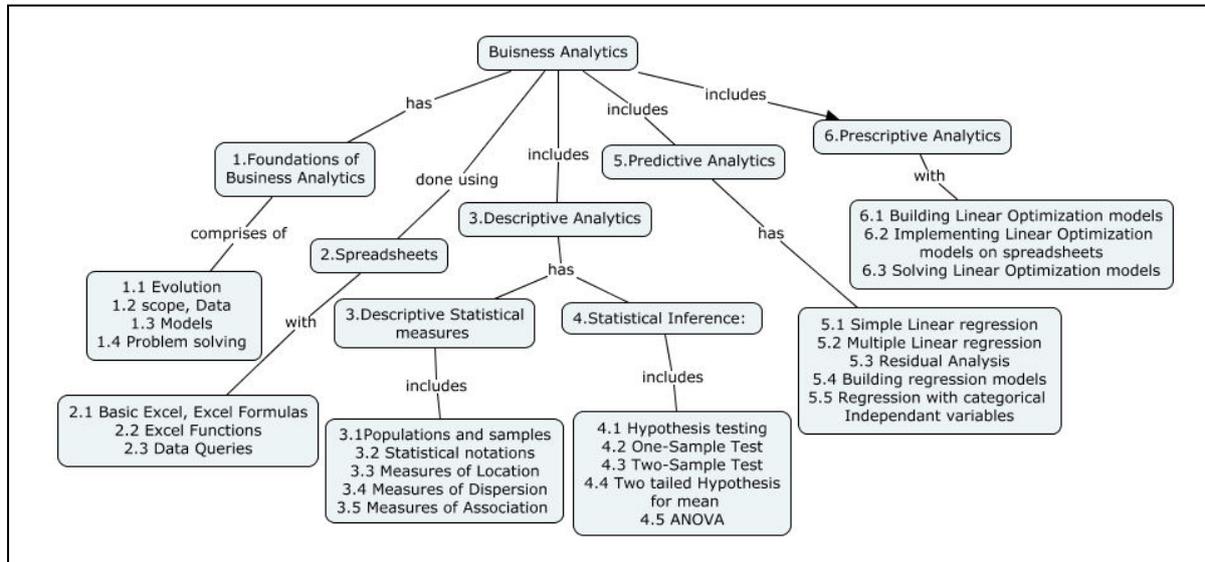
1. Show the Common types of mathematical functions used in predictive analytical models
2. Compute Using Excel to Find the Best Regression Line.
3. Outline the features of least-squares regression with example.
4. What is coefficient of determination?
5. Building Good Regression Models. Illustrate.

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

1. Apply the four-step process to develop a mathematical model for an optimization problem.

2. Show the Characteristics of Linear Optimization Models.
3. How do you Implement Linear Optimization Models on Spreadsheets.
4. Define feasible solution.
5. Illustrate Standard Solver for the SSC Problem.

Concept Map



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 Independent 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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Foundations of Business Analytics:	
1.1	Evolution of Business analytics	1
1.2	scope, Data for Business Analytics	2
1.3	Models in Business Analytics	2
1.4	Problem solving with business analytics	2
2	Analytics on Spreadsheets:	
2.1	Basic Excel, Excel Formulas	1
2.2	Excel Functions	1
2.3	Data Queries	2
3	Descriptive Analytics	
3.1	Descriptive Statistical measures	2
3.2	Populations and samples	1
3.3	Statistical notations	1
3.4	Measures of Location	2
3.5	Measures of Dispersion	2
3.6	Measures of Association	2
4	Statistical Inference:	
4.1	Hypothesis testing	1
4.2	One-Sample Test	1
4.3	Two-Sample Test	1
4.4	Two tailed Hypothesis for mean	1
4.5	ANOVA	1
5	Predictive Analytics	
5.1	Simple Linear regression	1
5.2	Multiple Linear regression	1
5.3	Residual Analysis	1
5.4	Building regression models	1
5.5	Regression with categorical Independent variables	1
6	Prescriptive Analytics	

Module No.	Topic	No. of Periods
6.1	Building Linear Optimization models	1
6.2	Implementing Linear Optimization models on spreadsheets	2
6.3	Solving Linear Optimization models	2
		36

Course Designer:

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

Preamble

The Customer Relationship Management (CRM) course is designed to introduce students to both CRM fundamentals and the utilization of technology in managing customers. The curriculum will introduce students to CRM concepts and functionality for professionals whose organizations utilize CRM or want to gain an understanding of the role of CRM in service management.

Prerequisite

- None

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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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
Create	0	0	0	0

Course Level Assessment Questions

Illustrate key concepts, technologies and best practices of CRM (CO1):

1. What is termed as industry segment?
2. What is significance of Customer Relationship?
3. How is time managed within the sales department? Single user or group calendar? Scheduling email? Others?

Discuss a view of the organization of business and its integration with CRM (CO2):

1. How are contracts and warranties managed in Organizations?
2. Explain the executive information system followed in an Organization for the different departments.
3. Discuss the role of CRM managers.
4. What is the executive information system followed in a telecommunication company for the above departments?
5. If you have a telemarketing department, how are call lists assembled, how are orders taken?

Apply CRM value proposition for different vertical markets (CO3):

List out the criteria for selecting profitable customers.

Draw the differences between analytical CRM and operational CRM.

Illustrate CRM customer data acquisition, management, research, analysis and use (CO4):

Discuss on the software support for Customer Relationship Management?

Write down the strategies for customer acquisition.

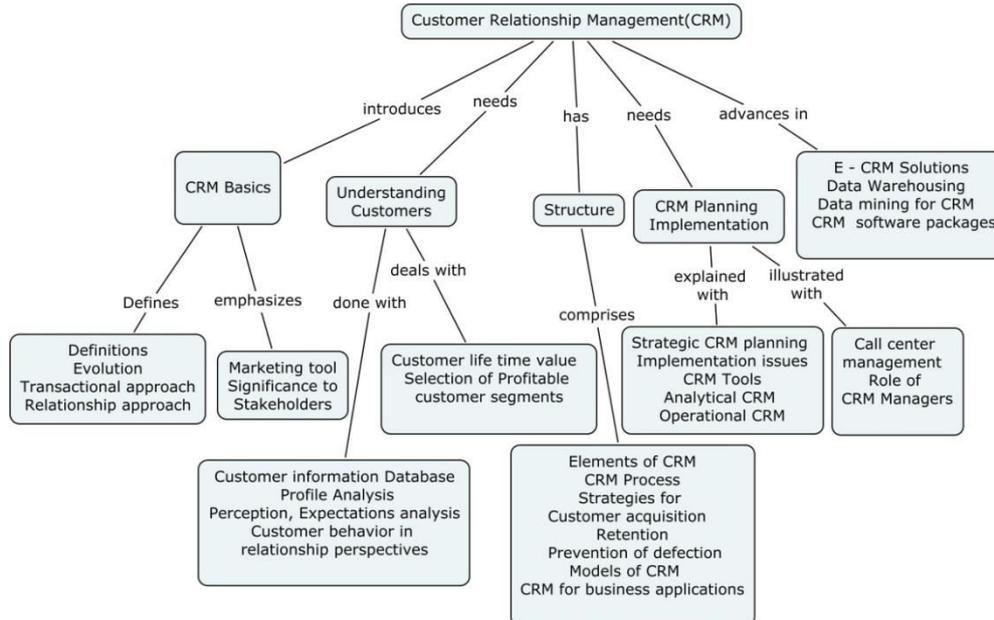
1. How could Data Mining helpful in the process of Customer Relationship management?
2. Discuss of application of E-CRM solutions to an online auction Organization.
3. How does your customer service department function in terms of incident assignment, tracking, reporting, problem management and resolution, and other functions?

Use CRM Tools for various process (CO5) :

1. Analysis the various CRM Software packages?
2. Discuss about the key challenges in CRM implementation?
3. Analyze the features of Oracle CRM and SAP ?

Demonstrate various Trends in CRM (CO6):

1. Discuss the usage of Data mining for CRM ?
2. Discuss the usage of Data warehousing for CRM ?
3. Analysis the various open source CRM tools

Concept Map**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 Perspective, 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.

Course Contents and Lecture Schedule

Module No.	TOPIC	No. of Lectures
1. Introduction to Customer Relation Management		
1.1	Definitions - Concepts and Context of relationship Management	1
1.2	Evolution	2
1.3	Transactional Vs Relationship Approach	2
1.4	CRM as a strategic marketing tool	1
1.5	CRM significance to the stakeholders	2
2. Understanding Customers		
2.1	Customer information Database	1
2.2	Customer Profile Analysis	2
2.3	Customer perception, Expectations analysis	2
2.4	Customer behavior in relationship perspectives; individual and group customer's	1
2.5	Customer life time value	1
2.6	Selection of Profitable customer segments	1
3. CRM Structure		
3.1	Elements of CRM	1
3.2	CRM Process	1
3.3	Strategies for Customer acquisition	1
3.4	Retention and Prevention of defection	1
3.5	Models of CRM	1
3.6	CRM road map for business applications	1
4. CRM Planning and Implementation		
4.1	Strategic CRM planning process	1
4.2	Implementation issues	1
4.3	CRM Tools	1
4.4	Analytical CRM – Operational CRM	1
4.5	Call center management	1
4.6	Role of CRM Managers	1
5. TRENDS in CRM		
5.1	E - CRM Solutions	1
5.2	Data Warehousing	1
5.3	Data mining for CRM	1
5.4	Open source CRM tools	2
5.5	CRM Analytics	2
5.6	CRM in Financial Techniques	2
5.7	Tutorials on CRM Financial Tools	1
Total		38

Course Designer:

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17CAPM0**ENTERPRISE RESOURCE
PLANNING**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

Students will understand the theory behind the design and development of an integrated software system for an enterprise namely the ERP.

Prerequisite

None

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 |

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions**Explore the business processes and the business models underlying the ERP system (CO1):**

1. Define: Business process.
2. What is Enterprise Information System?
3. Why do you require a business model?
4. Outline the elements of a business model.
5. Is it possible to compare the business processes across the enterprises?

Differentiate the software lifecycle for traditional and ERP software (CO2):

1. List the phases in traditional SDLC.
2. Mention the critical phases in ERP system implementation.
3. Highlight the challenges and issues in ERP lifecycle.
4. Why ERP is called packaged software?
5. Elaborate the features of open source ERP.

Select a suitable approach for ERP software selection and deployment (CO3):

1. Name the different approaches for ERP implementation.
2. How will you choose a suitable method for ERP deployment?
3. Elucidate the costs/benefit analysis for ERP software selection.
4. Outline the factors influencing the selection of ERP.
5. How will you compare a ERP software with traditional custom-built software?

Examine the integration of ERP modules and its sub-modules (CO4):

1. Name the various ERP modules and its sub-modules.
2. How is finance module of ERP useful for financial management?
3. Analyze the sales performance of an enterprise using sales module of ERP.
4. How are quality inspection conducted in manufacturing industries using quality management module of ERP?
5. Describe the processes in materials management module of ERP.

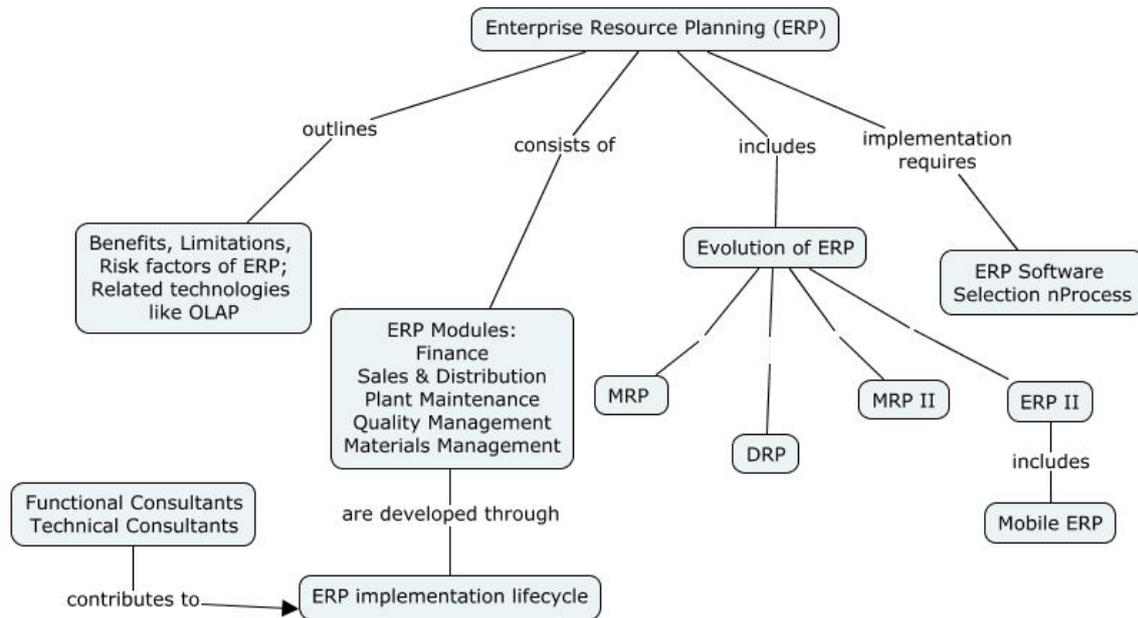
Re-engineer the business processes of chosen enterprise system (CO5):

1. Why is business process re-engineering (BPR) considered in manufacturing industries?
2. List the various steps in BPR.
3. Analyze the pros and cons of carrying out the BPR.
4. Examine the application of business models useful to BPR.
5. Illustrate as how business process complexity is managed using BPR by enterprises.

Develop a set of performance metrics for evaluating the impact of ERP implementation (CO6):

1. Develop your own software metrics to assess the performance of a given ERP system.
2. How will you evaluate the performance of ERP using metrics?
3. Outline the performance indicators of successful ERP system.
4. Propose a performance enhancement model for ERP implementation.
5. Examine the security metrics of ERP for both web based and Mobile platform.

Concept Map



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 E²RP A Case Study Approach", Sandeep Desai, Abhishek Srivastava, Prentice Hall of India, Delhi, 2013. .

Course Contents and Lecture Schedule

Module. No	Topics	No.of Lectures
1.0	Enterprise Resource Planning (ERP)	
1.1	Introduction	1
1.2	Evolution of ERP	1
1.3	MRP & MRP II	1
1.4	Business modeling	2
2.0	ERP and its related technologies	
2.1	Data Mining-Data Warehousing	1
2.2	Business Process Reengineering	2
2.3	Decision Support System (DSS)	1
2.4	Management Information System (MIS)	1
2.5	Executive Information System (EIS)	1
2.6	OLAP	1
2.7	Supply Chain Management (SCM)	1
3.0	ERP for manufacturing processes	
3.1	Distribution requirements planning (DRP)	1
3.2	Different manufacturing strategies	2
3.3	Master production schedule	1
4.0	ERP Software Selection	
4.1	Selection process	1
4.2	Risk analysis and management	1
4.2	Benefits of ERP software	1
4.3	Role of functional consultants	1
4.4	Role of technical consultants	1
4.5	Case studies	2
5.0	Modules in ERP software package	
5.1	Finance	1
5.2	Sales and Distribution	1
5.3	Plant maintenance	1
5.4	Quality management	1
5.5	Materials management	1
5.6	Quality management	1
5.7	Case studies	2

6.0	Future directions of ERP	
6.1	Mobile ERP system and software solution for the enterprises.	1
6.2	Case Studies of ERP implementation-Problems-challenges	2
6.3	Performance indicators of an ERP package	1
	Total	36

Course Designers

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

Preamble

To enable the students to gain knowledge in business process re-engineering and develop business models to improve the performance of an organization.

Prerequisite

None

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: Analyze the Case Studies on BPR like Software Support Process Simulating software Development Schedules	Analyze

Mapping with Programme Outcomes

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

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	30	30
Apply	40	40	40	40
Analyse	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Know the current state of Business Process Reengineering (CO1):

1. List out the process parameters?
2. What is the goal of CPI and TQM?
3. Define origami process?
4. What do you mean by CAPR method of documentation?
5. What do you mean by process drivers?
6. What do you mean by conditional processing?
7. What do you mean by iconic blocks?
8. Define hierarchical lock libraries.
9. What is software support process?

Apply the origami process based on Computer Aided Process Reengineering (CO2):

1. Explain the origami Process at level 1 and purchase order process at first Attempt?
2. How to apply TQM to level 1 Process? Explain
3. How to apply Process Drivers and Process Metrics in defined processes

Demonstrate Purchase order process based CAPRE Techniques. (CO3)

1. Describe the migration of the origami process in level 2 to level 3 and purchase Process third attempt at reengineering?
2. Describe BPR modeling and simulation terminology and techniques.
3. How to CAPRE tools where utilized in simulating software development schedules?

Analyze the concepts of TQM and CPI, modern business Process and practices (CO4):

1. Briefly explain SEI process maturity model?
2. Give short notes of purchase order process reengineering?
3. What are the functionalities of process reengineering facilitator?
4. What do you mean by process metrics?
5. What are the uses of Activity or Delay block?
6. How can you use modeling and simulation to determine schedules?

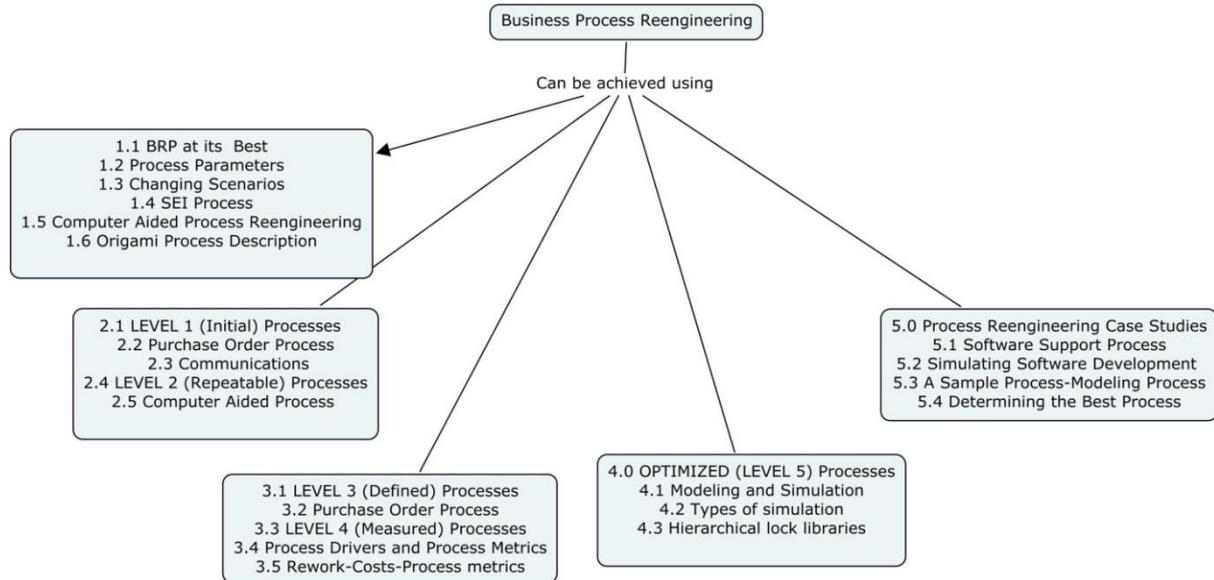
Analyze working knowledge of Business Accounting, Regulatory aspects of business and business practices in IT Fields (CO5):

1. How it will differ from Deming's theories of continuous improvement and sense's theories of casual analysis?
2. Briefly explain the different types of simulation like discrete, Continuous and Hybrid simulations?
3. Explain Applications of Computer Aided Process Reengineering with illustrated example.

Analyze theCase Studies on BPR for different business sectors (CO6)

1. Briefly explain the flight software maintenance?
2. Simulating software development schedule process?
3. Describe in detail about requirement based analysis?

Concept Map



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

Course Contents and Lecture Schedule

MODULE No.	Topics	No. of Lectures
1	Introduction to BPR (Business Process Reengineering)	1
1.1	BPR at its Best	1
1.2	Process Parameters-Disturbing Plot	1
1.3	Changing Scenarios.	1
1.4	A New Perspective on Change in Business	1
1.5	The state of Business Process Reengineering	1
1.6	Computer Aided Process Reengineering-	
1.7	The SEI Process Maturity Model-Deming's Theories of Continuous Improvement-Sense's Theories of Causal Analysis.	1
1.8	Origami Process Description	1
1.9	Purchase Order Process Description.	1
2	LEVEL 1 (Initial) Processes:- The Origami Process at Level 1	1
2.1	The Purchase Order Process: First Attempt at Reengineering.	1
2.2	TQM-Appling it to Level 1 Processes.	1
2.3	Communications:- The foundation of Process Reengineering.	1
2.4	LEVEL 2 (Repeatable) Processes:- Migration of the Origami Process to Level 2	1
2.5	Purchase Order Process: Second attempt at Reengineering	1
2.6	The Computer Aided Process Reengineering Method of Documentation.	1
3	LEVEL 3 (Defined) Processes:- Migration of the Original Process to Level 3-	1
3.1	Purchase Order Process: Third Attempt at Reengineering.	1
3.2	LEVEL 4 (Measured) Processes:- Measuring the Origami Process-	1
3.3	Purchase Order Process: Fourth Attempt at Reengineering	1
3.4	Process Drivers and Process Metrics	1
3.5	Input to Tasks-Staff Required for the task	1
3.6	Time Required to perform the task-	1

3.7	Conditional Processing-Task Initiation	
3.8	Rework-Costs-Process metrics.	1
4	OPTIMIZED (LEVEL 5) Processes:- Origami Process Migration to Level 5.	1
4.1	Modeling and Simulation Terminology and Techniques:- An Overview-	1
4.2	Visual Paradigm-Icons-Iconic Blocks	1
4.3	Types of Simulation-Discrete & Continuous-Hybrid Simulation	1
4.4	Object Orientation – Requirements – Based Analysis -	1
4.5	Hierarchical lock libraries-Open Architecture.	1
5	Process Reengineering Case Studies- Applications of Computer Aided Process Reengineering	1
5.1	Software Support Process	1
5.2	Simulating Software Development Schedules	
5.3	A Sample Process-Modeling Process	1
5.4	Determining the Best Process.	1
5.5	Case Studies on BPR for different business sectors	1
5.6	Comparing CMM levels with BPR levels	1
	Total	36

Course Designer:

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17CAPQ0**SOCIAL NETWORK ANALYSIS**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

To learn knowledge representation using ontology and Understand the concept of semantic web and related applications.

Prerequisite

None

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

Mapping with Programme Outcomes

S- Strong; M-Medium; L-Low

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

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	40	30
Analyse	0	40	20	20
Evaluate	0	0	0	10

Course Level Assessment Questions**Explain semantic web related applications. (CO1):**

1. What do you mean by Semantic Web?
2. Show the limitations of the current web.
3. Explain in detail about the Development of the Semantic Web.
4. Outline the emergence of the social web.
5. What is Web 3.0?

Explain key concepts and measures in network analysis (CO2):

1. What is Network Analysis?
2. Discuss in detail about the Development of Social Network Analysis.
3. Differentiate global and Macro structure of social networks.
4. Show the key concepts in social network Analysis.
5. How will you measure a social network?

Classify the Blogs and online communities (CO3):

1. Define Blog.
2. Illustrate different online communities with example.
3. In what way Features of blogs can be used for social network extraction. Analyze.
4. How Features in web pages can be used for social network extraction?
5. Explain Jaccard-coefficient.

Demonstrate knowledge using ontology. (CO4):

1. Ontology based Knowledge representation. Discuss in detail.
2. Show the special characteristics of Ontology.
3. Draw a neat diagram of ontological structures.
4. Define RDF.
5. Explain RDF and the notion of semantics with example.
6. What is OWL?
7. How do you represent State-of-the-art in network data? Give a flow graph.
8. Exhibit the different Classes and properties of the FOAF ontology.

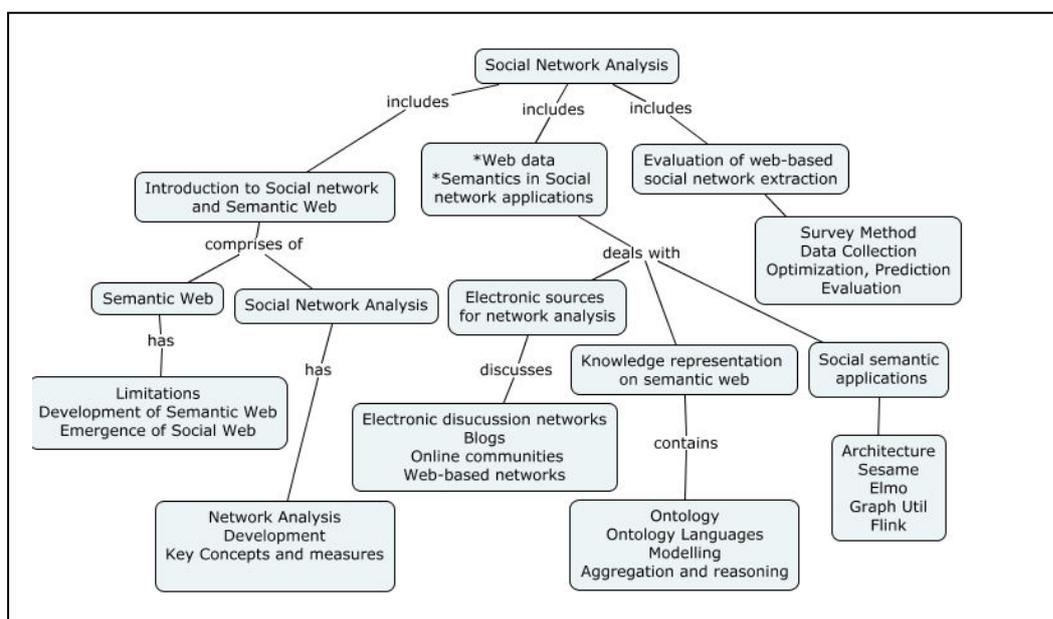
Discuss social network features with Semantic Web applications (CO5):

1. What are the criteria's to be met for Semantic Web applications with respect to the Challenge?
2. Draw the generic architecture of Semantic Web applications with a neat sketch.
3. Explain Sesame in detail.
4. Name the two main components of Elmo. Describe it.
5. Exhibit some features of Flink.
6. Draw a neat diagram of Flink architecture and explain it.

Evaluate web-based social network extraction (CO6):

1. Analyze the various steps in conducting case study of web based social network extraction.
2. Evaluate the survey method used for data extraction.
3. How will you optimize and predict the goodness of fit in network extraction.

Concept Map



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- Optimization- 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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	Introduction to Semantic Web:	
1.1	Limitations of current Web	2
1.2	Development of Semantic Web	2
1.3	Emergence of the Social Web	1
2	Social Network analysis:	
2.1	Development of Social Network Analysis	1
2.2	Key concepts and measures in network analysis	2
3	Electronic sources for network analysis:	
3.1	Electronic discussion networks	1
3.2	Blogs and online communities	2
3.3	Web-based networks	1
4	Knowledge representation on the Semantic web:	
4.1	Ontology and their role in the Semantic Web	1
4.2	Ontology-based knowledge	2
4.3	Representation	1
4.4	Ontology languages for the Semantic Web	1
4.5	Resource Description Framework	1
4.6	Web Ontology Language	1
5	Modelling and aggregating social network data:	
5.1	State-of-the-art in network data representation	1
5.2	Ontological representation of social individuals	2
5.3	Ontological representation of social relationships	2
5.4	Aggregating and reasoning with social network data	2
6	Social-semantic applications:	
6.1	Generic Architecture	1
6.2	Sesame- Elmo – Graph util	2
6.3	Flink-Open academia	1

Module No.	Topic	No. of Periods
7	Social network extraction:	
7.1	Survey method	1
7.2	electronic data extraction	1
7.3	Data collection	1
7.4	Optimization	1
7.5	Semantic Web Tool demo and Exercise	2
		36

Course Designer:

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17CAPR0**OPEN SOURCE SOFTWARE**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

This course aims at facilitating the students to understand open source software practices and tools. The course helps the students to use the open source software in operating systems, Programming and web framework in approaching real time applications.

Prerequisite

- 17CA120 : Programming in C
- 17CA150: Database Management Systems
- 17CA320 : Internet and Java Programming

Course Outcomes

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

- CO1: Explain the significance of open source practices and guidelines. Understand
- CO2: Manipulate open source databases based on user requirements Apply
- 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

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

Assessment Pattern

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

Course Level Assessment Questions

Explain the significance of open source practices and guidelines (CO1):

1. State the significance of using open source software.
2. Present an overview on the environment tools and systems necessary for open source software practice
3. Give guidelines on using the open source software.

Manipulate open source databases based on user requirements (CO2):

1. Differential NO SQL from SQL.
2. Write a query to retrieve all tutorials titled "MongoDB operations".
3. Demonstrate the usage of Sort command in Mongo DB.

Implement web programming with PHP (CO3):

1. Give code to set and retrieve cookies in PHP.
2. The exam portal of ABC institute needs to maintain sessions for attendance management of students. Each faculty must be given sessions to update attendance of the courses handled by them. Write PHP code to establish sessions.
3. Write a simple PHP program to check that emails are valid.
4. Write a PHP script to generate simple random password [do not use rand() function] from a given string.

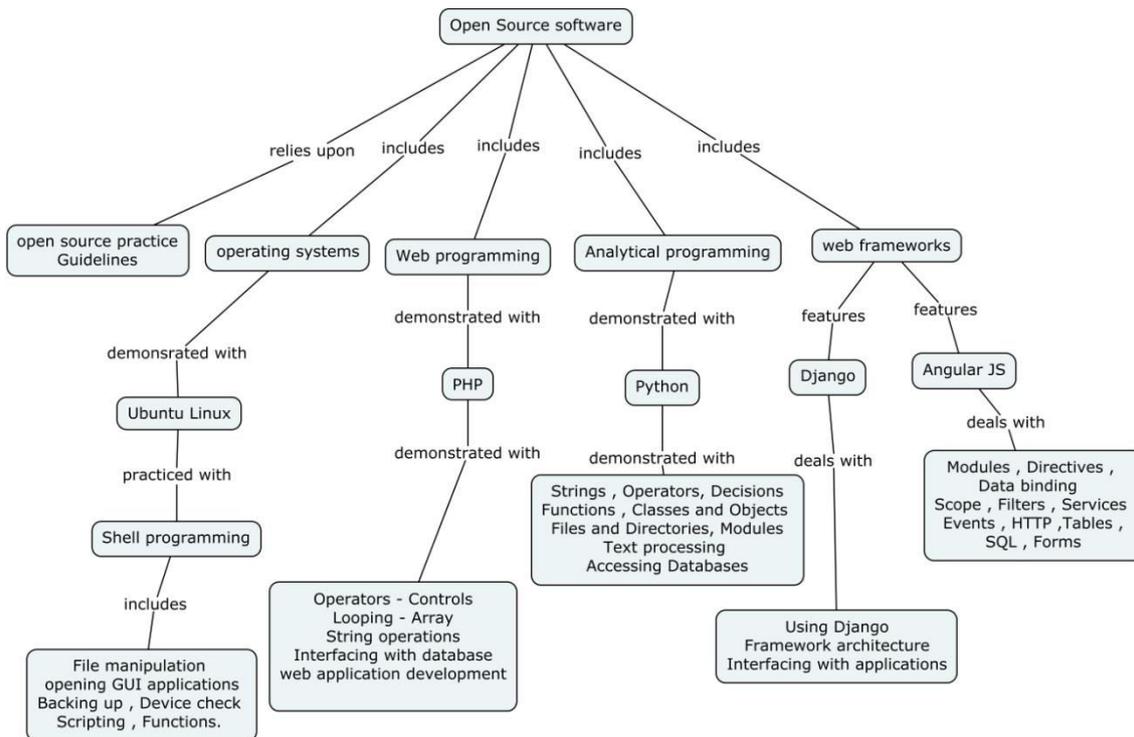
Write desktop and web applications with Python (CO4):

1. Write a Python program which accepts the radius of a circle from the user and compute the area.
2. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are same from a given list of strings.
3. Write a Python program that accepts a word from the user and reverse it.
4. Write a Python program that accepts a hyphen-separated sequence of words as input and prints the words in a hyphen-separated sequence after sorting them alphabetically.

Integrate open source web frameworks in an application (CO5):

1. Demonstrate the integration of Angular JS with HTML.
2. Explain Angular JS boot process.
3. Write down the directives necessary for Angular JS framework in an online restaurant application.
4. Present the architecture of Django.

Concept Map



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, Joaquín Seoane Pascual, 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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Introduction	
1.1	Need for free and open source software, Development environment tools and systems	1
1.2.	FOSS practices -programming guidelines	1
2	PHP	
2.1	PHP Language Basics	1
2.2	Functions - calling a function, variable function, and anonymous function	1
2.3	Strings - cleaning, encoding and escaping and comparing strings	2
2.4	Arrays – storing data in arrays, extracting multiple values, traversing, and sorting arrays	1
2.5	Objects – creation, introspection, and serialization	2
2.6	Web Techniques – processing forms and maintaining state	1
2.7	Connecting to databases	1
3	Python Programming	
3.1	Strings – Operators – data types	1
3.2	Decisions- Loops - Functions	2
3.3	Lists	1
3.4	Classes and Objects	1
3.5	Files and Directories	1
3.6	Text processing	1
3.7	Accessing Databases	1

3.8	Simple web application using python	1
4	Open source databases	
4.1	MYSQL , Postgre SQL, Mongo DB features	2
4.2	Database demonstration with Mongo DB , Insert, Delete, update and query	1
4.3	Projection, Aggregation, Sorting	1
4.4	Sharding	1
4.5	Integration with front end application.	1
5	Web frameworks	
5.1	Angular JS: Introduction – Modules – Directives	1
5.2	Data binding – Scope – Filters	2
5.3	Services – Events	2
5.4	Tables - Forms	2
5.5.	Django Frame work	1
	Total	34

Course Designer:

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17CAPS0**SOFT COMPUTING**

Category	L	T	P	Credit
PE	3	0	0	3

Preamble

Soft Computing represents a collection or set of computational techniques in computer science and engineering, which investigate, simulate, and formalize the human ability to make rational decisions in an environment of uncertainty, imprecision, partial truth, and approximation. The course is designed to introduce students to soft computing concepts and techniques and foster their abilities in analyzing soft computing based solutions for real-world problems.

Prerequisite

- 17CA230 : Design and Analysis of Algorithms
- 17CA120/17CA220/17CA320 : Programming in C/C++/Java

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 |

Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

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

Course Level Assessment Questions

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

1. What are the advantages of using Soft Computing?
2. Identify the major categories of soft computing techniques.
3. Give few applications that uses soft computing techniques and explain them in detail.
4. How is Artificial Intelligence and soft computing interrelated?
5. Explain in detail about the dependency between machine learning and soft computing.
6. Is soft computing strictly a part of software solutions? Give reasons.

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

1. Give some common applications of fuzzy logic?
2. What are the different methods of De-fuzzification?
3. What are the parameters to be considered for the design of membership function?
4. Find the fuzzy max and fuzzy min of A and B
Let $A = \{(x_1, 0.2), (x_2, 0.7), (x_3, 0.4)\}$ and $B = \{(y_1, 0.5), (y_2, 0.6)\}$ be two fuzzy sets defined on the universe of discourse $X = \{x_1, x_2, x_3\}$ and $Y = \{y_1, y_2, y_3\}$ respectively. Find the Cartesian product of the A and B and fuzzy relation R.
5. A realtor wants to classify the houses he offers to his clients. One indicator of comfort of these houses is the number of bedrooms in them. Let the available types of houses be represented by the following set.
 $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
The houses in this set are described by u number of bedrooms in a house. The realtor wants to describe a "comfortable house for a 4-person family," using a fuzzy set. Derive a solution for this.

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

1. What are the types of learning?
2. Mention the linear and non-linear activation functions used in ANN.
3. What is perceptron?
4. What is feed forward network? Give example.
5. Compare Supervised neural networks with unsupervised neural networks.
6. Explain multilayer perceptron with its architecture. How is it used to solve XOR Problem?
7. A two layer network is to have four inputs and six outputs. The range of the outputs is to be continuous between 0 and 1. What can you tell about the network architecture? Specifically,
 - (a) How many neurons are required in each layer?
 - (b) What are the dimensions of the first-layer and second layer weight Matrices? (Hidden layer neurons are 5)
 - (c) What kinds of transfer functions can be used in each layer?

Use genetic algorithms to combinatorial optimization problems (CO4):

1. Define: optimization
2. Mention the different methods selection.
3. What are the genetic operators used in GA?
4. Analyze the different methods of generating the population in genetic algorithms and make a comparison study.
5. Probe two different scenarios where binary coded and real coded GA apply themselves.

6. Perform two generations of simple binary coded and real coded genetic algorithm to solve the following optimization problem. Maximize $f(x) = |x| \sin(x)$ $-5 \leq x \leq 5$, x is real number. Use proportionate selection, single point crossover, and binary mutation for simple GA and proportionate selection, Arithmetic crossover, and Gaussian mutation for RGA. Use population size of six for both SGA and RGA. Evaluate the performance of SGA and RGA after two generations.

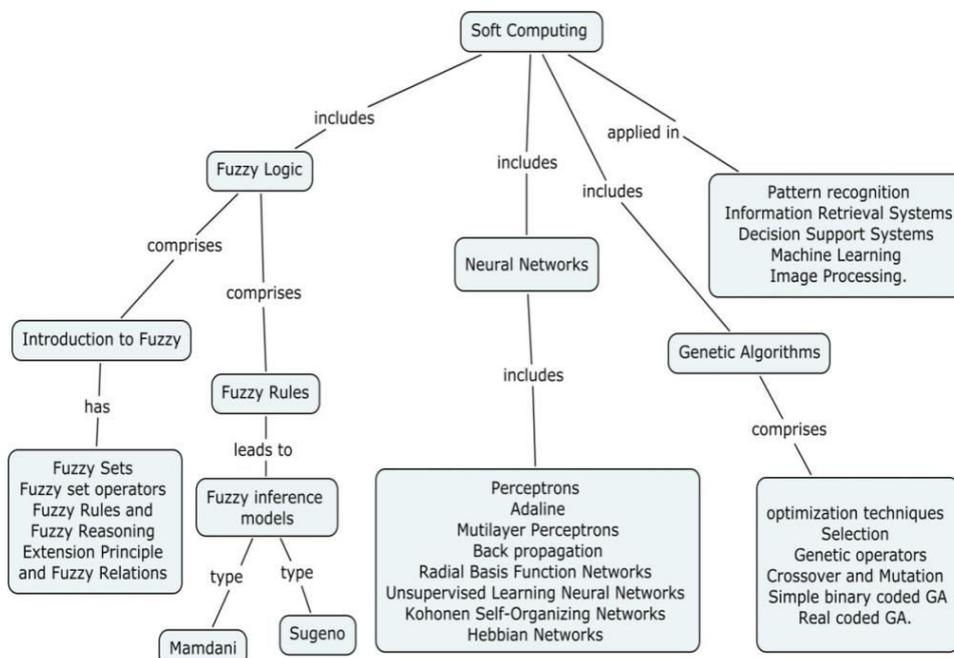
Explain the behavior of evolutionary computing algorithms (CO5):

1. Explain the working principle of Particle Swarm Optimization.
2. Give the formula for updating pherone value in Ant Colony optimization.

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

1. Analyze the application of Soft computing in Image Processing.
2. Justify and give suggestion of improving IR systems with Soft Computing techniques.
3. Consider a character recognition problem from a given handwritten text. Justify the use of Neural networks and genetic algorithms in getting the needed output.
4. Consider a 4 input, 1 output parity detector. The output is 1 if the number of inputs is even. Otherwise, it is 0. Is this problem linearly separable? Justify your answer.

Concept Map



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 – Kohonen 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)
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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lecture hours
1. Introduction		
1.1	Introduction to Soft Computing	1
1.2	Artificial intelligence	1
1.3	Basic applications and techniques	1
2. Fuzzy Set theory		
2.1	Fuzzy sets – Basic Definition and Terminology	1
2.2	Fuzzy Set operators	
2.3	Fuzzy Rules and Fuzzy Reasoning	2
2.4	Extension Principle and Fuzzy Relations	1
2.5	Fuzzy Inference Systems – Mamdani Fuzzy Models	1

2.6	Sugeno Fuzzy Models – Fuzzy Modeling	2
2.7	Case study for Fuzzy inference system	1
3. Optimization Techniques		
3.1	Introduction to optimization techniques	2
3.2	Genetic Algorithms	1
3.3	Selection - Genetic operators	2
3.4	Crossover and Mutation	
3.5	Binary coded GA – Real coded GA	2
3.6	Particle Swarm Optimization	2
3.7	Ant Colony Optimization	1
3.8	Case study for Genetic algorithm	1
4. Neural Networks		
4.1	Introduction - Supervised Learning Neural Networks	1
4.2	Perceptrons – Adaline	2
4.3	Mutilayer Perceptrons	1
4.4	Feedforward networks	1
4.5	Back propagation	2
4.6	Unsupervised Learning Neural Networks – Kohonen	2
4.7	Case study of Neural networks	1
5	Case study of Hybrid systems	2
		34

Course Designer:

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

Preamble

Cloud computing paradigm covers a range of distributed computing, hosting and access solutions, including service-based computing. The objective of the course is to provide comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications and implementations.

Prerequisite

- 17CA420 : Computer Networks

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

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	PO11	PO12
CO1	M											M
CO2	M				L							M
CO3	M											M
CO4	S	M	L		S		S	S	S	S		S
CO5	S	S	M	L	S	S	S	S	S	S	S	S
CO6	M	S			S		L					

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	20	20	20	20
Evaluate	0	0	0	0
Create	0	0	0	0

Course Level Assessment Questions

Describe the key technologies, architecture, strengths, limitations and applications of cloud computing (CO1):

1. Define Cloud computing, Enlist and explain essential characteristics of cloud computing.
2. What is self service provisioning?
3. Explain in brief, how cloud helps reducing capital expenditure?
4. What is the difference between process virtual machines, host VMMs and native VMMs?
5. What are the fundamental differences between the virtual machine as perceived by a traditional operating system processes and a system VM?

Explain the types and service models of cloud (CO2):

1. Explain the services provided by the Amazon infrastructure cloud from a user perspective.
2. What is cloud computing? Enlist and explain three service models, and four deployment models of cloud computing.
3. Explain a user view of Google App Engine with suitable block schematic.

Describe the core issues such as security, privacy, and interoperability in cloud platform (CO3)

1. Examine some of the common pitfalls that come with virtualization.
2. Show the reasons of Cloud Computing brings new threats
3. Classify secure execution environment and communication in cloud?
4. Show risks from multi-tenancy, with respect to various cloud environments.
5. Illustrate trusted cloud computing?

Apply suitable technologies, algorithms, and applications in the cloud computing driven systems (CO4)

1. Construct the SOAP and REST paradigms in the context of programmatic communication between applications deployed on different cloud providers, or between cloud applications and those deployed in-house.
2. Show conceptual representation of the Eucalyptus Cloud. Explain in brief the components within the Eucalyptus system.
3. Illustrate Nimbus? What is the main way to deploy Nimbus Infrastructure? What is the difference between cloudinit.d and the Context Broker?
4. Show Open Nebula Cloud? Explain main components of Open Nebula.
5. Show Xen Cloud Platform (XCP) with suitable block diagram.

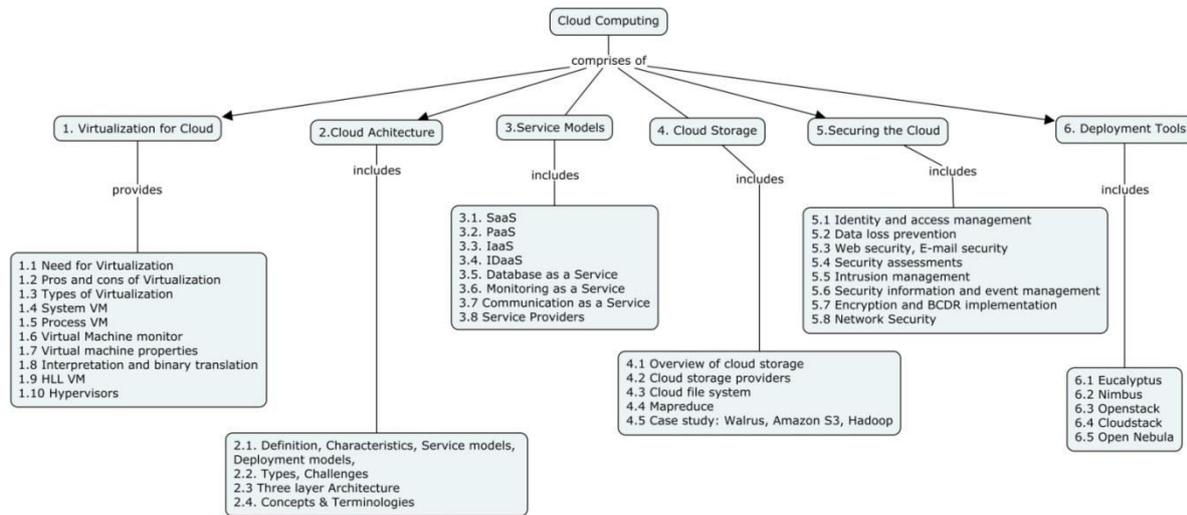
Provide appropriate cloud computing solutions for the given scenario (CO5)

1. Construct the architecture of cloud file systems (GFS, HDFS).
2. Solve with suitable example, how a relational join could be executed in parallel using MapReduce.
3. Show how Big tables are stored on a distributed file system such as GFS or HDFS.
4. Construct MapReduce model with suitable example.

Analyze how applications are deployed in cloud (CO6):

1. Explaining how applications are deployed on IaaS, PaaS, private, public and hybrid clouds.
2. Classify the Deployment tools for Cloud Application.
3. Identify different models for deployment in cloud computing.

Concept Map



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 Madiseti, "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.

Course Contents and Lecture Schedule

Module No.	Topic	No. of Lectures
1	Virtualization for Cloud	
1.1	Need for Virtualization	1
1.2	Pros and cons of Virtualization	
1.3	Types of Virtualization	1
1.4	System VM	
1.5	Process VM	2
1.6	Virtual Machine monitor	
1.7	Virtual machine properties,	2
1.8	Interpretation and binary translation	
1.9	HLL VM	2
1.10	Hypervisors :Xen, KVM , VMWare, Virtual Box, Hyper-V.	1
2	Cloud Architecture	
2.1	Definition, Characteristics, Service models, Deployment models	1
2.2	Types, Challenges	1
2.3	Three-layer architecture	
2.4	Concepts & Terminologies - Virtualization, Load balancing, Scalability and elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Service level agreement, Billing.	2
3	Service Models	
3.1	SaaS – Multitenant, OpenSaaS, SOA.	1
3.2	PaaS – IT Evolution, Benefits, Disadvantages.	1
3.3	IaaS – Improving performance, System and storage redundancy, Cloud based NAS devices, Advantages, Server types.	2
3.4	IDaaS – Single Sign-on, OpenID.	1
3.5	Database as a Service	1
3.6	Monitoring as a Service	1
3.7	Communication as services	1
3.8	Service providers - Google, Amazon, Microsoft Azure, IBM, Sales force.	1
4	Cloud Storage	
4.1	Overview of cloud storage	1
4.2	Cloud storage providers	1
4.3	Cloud file system	1
4.4	Mapreduce.	1
4.5	Case study: Walrus, Amazon S3, Hadoop.	2
5	Securing the Cloud	
5.1	Identity and access management	1
5.2	Data loss prevention	
5.3	Web security, E-mail security	1
5.4	Security assessments	
5.5	Intrusion management	1

5.6	Security information and event management	
5.7	Encryption and BCDR implementation	2
5.8	Network Security.	
6	Deployment Tools	
6.1	Eucalyptus	1
6.2	Nimbus	
6.3	Openstack	1
6.4	Cloudstack	
6.5	Open Nebula	1
Total Lectures		36

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