Department of Computer Science and Engineering
6th Sem - Course Information
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GENERAL GUIDELINES

Do's:-

- Students should be on time for every lecture.
- Students are advised to show due respect to all faculty members.
- Students should keep the Classrooms, Laboratories and Workshops clean and tidy.
- Students must maintain absolute discipline and decorum, while on campus.
- Students should come prepared with algorithm / flowchart / program / procedure for all the experiments before attending the laboratory session.
- Students should bring the data sheets and laboratory records completed in all respects to the laboratory.
- Students are advised to clarify their doubts in the respective courses with the faculty.
- Students have to inform their parents that they should follow up the progress of their wards by being in touch with the institution authorities at regular intervals.
- Students are advised to be present for the mentor meetings conducted by their respective Faculty Advisors, failing which appropriate disciplinary action will be taken.

Don'ts:-

- Students are not permitted to attend the class without the identity card, once issued.
- Ragging is strictly prohibited because it is punishable under Karnataka Education Act. Any student involved in ragging, will be severely punished – which includes handing over the case to Police, rustication from the college etc.
- Writing on desks and walls is strictly prohibited, failing which the students will be fined heavily. If the identity of the individual is not established the entire class / students in the block will be fined.
- Students must not use their cell phones during class hours. If any student is found using their cell phone during class hours it will be confiscated.
- Students are not supposed to alter the configuration of the system / any software on the systems.

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VI SEMESTER (2018-2022)

SI. No.	Course Code	Course Title	Hours per week				Credits	Tools / Languages	Course Type
			L	T	P	S	C		
1	UE18CS351	Compiler Design[!]	4	0	0	4	4	Lex and Yaac	CC
2	UE18CS352	Cloud Computing[@@]	4	0	0	4	4	Amazon AWS, Docker, Kubernetes, Github, NoSQL, databases, Flask	CC
3	UE18CS353	Object Oriented Analysis and Design with Software Engineering	4	0	0	4	4	Github, MS Project, Jupiter, StarUML/ Java	CC
4	UE18CS354	Cloud Computing Laboratory	0	0	2	1	1	Amazon AWS, Docker, Kubernetes, Github, NoSQL, databases, Flask	CC
5	UE18CS355	Object Oriented Analysis and Design with Software Engineering Laboratory	0	0	2	1	1	Github, MS Project, Jupiter, Start UML/ OO Languages	CC
6	UE18CS33X	Elective III	4	0	0	4	4		EC
7	UE18CS34X	Elective IV	4	0	0	4	4		EC
8	UE18CS390A	Capstone Project Phase-1	0	0	8	2	2		PW
		Total	**20**	**0**	**12**	**24**	**24**		
Elective – III									
9	UE18CS331	Generic Programming[#]	4	0	0	4	4	C, C++, C#	EC
10	UE18CS332	Algorithms for Intelligence Web and Information Retrieval[**]	4	0	0	4	4	Scikit, Tensorflow, Solr, Lucene Search Engines/ Python	EC
11	UE18CS333	Digital Image Processing[**]	4	0	0	4	4	Matlab	EC
12	UE18CS334	Natural Language Processing[##]	4	0	0	4	4	Tensorflow, Spacy , NLTK, SCIKIT Learn/ Python 3.x	EC
13	UE18CS335	Computer Network Security[%%]	4	0	0	4	4	Seed Labs, Wireshark, netwox, Scapy	EC
14	UE18CS336	Wireless Network Communication[%%]	4	0	0	4	4	Claynet, Python	EC
15	UE18CS337	Cyber Forensics	4	0	0	4	4	Open source Forensics Tools	EC
16	UE18CS338	Enterprise and Resource Planning	4	0	0	4	4		EC
17	UE18CS339	Hardware Accelerated Computing?	4	0	0	4	4		EC

Elective – IV									
18	UE18CS341	Design Patterns**	4	0	0	4	4	UML/ Python	EC
19	UE18CS342	Heterogeneous Parallelism!!!	4	0	0	4	4	pthread, OpenMP CUDA, openCL, Chapel, UPC.	EC
20	UE18CS343	Topics in Deep Learning&&&	4	0	0	4	4	Tensorflow 1.15, Keras 2.3.1/ Python 3.7	EC
21	UE18CS344	Advance Computer Networks***	4	0	0	4	4	Claynet, Cisco packet tracer	EC
22	UE18CS345	Bio-inspired Computing**	4	0	0	4	4	Matlab	EC
23	UE18CS346	Social Network Analytics%%%	4	0	0	4	4	Gephi, VNetLogo, NetwotkX, SocNetV	EC
24	UE18CS347	Information Security	4	0	0	4	4	Seed Labs, Scapy, Burp-Suit,N-Map, 'C'	EC
25	UE18CS348	Human Computer Interaction	4	0	0	4	4		EC

Note: Desirable Knowledge: !UE18CS202, UE18CS254,@@UE18CS301,UE18CS302.
Pre-requisite Courses: #UE18CS151, UE18CS202, UE18CS251 **- UE18CS251, ##UE18CS303, %%UE18CS301.
Pre-requisite Courses: !!!-UE18CS151, UE18CS253, &&&-UE18CS303, ***UE18CS301, %%%UE18CS202, UE18MA251, ? UE18CS201.

ELECTIVES TO BE OPTED FOR SPECIALIZATION

Sl. No.	SPECIALIZATION	ELECTIVE – III	ELECTIVE – IV
A	System and Core Computing(SCC)	UE18CS331, UE18CS332, UE18CS339.	UE18CS341, UE18CS342
B	Machine Intelligence and Data Science(MIDS)	UE18CS332, UE18CS333, UE18CS334, UE18CS335, UE18CS338.	UE18CS343, UE18CS345 UE18CS346, UE18CS347, UE18CS348.
C	Network and Cyber Security(NWCS)	UE18CS335, UE18CS336, UE18CS337.	UE18CS344, UE18CS347.

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UE18CS351: Compiler Design (4-0-0-4-4)

# of Credits : 4 **# of Hrs: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of portions covered	
			Reference Chapter	Cumulative
UNIT 1: I Compilers (10 hours)				
1	**T1 Ch 1, 1.1-1.2 and Ch 3, 3.1-3.5**	Introduction, Language Processing System	17.86%	17.86%
2		Structure of a Compiler, Grouping of phases into passes		
3				
4		Role of the Lexical Analyser		
5		Input Buffering		
6				
7		Specification of Tokens		
8		Recognitionof Tokens		
9				
10		Lexical Analyser Generator		
UNIT 2 Syntax Analysis (12 hours)				
11	**T1 Ch 4, 4.1.1,4.1.3-4.1.4, 4.2-4.3, 4.4.1-4.4.6, 4.5, 4.6, 4.7**	The role of the parser	21.43%	39.29%
12		CFG, Ambiguity, Eliminating Left Recursion, Left Factoring		
13		Syntax Error Handling, Error-Recovery Strategies.		
14		Top-down parsing: Recursive Descent Parser (RDP) with Backtracking		
15		LL(1) Parser		
16				
17		Bottom-up parsing Introduction, Shift-Reduce Parsing		
18		LR (0)		
19		SLR		
20		LR(0) AND SLR : MORE EXAMPLES		
21		CLR, LALR		
22				
UNIT 3: Syntax-Directed Translation (12 Hours)				
23	T1 **ch 5, 5.1-5.3, 5.4.1-5.4.4, 5.5**	Syntax-directed definitions	21.43%	60.72%
24		Evaluationorders for SDD's,		
25				
26				
27		Applications of Syntax-Directed Translation		
28		Syntax-directed Translation Schemes – Postfix Translation Schemes.		
29		Parser Stack Implementation: Parser Stack Implementation of Postfix SDT's,		
30				
31		SDT's with actions inside Productions		
32		SDT's for L-Attributed Definitions		
33		Implementing L-Attributed SDD's: Bottom-Up		

34		Parsing		
UNIT 4 : Intermediate-Code Generation (12 Hours)				
35	T1	Variants of Syntax Trees – Directed Acyclic Graphs for Expressions	21.43%	82.15%
36				
37	Ch 6, 6.1-6.2, ch 8, 8.4 : 8.4.1-8.4.6, ch 8, 8.5, Ch 9, 9.1-9.2	Three-Address Code – Addresses and Instructions, Quadruples, Triples, Indirect Triples, SSA Form,		
38		Control Flow Graph.		
39				
40		Optimization of Basic Blocks.		
41				
42		Machine Independent Optimization: Different Optimizations,		
43				
44				
45		Next-use algorithm.		
46		Data Flow Analysis: Live-variable analysis		
UNIT 5 : Run-Time Environments (10 Hours)				
47	**T1 ch 7, 7.1-7.3 ch 8, 8.1-8.3, 8.6**	Storage Organization, Different Allocation Strategies, Stack Allocation of space, Access to Non local Data on the stack.	17.85%	100%
48				
49				
50		Code Generation: Issues in the design of a code generator		
51				
52		Target language		
53		Addresses in the target code, static allocation, stack allocation, run-time addresses for names		
54				
55		A Simple Code generator - The Code generation algorithm		
56				

Literature:

Book Type	Code	Title & Author	Publication Info		
			Edition	Publisher	Year
Text Book	T1	Compilers–Principles, Techniques and Tools Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffery D. Ullman	2nd	Pearson Education	2009
Reference Book	R1	"Modern Compiler Design", Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen,	2nd	Pearson Education	2012

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UE18CS352 – Cloud Computing (4-0-0-4-4)

# of Credits : 4 **# of Hours: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
1	Unit 1: Cloud Programming Models	Parallel computing T1-6.2.1 and https://www.omnisci.com/technical-glossary/parallel-computing#:~:text=Parallel%20computing%20refers%20to%20the,part%20of%20an%20overall%20algorithm.	21.4	21.4
2		Grid computing - T1-1.3.2, T2-Pg 374-381		
3		Introduction – background, business case, computing models (T2-chap 1 pg 8-18)		
4		Technology challenges, public private clouds (T2-chap 1 pg 8-18)		
5		Distributed System Models & business drivers (T2-chap 1 pg 8-18)		
6		Cloud Architecture (T1 4.3.1)		
7		IaaS Programming Model (T1-4.1.3) and AWS demo		
8		REST – (T1-5.1.1), Web Services (T1- 5.1.2-5.1.2.1)		
9		Paas Programming Model (T1-4.1.4) and demo SaaS (T1-4.1.4) and demo		
10		Communication using Message queues - pub sub model (textbook ref not found)		
11		SaaS Programming model – Microservices and monolithic model (ref last year slides, textbook ref not found)		
12		Challenges of migrating monolithic applications (ref last year slides, textbook ref not found)		
13	Unit 2: Virtualization	Types of hypervisor (T1-3.2.1),	21.4	42.8
14		Paravirtualization (T1-3.2.3) and Transparent virtualization (ref not found)		
15		Software – trap and emulate, binary translation (T13.3.1)		
16		Hardware (T13.3.1)		
17		Memory virtualization T1-3.3.3		
18		Goldberg Popek principles for Virtualization (internet ref)		
19		VM Migration:T1-3.4,		
20		Lightweight virtualization-Containers , namespaces, cgroups (R1-1.1.3)??		
21		Deployment of cloud native applications through Docker – Unionfs (R1-7.2.1)		
22		DevOps (R2, Pg 3-7)		
23		Orchestration and Kubernetes (R2, Pg 10-16)		
24		Demo Amazon ECS		
25	Unit:3 Distributed Storage	Storage layers – introduction – block storage (T2-pg 39 or pg 369-373),	21.4	64.2
26		Object storage (T2:pg 365, 219-224) ,		
27		Replication, lag (T2: pg 91, pg 205-219)		
28		Multileader replication (T2: pg 91, pg 205-219)		
29		Leaderless Replication (T2: pg 91, pg 205-219)		
30		Consistent hashing (T2: pg 91, pg 205-219)		
31		Partitioning – key-value data (T2: pg 91, pg 205-219)		
32		Partitioning - rebalancing partitions (T2: pg 91, pg 205-219)		
33		Request Routing (Slides)		
34		Consistency models (T3: pg 113)		
35		CAP theorem (T2:272- 276)		
36		Transactions, Two-phase commit (Slides)		
37	Unit 4: Cloud Controller	Master-slave v/s p2p models (T1:1.3.3)	17.9	82.1
38		Resource allocation – storage and compute (T1:4.3.2.1, 4.3.3.1,4.5.2)		
39		Scheduling algorithm (T1:2.4 and Internet ref's:		

		https://www.intechopen.com/books/scheduling-problems-new-applications-and-trends/types-of-task-scheduling-algorithms-in-cloud-computing-environment) and https://github.com/eBay/Kubernetes/blob/master/docs/devel/scheduler_algorithm.md		
40		Cluster coordination - consensus (T1:2.3)		
41		Cluster coordination – leader election (T1:2.3, R3:chap 3)		
42		Fault tolerance (T1:2.3.2.1-2.3.2.6, 2.3.3, 2.3.4)		
43		Unreliable communication (ref not found)		
44		Distributed locking (R3: chap 3 and last year slides)		
45		Zookeeper (T3: chap 3.7)		
46		Revision		
47	**Unit 5**: **Performance, Scalability and Security in Cloud**	Reverse proxies – (last year slide and internet ref)	17.9	100
48		Scaling computation - hybrid cloud and cloud bursting (ref: internet source)		
49		Multitenancy, Multitenant databases (Dinkar book and last year slides)		
50		Failure detection - checkpointing and application recovery (internet source)		
51		Cloud security requirements - physical/virtual security (T1:4.6.1 – 4.6.3.2)		
52		Risk management, security design patterns (last year slides and internet sources)		
53		Security architecture, legal and regulatory issues (last year slides and internet sources)		
54		Authentication in the cloud: Keystone (last year slides and internet sources)		
55		Cloud Threats – DoS (T1:chap 4.6)		
56		Economic Denial of Sustainability (T1:chap 4.6)		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	"Distributed and Cloud Computing", Kai Hwang, Jack Dongarra, Geoffrey Fox.ISBN: 978-0-12-385880-1, Morgan Kaufmann, 2012		Elsevier	2012
Reference Text Book	T2	"Moving to the clouds: Developing Apps in the new world of cloud computing", Dinkar Sitaram and Geetha Manjunath. Syngress, 2011		Syngress	2011
Reference Text Book	T3	"Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", Martin Kleppmann. O'Reilly,2017.		O'Reilly	2017
Reference Book	R1	"Docker in Action", Jeff Nickoloff, Manning Publications, 2016.		Manning	2016
Reference Book	R2	"Cloud Native DevOps with Kubernetes", John Arundel and Justin Domingus, OReilly, 2019.		O'Reilly	2019
Reference Book	R3	Cloud and Distributed Computing: Algorithms and Systems, Rajiv Misra and Yashwant Singh Patel		Wiley	2020

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UE18CS353: Object Oriented Analysis and Design with Software Engineering (4:0:0:0:4)

# of Hours : 56

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			Reference Chapter	Cumulative
1	Unit: 1 IntroductionRequirements Engineering and Project Management	Understand the context of Software Engineering; Fundamental drivers of Software Engineering.	21	21
2		Software Lifecycle, Generic Process framework, Phases in the development of software		
3		SDLC, PDLC, SMLC, PLC		
4		Legacy SDLC (Waterfall, V, Prototype)		
5		Incremental model, Evolutionary model, Introduction to Agile and Scrum		
6		CBSE, SOA and Product Lines, Software Requirements – Introduction Feasibility Study		
7		Software Requirements Engineering Process, Requirement Elicitation, Analysis, Requirements specification, Validation and Traceability		
8		Introduction to UML Structural model and interaction models		
9		Use case model		
10		Use case model		
11		Intro to Project Management and introduction to planning process		
12		Details of Planning, Estimation		
13	Unit : 2 Architecture and Design	Software Architecture, architectural drivers, Architectural, choices and impacts	21	42
14		Introduction to architectural views, Architectural styles and architecture/design patterns		
15		Classical and Object-Oriented system design and its techniques		
16		Object Oriented Modeling as a design technique		
17		Class model		
18		Class model		
19		Activity model		
20		Sequence model		
21		State model		
22		Component model		
23		Deployment model		
24		Exposure to a design tool		
25	Unit :3 Development and Implementation	UG System conception and class design with ATM as an illustration	21	63
26		GRASP principles Implementation		
27		SOLID principles Implementation		
28		Introduction to Implementation, Coding standards & guidelines		
29		Factors for Effective Coding		
30		Code Review/Peer Review		
31		Change, Build & Release Management		
32		Elements of a Configuration Management Systems		
33		Baselines, Repository, the SCM plan and process		

34		Management of code versions, release versions		
35		Patching and patch management.		
36		Exposure to code management tools like GitHub, Build Bot		
37	**Unit: 4** **Software Testing, Quality and Ethics**	Software Testing and the Software test Life cycle	19	82
38		Testing Strategies, Verification and Validation		
39		Planning and Documentation		
40		Manual test Techniques, Coverage Based Test Techniques		
41		Fault based test techniques, Error Based Test Techniques, Comparison of Test Techniques		
42		Test Stages and Estimating Software Reliability		
43		Software Maintenance		
44		Managing Software Quality, Taxonomy of Quality Attributes, the quality system, Software Quality assurance		
45		Software Metrics		
46		The Capability Maturity Model		
47	**Unit : 5** **IT Services Management and Dev Ops**	Software Development in a Global Env	18	100
48		Hacking &Ethics in Software Development		
49		Introduction to ITSM & ITIL		
50		ITSM		
51		ITIL		
52		Introduction to DevOps		
53		Terminologies in DevOps		
54		Pillars of DevOps		
55		Illustration of Processes in DevOps		
56		Tools in DevOps		

Text Book:
1: “Software Engineering: Principles and Practice”, Hans van Vliet 3rd edition Wiley India 2010.

Reference Book(s):
1: Object Oriented Modeling and Design with UML by Micheal Blalh and James Rumbaugh 2nd edition Pearson 2013.
2: Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling by Jennifer Davis, Ryn Daniels 3rd edition O’Reilly 2013.
3: Software Engineering, Ian Somerville, 9th edition 2009.
4: IEEE SWEBOK and Other Sources from Internet.

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UE18CS354 : Cloud Computing Laboratory (0-0-2-1-1)

The cloud computing course introduces not only the various technologies that go into building a cloud native application, but also how cloud systems are designed. The student is introduced to various tools and design techniques/tradeoffs. It also gives a flavour for the business relevance/ethics of using cloud computing.

Course Objectives:

- Introduce working with a public cloud and the terminology associated with cloud services.
- Introduce different communication mechanisms.
- Introduce cloud native programming models.
- Introduce deployment tools on the cloud like Docker and Kubernetes.

Course Outcomes:

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

- Work with a public cloud and work on.
- Build and deploy a sample application on the cloud.
- Demonstrate use of tools in building cloud applications.
- Demonstrate their learning through practical hands-on assignments.

Instructions to Students

- CC Lab sessions will be conducted **online** until further notice. A Lab instruction manual will be sent to the students every week. It will contain the program/experiment details, preparation notes/concepts and relevant steps to conduct the experiment along with the results expected. Students need to prepare well before working on the experiments.
- Experiments will have to be conducted individually, no teams or groups allowed
- Students will execute the programs from home and do the submissions as per the requirement (Edmodo , google drive, piazza - TBD) on or before the due date.
- Edmodo Class Code will be shared with the individual section students.
- Students should contact their respective lab faculty for queries on the instructions and lab conduction.
- We have initiated AWS account creation for all the students and lab faculty.
- It is the responsibility of the students to arrange for a laptop with required Operating System and environment to get access to AWS.
- Weekly submission mode and due date for each experiment will be intimated later.
- Student submissions will be auto-evaluated wherever possible.
- If the lab program solutions are shared with other students, their marks are also shared. No full marks. In some cases, Zero marks will be given. Plagiarism will be checked on every submission.
- As part of lab evaluation, 2 or more Viva's will be conducted by the respective lab faculty to validate the weekly submissions made by every student and their understanding of the
- concepts and the experiments that they conducted. During this time, you may be asked to show the execution of the programs, program code and answer a few questions on the experiments.

- Submission of the lab programs on or before the due date carries full marks. Late submissions will attract 10% penalty for every week of delay.

LIST OF CC LAB PROGRAMS PLANNED (consolidate and finalise 12 weekly experiments, lab session - 2 hours per week)

1. **(a) Connecting to Public cloud and creating a VM on the public cloud; setup the firewalls(SSH only) to allow connection to the VM. (install VM, OS on top of it, develop simple application)**
   Install EC2, EBS and S3. Creation of Amazon S3 bucket, configuration and understanding access to buckets

Study on Virtualization – Installation and Configuration of an open source virtualization technology. (VirtualBox, KVM, Xen, VMWare Esxi)

a. Install Virtualbox/VMware Workstation with linux/Ubuntu 16x on top of windows
b. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
c. Install Google App Engine. Create hello world app and other simple web applications using python/java.

Ref: https://annauniversityedu.blogspot.com/2020/10/cs8711-cloud-computing-laboratory.html

(b) Create EBS – https://docs.aws.amazon.com/whitepapers/latest/aws-overview-security-processes/elastic-block-storage-amazon-ebs-security.html

Qwiklab links -

1. https://www.qwiklabs.com/focuses/14761?catalog_rank=%7B%22rank%22%3A3%2C%22num_filters%22%3A2%2C%22has_search%22%3Afalse%7D&parent=catalog

2. https://www.qwiklabs.com/focuses/14303?catalog_rank=%7B%22rank%22%3A7%2C%22num_filters%22%3A2%2C%22has_search%22%3Afalse%7D&parent=catalog

2. **Setup a web server on the VM in the public cloud with HTTP and SSH firewall access. Create a web page on the web server and access it from your desktop. Generate HTTP load using apache benchmark(only GET for webpage) and monitor cloud usage(AWS CloudWatch). In elastic beanstalk, install apache, mysql and test GET, PUT, POST APIs**

Qwiklab links -

1. https://www.qwiklabs.com/focuses/14761?catalog_rank=%7B%22rank%22%3A3%2C%22num_filters%22%3A2%2C%22has_search%22%3Afalse%7D&parent=catalog
2. https://medium.com/zykrrtech/performance-testing-with-apachebench-e2cef6882285
3. https://medium.com/tensult/amazon-cloudwatch-an-ultimate-weapon-for-cloud-monitoring-455f327095a1
4.

3. **(a) Create Virtual Private Cloud Network,create subnets within across 2 regions,understand connectivity within and between subnets.**
   (b) Migrate application developed earlier on elastic beanstalk to VPC
   Experiment to use both public and private cloud – Data initially resides in private cloud, when load increases data is stored in public cloud

Qwiklab links -

1. **https://www.qwiklabs.com/focuses/15518?catalog_rank=%7B%22rank%22%3A13%2C%22num_filters%22%3A2%2C%22has_search%22%3Afalse%7D&parent=catalog**

2. **https://www.qwiklabs.com/focuses/15683?catalog_rank=%7B%22rank%22%3A2%2C%22num_filters%22%3A2%2C%22has_search%22%3Afalse%7D&parent=catalog**

4. **Infrastructure as a Service – Installation and Configuration of single node Openstack devstack (clone in gitHub).**

Github links -

1. **https://github.com/openstack/devstack**

5. Introduction to message queues for communication.

6. (a) Docker images; deploying docker containers.
   (b) Dockerizing the micro service app, network setup.

7. Load balancers on the cloud.

8. Introduction to kubernetes setup and sample deployment

9. Storing data persistently.

10. Zookeeper.

11. Install Hadoop single node cluster on VirtualBox with ubuntu and run simple applications like wordcount using mapreduce function

12. DevOps tool - Jenkins

Reference Book(s):

1. "Docker in Action", Jeff Nickoloff, Manning Publications, 2017.
2. "Cloud Native DevOps with Kubernetes", John Arundel and Justin Domingus, OReilly, 2019.
3. Laboratory Manual prepared by the Department of Computer Science and Engineering, PES University.

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Object Oriented Analysis and Design with Software Engineering Laboratory
Subject Code: UE18CS355

This course focuses on designing an application using Object Oriented Approach and Software Engineering Skills.
As part of the course, students are expected to do a project. The details of how this project must be done and evaluated is as described below:

Guidelines:

1: Project team has to identify an application case study ex: e-ticket/Banking/Recruitment System/Trading System
2: Team has to prepare a synopsis to enlist all the features of the chosen application.
3: Prepare a document consisting of requirements, planning, design, implementation and testing details
4: Report consisting of all the relevant documents has to be submitted.

Project Team:

The project will be done by a group of 3students (3 and no more or no less). One or two teams in a class may be an exception with prior approval of the class teacher. Teams must be among students belonging to the same section.

Laboratory Deliverables and Evaluation Details

Week 1	• Introduction to lab policies • Finalisation of Team and Title • Exploring the Design Tools (Star UML/Lucidchart/Visual Paradigm) and Libre Office / WPS
Week 2	Requirement Documentation

Week 3	Submit the Requirement Document in the specified format along with Use case model
Week 4	Project Planning
Week 5	Problem set-1 (Related to Software Engineering to be solved individually)
Week 6	Problem set-2 (Related to Object oriented design to be solved individually)
Week 7	Design -1 (Activity Diagram, Sequence Diagram, System Architecture)
Week 8	Design -2 (State Diagram, Class Diagram, Component Diagram)
Week 9	Prepare Test Cases covering all functionalities
Week 10	Implementation using either C++/Java/any OO language
Week 11	Implementation using either C++/Java/any OO language
Week 12	Implementation using either C++/Java/any OO language
Week 13	Implementation and testing with designed test cases
Week 14	Presentation/Evaluation with the report

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UE18CS331 - Generic Programming (4:0:0:0:4)

# of Credits: 4 **# of Hours: 56**

Class #	Topics to be Covered	% of Portion covered	
		Syllabus	Cumulative
1-2	Motivation for the course. Scheme of the course. Introduction	20/56%	20/56%
3-5	Function call resolution in C++; overloading; generic function; implicit and explicit instantiation; specialization of function		
6-9	Variable – name, location, value, type, storage class, qualifier, life and scope – build cycle – linkage concept		
10-11	Class - fundamental operators		
12-13	tutorial		
14-15	Template function – orthogonal template parameters – callback – functorintro to lamdda		
16-17	Lambda – capture – life and scope – generic lambda – auto - decltype		
18-19	Template class – type paramenter		
20	Iterator		
	tutorial		
21-22	Introduction to STL; philosophy of STL	40/56	40/56
23-24	Use of STL algorithms and containers		
25-26	Use of STL algorithms and containers		
27-28	Use of STL algorithms and containers		
29-30	tutorial		
31-32	Template Metaprogramming - programming with types at compile time		
33-34	Template metaprogramming - - Traits & policies		
35-36	Design of classes, algorithms and iterators		
37-38	Design of classes, algorithms and iterators		
39-40	Tutorial		
41-42	Generics in Java	56/56	56/56
43-44	Generics in Java		
45-47	Generics in C#		
48-50	Generics in C#		
51-53	Generics in C#		
54-56	Tutorial		

Literature

Book Type	Title & Author	Publication Information		
		Edition	Publisher	Year
Text Books	A tour of C++, Bjarne Stroustrup	2	Pearson	2018
	C++ templates the complete guide David Vandevoorde, Nicolai M. Josuttis, and Douglas Gregor	2	Addison-Wesley Professional	2017
	STL Tutorial and Reference Guide: C++ Programming with the Standard Template Library	2	Addison-Wesley Professional; 2nd edition	2001
	Java Documentation: *generics https://docs.oracle.com/javase/tutorial/java/generics/index.html *collections https://docs.oracle.com/javase/10/docs/api/java/util/Collections.html			
	Microsoft documentation: C# Programming Guide *https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/*			
Reference Book	Effective C++, Scott Meyers			
	More effective c++, Scott Meyers			
	Effective Modern C++, Scott Meyers			
	Effective STL, Scott Meyers			
	Exceptional C++ : Herb Sutter			
	More Exceptional C++ : Herb Sutter			

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UE18CS332: ALGORITHMS FOR INTELLIGENCE WEB AND INFORMATION RETRIEVAL (4:0:0:0:4)

# of Credits: 4 **# of Hours: 56**

Class No	Chapter Title / Reference Literature	Topics to be covered	% of portions covered	
			Reference chapter	Cumulative
1	Overall understanding of what will be covered in the course	Detailed Course Introduction unit 1-3, Detailed Course Introduction unit 4-5	1	1
2	T1 : Chapter 1 - section 1.1, 1.2, 1.3	An example information retrieval problem, Inverted Index, Boolean Query Processing with Inverted Index	1	2
3	T1 : Chapter 1- section 1.4, Page 13	Boolean Retrieval Examples and Shortcomings, Boolean Query Optimization	2	4
4	T1 : chapter 2 - Page 18-33, section 2.3, 2.4.1	Text, Tokens, Terms ; Skip Pointers; Bi-word indexes	1	5
5	T1 : chapter 2 - section 2.4.2, 2.4.3 T1 : chapter 3, section 3.1	Positional Index, Dictionary and Posting List Implementation	2	7
6	T1 : chapter 3- section 3.2, 3.2.1	Tolerant retrieval , Wild card query, Permuterm Index	2	9

7	T1 : chapter 3- section 3.2.2, 3.3, 3.3.1, 3.3.2	K gram index, Introduction to Error Correction	2	11
8	T1 : chapter 3- section 3.3.3	Edit Distance and Weighted Edit Distance	2	13
9	T1 : chapter 3 - section 3.3.4, 3.3.5	K gram overlap and Context sensitive spelling correction	2	15
10	T1 : chapter 3-section 3.4	Phonetic Error Correction and Summary of Unit 1	2	17
11	T1 : chapter 4- section 4.1, 4.2	Hardware Basics, Blocked Sort based Indexing (BSBI)	2	19
12	T1 : chapter 4 - section 4.3	Single-pass in-memory indexing (SPMI)	1	20
13	T1 : chapter 4- section 4.4	Distributed Indexing	2	22
14	T1 : chapter 4- section 4.5	Dynamic Indexing	2	24
15	T1 : chapter 5- section 5.1	Term statistics	2	26
16	T1 : chapter 5- section 5.2	Dictionary Compression	2	28
17	T1 : chapter 5- section 5.3	Posting Compression	2	30
18	T1 : chapter 6 - section 6.2	Term frequency and weighting	2	32
19	T1 : chapter 6- section 6.3	Vector space model for scoring	2	34
20	T1 : chapter 6 - section 6.4	Variant TF IDF functions	1	35
21	T1 : chapter 7- section 7.1	Efficient scoring and ranking	2	37
22	T1 : chapter 7- section 7.3	Vector space scoring and query operator interaction , Summary of Unit 2	1	38
23	T1 : chapter 8- section 8.1,8.2	Evaluation benchmark	1	39
24	T1 : chapter 8- section 8.3	Unranked evaluation	1	40
25	T1 : chapter 8- section 8.4	Ranked evaluation	1	41
26	T1 : chapter 8- section 8.5	Assessing relevance	2	43
27	T1 : chapter 9- section 9.1	Relevance Feedback	2	45
28	T1 : chapter 9- section 9.2	Query expansion	2	47
29	T1 : chapter 10- section 10.2,10.3	A vector space model for XML retrieval	2	49
30	T1 : chapter 10- section 10.5	Text Centric vs Data centric XML retrieval	2	51
31	T1 : chapter 12- section 12.1, 12.2	Language Models and Query likelihood model	2	53
32	T1 : chapter 12- section 12.3	Language Modeling vs. other approaches , Summary of Unit 3	2	55

33	T1 : chapter 19- section 19.1	Web IR introduction, Web Characteristics	1	56
34	T1 : chapter 19- section 19.4	Search User Experience	1	57
35	T1 : chapter 19- section 19.3	Advertising as Economic model	2	59
36	T1 : chapter 19- section 19.5	Index size	2	61
37	T1 : chapter 19- section 19.6	Handling near duplicates	2	63
38	T1 : chapter 20- section 20.1,20.2	Crawler overview	2	65
39	T1 : chapter 20- section 20.3,20.4	Distributed indexes and connectivity servers	2	67
40	T1 : chapter 21- section 21.1,21.2	Web as a graph and PageRank	2	69
41	T1 : chapter 21- section 21.2	PageRank -2	2	71
42	T1 : chapter 21- section 21.3	HITS algorithm	2	73
43	T1 : chapter 21- section 21.3	HITS algorithm - 2	2	75
44	Overall understanding	Building a complete search system, Summary of Unit 4	2	77
45	T1 : chapter 13 - section 13.3, 13.5	Naïve Bayes – multinomial and Bernoulli, Feature Selection approaches in text classification	3	80
46	T1 : chapter 14- section 14.2, 14.3 T1 : chapter 15- section 15.2	Vector Space classification – Rocchio, KNN and SVM for text	2	82
47	T1 : chapter 14 - section 14.4	Linear vs. non linear text classification	2	84
48	T1 : chapter 14- section 14.6	Bias variance trade off in text classification	2	86
49	T1 : chapter 15- section 15.3	Classification issues for text documents	2	88
50	T1 : chapter 16- section 16.5	Model based clustering	2	90
51	T1 : chapter 18-18.2,18.3	Matrix decomposition and latent semantic indexing - 1	2	92
52	T1 : chapter 18- 18.4	Matrix decomposition and latent semantic indexing - 1	2	94
53	Material to be provided	Topic classification and Topic Model	2	96
54	Material to be provided	Text Summarization	2	98
55	Material to be provided	Question Answering system	1	99
56	T1 : chapter 8.7	Snippet Generation, Personalized IR, Summary of Unit 5	1	100

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	"Introduction to Information Retrieval", Christopher D. Manning, PrabhakarRaghavan, HinrichSchutze	South Asia Edition 2018	Cambridge University Press	2009
Reference Book	R1	"Speech and Natural Language Processing", Daniel Jurafsky and James H. Martin	2nd	-	-

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UE18CS333 – Digital Image Processing (4:0:0:0:4) # of Hours: 56

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered % Syllabus %Cumulative
1	**Unit#1 Introduction and Image Enhancement in Spatial Domain T : Chapter 1,2,3.1-3.4**	Origins, example fields and various components	**25% 25%**
2		Basics of visual perception	
3		Image acquisition	
4		Sampling	
5		Quantization	
6		Relationship between pixels	
7		Review of relevant linear algebraic concepts	
8		Interesting problems in the field of image processing	
9		Basics of spatial processing, Negative, log,, power law	
10		Piece wise linear functions	
11		Histograms and using histogram statistics for processing	
12		Histogram equalization and matching	
13		Mechanics of spatial filtering	
14		Correlation and convolution	
15	**Image enhancement In the spatial domain T: Chapter 3 3.5-3.6 Image enhancement in the frequency domain T1: Chapter 4, 7 4.7-4.10, 7.8,7.9,11.5**	Smoothing and sharpening filters, order statistics filtering	21.43% 46.43%
16		First and second derivatives for filtering, Image gradient	
17		Basics of the Fourier transform and interpreting an image in the transformed domain	
18		Correspondences between the space and frequency domains	
19		Smoothing and Sharpening in the frequency domain	
20		Ideal versus optimal filters, Types of noise that can affect an image and enhancement	
21		Evaluating the performance of the filter	
22		Introduction to multi-resolution transformations or the space-frequency domain	
23		Image transformation and subband coding for denoising, compression and feature extraction	
24		Introduction to Matrix and Wavelet based Transforms	

25		Slant Transform and Haar Transform	
26		K-L Transform	
27	**Unit#3 Morphological processing and image segmentation T: Chapter 9, 10 9.1-9.6 10.1-10.5**	**Morphological processing basics**	17.86% 64. 29%
28		Erosion, dilation, open and closing	
29		Hit or miss	
30		Some algorithms – boundary extraction, hole filling, thinning	
31		Gray scale morphology	
32		**Segmentation basics** – point, line and edge detection	
33		Thresholding – global, using Otsu's method, multiple thresholds	
34		Segmentation using region-growing and region-merging	
35		Segmentation using morphological operations revisited	
36		An overview of other segmentation techniques	
37	**Unit #4 Colour image processing and basics of image compression T : Chapters 6, 8 6.1-6.9 8.1-8.9**	**Colour image processing basics**	17.86% 82.15%
38		Colour models, pseudo colour images	
39		Colour transformations, Smoothing and sharpening of colour images	
40		Image segmentation based on colour, Noise in colour images	
41		**Basics of image compression** - concept of redundancy	
42		Some encoding techniques – Huffman coding	
43		Run length coding, symbol based encoding	
44		Block transform coding	
45		Compression of colour images	
46		An insight to extending these ideas to process video frames	
47	**Unit #5 Feature Extraction and Image Pattern Classification T: Chapters 11.7,12.2-12.6**	Scale Image Feature Transform	17.85% 100%
` 48		Scale Image Feature Transform	
49		Patterns and Pattern Classes, Pattern Classification by prototype matching	
50		Bayes Classifier for Gaussian Pattern Classes	
51		Neural Networks and Deep Learning	
52		Neural Networks and Deep Learning	
53		Deep Convolutional Neural Networks	
54		Deep Convolutional Neural Networks	
55		Deep Convolutional Neural Networks	
56		Future aspects of Image Processing	

Literature

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T	Digital Image Processing – Gonzalez and Woods	4	Pearson	2018
Reference Book	R1	Digital Image Processing and Analysis – Scott E. Umbaugh	3	CRC Press	2017
	R2	Digital Image Procesing - S.Jayaraman, S.Esakkirajan, T.Veerakumar	Scilab	McGraw Hill Ed. (India) Pvt. Ltd.	2013
	R3	Digital Signal and Image Processing - Tamal Bose	1	John Wiley	2004

Department of Computer Science and Engineering
6th Sem - Course Information
Session: Jan – May, 2021

UE18CS334 : Natural language Processing (4:0:0:0:4)

# of Credits : 4 **# of Hours: 56**

Unit No	Class No.	Content	Chapter Title / Reference Literature	Percentage of coverage	
Unit 1	1	Introduction to NLP, Application of NLP, Why NLP is important? Connection of NLP and Machine Intelligence., Introduction to 3 themes of NLP, Learning and Knowledge, Search and Learning, Relational, Compositional and Distributional Perspectives.	Section 1.2 of TB Sec 3.8 of RB, Section 3.9 of RB Sec 3.10 and 3.11 of RB section 5.9 of RB Sec 2.1 of TB+Sec 2.8 Sec 2.2 of TB Sec 3.1 of TB Sec 3.1 of TB Sec 5.1 of TB	18	18
	2	Different phases/steps in NLP			
	3	Text Normalization: Content and Function Words, Type vs. Token, Word Tokenization and Normalization; Lemmatization and Stemming, Sentence Segmentation, Types of Ambiguity in Natural Language Processing			
	4	Morphological Parsing of words-Porter Stemmer,			
	5	Detection and Spelling Error, Minimum Edit Distance Algorithm, Noisy Channel Model ; Real World Spelling Error; , Concept of noisy channel model			
	6	Introduction to Linear classification- BoW model			
	7	Introduction to Linear classification-An example of Naive Bayes			
	8	Introduction to non-Linear classification-Feedforward Neural Network			
	9	Introduction to non-Linear classification-Feedforward Neural Network			
	10	Learning without supervision			
Unit 2	11	Introduction to n-grams , n-gram language model. Smoothing , discounting and back-off,	Sec 6.1, 6.2 of TB(Sec 4.2, 4.5, 4.7 of RB) Sec 6.2.4 of TB(4.9.1 of RB) Sec 6.2.3, 6.4.2 of TB (Sec 4.3, 4.4, 4.6 of RB) Sec 7.1 of TB (Sec 6.1, 6.2 of RB) Sec 7.2of TB (Sec 6.3, 6.4 of RB) Sec 7.3.1, 7.4 of TB Sec 6.7 of RB Sec 7.5.3 of TB Sec 8.3 of TB(Sec22.1 of RB)	22	40
	12	Kneser-Ney Smoothing			
	13	Interpolation, Perplexity as an evaluation measure			
	14	Sequence labelling as classification			
	15	Sequence labelling as structure prediction.			
	16	Viterbi algorithm and HMM			
	17	POS tagging example , POS Tagging using discriminative models (MEMM)			
	18	POS Tagging using discriminative models (MEMM)			
	19	Conditional Random Field-Discriminative Sequence labeling			
	20	Named Entity Recognition(NER), Practical NER architectures			
	21	NER continued			
	22	Sequence over utterances, Chatbots-rule and corpus based			
Unit 3	23	Syntactic Parsing, Ambiguity in parse trees, Introduction to CKY parsing	Sec13.1,13.2 of RB (437-441) Sec 13.4.1, 13.4.3 of RB 13.4.2, 13.5 of RB 14.1, 14.2, 14.3 of RB 14.4, 14.6 of RB Chap 11 of TB Chap 15 Sec 15.1, 15.2 of TB	18	58
	24	CKY PArsing Example,Chart Parsing			
	25	Earley Parser, Partial Parsing- Chunking			
	26	PCFG, Probabilistic CKY parsing of PCFG			
	27	Problems with PCFG, Probabilistic Lexicalized CFG			
	28	Introduction to dependency parsing, dependency relations,Dependecy Formalisms, Dependecy Tree banks, Evaluating parsers			
	29	**Co-reference Resolution and Discourse: Forms of referring expression. Algos for coreference resolution**			
	30	Mention pair and mention ranking model, mention detection, classifiers using hand-built features			
	31	Discourse, Segmentation-topic and functional, relations			
	32	**Shallow discourse relation**			

			Sec 15.3 of TB Sec 16.1 of TB Sec 16.3.1 of TB		
Unit 4	33	Word Senses and relations between word senses, Wordnet: A database of Lexical Relations	Sec 19.1, 19.2, 19.3(RB) Sec 20.2(RB), Sec 20.4(RB) Sec 20.5(RB), Sec 20.23(RB), Sec 20.26(RB), Sec 20.27(RB) Sec 20.28, Sec 20.29, Sec 20.30 (RB) Sec 4.1, 4.1.1(TB) 20.36 under Sec 20.7.2(RB) Sec 20.7, Sec 20.7.1, Sec 20.7.2(RB) Sec 14.1 (TB) Sec 14.5 of TB	22	80
	34	WSD: supervised WSD, dictionary and thesarus methods			
	35	Semi supervised WSD, Resnik similarity, Lin similarity			
	36	Jiang-Conrath distance, Extended Gloss overlap and Extended Lesk method			
	37	Lexicons for sentiment and affect extraction: available sentiment and emotion lexicons			
	38	Words and Vectors, TF-IDF, Pointwise mutual information			
	39	Measuring similarity, using syntax to define a word's contextevaluating vector models			
	40	Dense vectors via SVD Distributional hypothesis			
	41	Neural embeddings: skip gram and CBOW			
	42	Word2Vec and Glove, improving WOrd2vec, fastText, limitation of distributional methods.			
	43	**Buffer**			
	44	Buffer			
Unit 5	45	**Neural sequence labelling: RNN language model for POS tagging**	**Sec7.6 of TB** Sec 19.3.3(TB), Sec 18.3.1(TB) + research papers	20	100
	46	CNN for text: word and character level language model with CNN and Sentiment analysis			
	47	Seq2seq chatbots using encoder-decoder architecture, attention model			
	48	**Neural Question Answering- IR based factoid QA**			
	49	*Knowledge based QA*			
	50	Neural QA			
	51	Introduction to Transfer learning in NLP			
	52	BERT model, variants of BERT			
	53	ELMo, GPT			
	54	ULMfit			
	55	Buffer			
	56	Buffer			

Text Book:

1: "Introduction to Natural Language Processing", Jacob Eisenstein, MIT Press, Adaptive computation and Machine Learning series, 18th October, 2019.

The open source softcopy is available at githubhttps://github.com/jacobeisenstein/gt-nlp class/blob/master/notes/eisenstein-nlp-notes.pdf.

Reference Book(s):

1: "Speech and Natural Language Processing", Daniel Jurafsky and James H. Martin, 2nd edition paperback,2013.

The more up to date 3rd edition draft is available at http://web.stanford.edu/~jurafsky/slp3/.

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Department of Computer Science and Engineering
6th Sem - Course Information
Session: Jan – May, 2021

UE18CS335: COMPUTER NETWORKSECURITY (4-0-0-0-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title /Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
Unit – 1 Introduction to Computer Network Security				
1	R	Plagiarism, CIA, Passive and active attack, Attack surface categories	**17.86**	**17.86**
2	R	Vulnerabilities, Threats, Attacks and Assets		
3	R	Countermeasures, Privacy		
4	R	General data protection regulation, Security vs Privacy, Data breaches		
5	R	Vulnerabilities by category		
6	R	Real life examples of Cybercrime, IIoT Cyber-attacks		
7	R	Ransomed medical devices, The attack landscape		
8	R	MITM / Eavesdropping, Phishing, DoS		
9	R	Malware / Ransomware, Security framework		
10	R	Job outlook		
Unit – 2 Network Security Analysis				
11	T	Packet sniffing, Shared networks	**21.43**	**39.29**
12	T	Packet flow in the system, Promiscuous and Monitor mode		
13	T	Packet filter, Receiving packets using raw socket		
14	T	Packet Sniffer, PCAP library		
15	T	Types of spoofing attacks		
16	L	Lab – Packet sniffing		
17	L	Lab – Packet spoofing		
18	T	TCP attacks – SYN flooding attack		
19	T	SYN cookies, TCP reset attacks		
20	T	TCP session hijacking attack, Reverse shell		
21	L	Lab – TCP attacks		
22	L	Lab – TCP attacks		
Unit – 3 Network Security Systems				
23	T	Firewall	**21.43**	**60.72**
24	T	Building a firewall using Netfilter, Kernel modules		
25	T	Testing our firewall, Applications, Firewall evasion		
26	L	Lab – Firewall		
27	L	Lab – Firewall		
28	R	IDS (Snort) – NIDS & HIDS		
29	R	IPS, Honeypot		
30	T	VPN & types		
31	L	Lab – Virtual Private Network		
32	L	Lab – Virtual Private Network		

33	L	Lab – Firewall evasion using VPN		
34	C	Case Study – 1 (iPremier Case Study)		
Unit – 4 Risk, DNS, Heartbleed				
35	T	DNS Hierarchy, Zones, and Servers	**21.43**	**82.15**
36	T	DNS query process, DNS cache poisoning attack		
37	T	Remote DNS cache poisoning attack, Reply forgery attacks from malicious DNS servers		
38	T	DNS rebinding attack, Protection against DNS cache poisoning attacks		
39	L	Lab – DNS cache poisoning attack		
40	L	Lab – DNS remote cache poisoning attack		
41	R	IT security controls, plans and procedures		
42	R	IT security controls, plans and procedures		
43	T	Fixing the Heartbleed bug		
44	L	Lab – Heartbleed attack		
45	L	Lab – Heartbleed attack		
46	C	Case Study – 2 (University of Virginia)		
Unit – 5 Cloud & Wireless Network Security				
47	R	Cloud computing service models and layers	**17.85**	**100**
48	R	Security issues in Cloud computing		
49	R	Bluetooth security: Bluetooth protocol stack, Multiple security modes		
50	R	Mobile security: Security concepts, Requirements, Architecture		
51	R	Wireless communications and 802.11 WLAN standards		
52	R	WEP		
53	R	Wireless Protected Access (WPA)		
54	R	IEEE 802.1x, 802.11i/ WPA2		
55	R	Wireless NetworkThreats, ZigBee security		
56	R	Wireless Mesh Network security		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Books	T	Computer & Internet Security – A Hands-on Approach, Wenliang Du	2	Wenliang Du	2019
Reference Books	R	Computer Security: Principles and Practice, William Stallings & Lawrie Brown	2	Pearson	2014

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Department of Computer Science and Engineering
6th Sem - Course Information
Session: Jan – May, 2021

UE18CS338: Enterprise Resource Planning(4-0-0-0-4) # of Hours: 56

Class #	Chapter Title/ Reference Literature	Topics to be Covered	% of Portions Covered	
				Cumulative
	Unit: I Overview, Implementation Lifecycle, Business Case and ROI Analysis for ERP T1: Ch 1, 2, 3	1. Introduction to Enterprise Resource Planning Systems: Introduction to ERP, ERP Overview, Need for an ERP,	21	21
1.		Definition of ERP, Evolution of ERP Systems, Enterprise Processes,		
2.		Benefits and Challenges,		
3.		**Extended ERP, Major ERP Players – Product and Consulting Companies, ERP Implementations.**		
4.		**2. ERP Implementation Life Cycle: LCIntroduction, Life Cycle of an ERP Implementation Project, Phases**		
5.		**Phases 1-3: Activities, Deliverables, Milestones**		
6.		**Phases 4-6: Activities, Deliverables, Milestones**		
7.		ERP Implementation Methodologies		
8.		Types of ERP Projects, Deployment Strategies.		
9.		**3. Business Case and ROI Analysis for ERP:** Cost of ERP Implementation,		
10.		Benefits of an ERP System,		
11.		Building business case for an ERP System.		
12.	**Unit: II** **Change Management; BPR, BPM and BM;** T1: Ch 9, 10, 17, 18	**4. Change Management:** CM Introduction, Reasons People Resist Change,	21	42
13.		ange Management Strategies,		
14.		**Organization Design,**		
15.		**Change Management Team and Roles,**		
16.		**Change Management Activities.**		
17.		**5. Business Process Re-engineering:**BPR Introduction, Principles and Need, Definition, Phases,		
18.		**Pros and Cons, Keys to Success, Reasons for Failure, BPR Team and Roles,**		
19.		**Process Selection and Diagnosis, Process Redesign, BPR and ERP,**		
20.		Benchmarking, Best Practices.		
21.		**Business Process Modelling and Business Modelling**: BPM Introduction, **BPM Need, Guidelines, As-Is and To-Be Modelling,**		
22.		**Business Process Hierarchy, Standards for BPM, Process Modelling Software,**		
23.		**Business Modelling, Integrated Data Modelling.**		
24.	**Unit : III** **ERP Functional Modules**	**ERP** Functional Modules: **7. Human Capital Management:** Introduction,	22	64
25.		HCM Systems, Recruitment Process, KPIs, Leading HR Solutions from ERP Vendors,		

26.	T1: Ch 20, 21, 22, 24	**Strategic Vs. Operational HR Processes and HR Outsourcing, Employee Health and Safety.**		
27.		**8. Financial Management:** Introduction,		
28.		ERP Financial Applications,		
29.		Financial Modules in detail		
30.		Financial Modules in detail.		
31.		**9. Production Planning and Execution:** Understanding MRP II Concepts,		
32.		How ERP PP module supports MRP II Processes,		
33.		Five stages of MRP II Processes		
34.		Five stages of MRP II Processes		
35.		Critical master Data Elements. Managing different Production Scenarios.		
36.	**Unit: IV** **Selecting Consulting Partner and Package Selection Managing an ERP Project T1: Ch 31, 4, 5**	**10. Procurement and Inventory Management:** Procurement Process, Types, KPIs.	18	82
37.		Inventory Management Process,		
38.		Types, Models, KPIs.		
39.		**11. ERP Package Selection:** Selection Team, Selection Criteria, Parameters for Package Selection,		
40.		Request for Proposal (RFP), Gap Analysis, ERP Market.		
41.		**12. ERP Consulting Partner Selection:** Selection Criteria, RFP Process,		
42.		In-house and Offshore Implementations, Pros and Cons. ERP Consulting companies.		
43.		**13. Managing an ERP Project:** Scoping, Plan,		
44.		Charter, Risk Management. **Project Teams.**		
45.		**14.Success or Failure of ERP Implementation**: Reasons for failures of ERP Implementations, Reasons for success of ERP Implementations.		
46.	**Unit: V ERP and Enterprise applications, Case Studies** **T1: Ch 34, Sec 6**	**ERP and Enterprise Applications: 15. Supply Chain Management (SCM)**	18	100
47.		**16. Customer Relationship Management (CRM)**		
48.		**17. Product Life Cycle Management (PLM): Introduction, What is PLM – Business Drivers and Value proposition, Different Phases, Functionalities, Difference of PLM with ERP, Product Safety and Environmental Compliances.**		
49.		**18. Data Warehousing, Business Intelligence (DW-BI)**		
50.		**19. ERP on Cloud**		
51.		**20. ERP for Manufacturing and Service Industries**		
52.		**Emerging Trends in ERP space**: New models of deploying ERP and Enterprise Applications		
53.		**22. Articles and Case Studies**		
54.		**Case Studies**		
55-56		Guest Lecture		

Literature:

Book Type	Code	Title & Author	Publication Information	
			Publisher	Year
Text Book	T1	Enterprise Resource Planning- Text & Cases, Rajesh Ray	McGraw Hill, 1st Ed	2017
Ref Book	R1	ERP Demystified, Alexis Leon	McGraw Hill Education, 3rd Ed	2016
Ref Book	R2	Enterprise Resource Planning: A Managerial Perspective, Veena Bansal	Pearson Education India	2013

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UE18CS341 - Design Patterns(4:0:0:0:4) # of Hours: 56

Class #	Topics to be Covered	% of Portion covered	
		Syllabus	Cumulative
1-2	Introduction – discussion of syllabus – scheme of assessment – Concept of Interface and Implementation	22/56%	22/56%
3-4	SOLID principles		
5-6	SOLID principles		
7-8	SOLID principles		
9-10	Tutorial		
11-12	C design patterns - PIMPL		
13-14	Reference counting		
15-16	Exception pattern		
17-18	Constructor related patterns		
19-20	Constructor related patterns		
21-22	Tutorial		
23-24	Introduction to GOF patterns	24/56	46/56
25-26	Creational patterns : singleton		
27-28	Factory method, abstract factory		
29-30	Structural patterns - Iterator		
31-32	Iterator continued		
33-34	Tutorial		
35-36	Adaptor, decorator		
37-38	State, strategy		
39-40	Command, visitor, flyweight		
41-42	Other GOF patterns		
43-44	Patterns in Persistence		
45-46	Patterns in concurrency		
47-48	Antipatterns and refactoring	10/56	56/56
49-50	Organizational, project management related		
51-52	Software design, OO programming		
53-54	Methodological, configuration		
55-56	Tutorial		

Text Book:

1: "Design Patterns" Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, Pearson Publication,2013.

Reference Book(s):

1:"Design Principles and Design Patterns", Robert C Martin, 2000.
2: "Object- oriented analysis, design and implementation", Brahma Dathan, Sarnath Rammath, Universities Press,2013.
3. "AntiPatterns - The Survival Guide to Software Development Processes", Alexander Shvets, Online Reference at http://bit.ly/2e4nxzd.

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UE18CS342 – Heterogeneous Parallelism (4-0-0-4)

Credits: 4 **No. of Hours: 56**

Class #	Chapter Title / Reference	Topics to be covered	% of Portions covered	
			Reference Chapter	Cumulative
UNIT 1: Fine Grained Parallelism (12 Hours)				
1	Unit – 1 (R2: Ch 3, 4)	Introduction	22%	22%
2		Types of Parallelism		
3		ILP & Enhancement Techniques-1		
4		ILP & Enhancement Techniques-2		
5		ILP & Enhancement Techniques-3		
6		Limits of Parallelism		
7		Dependence Analysis		
8		Predication & Speculation-1		
9		Predication & Speculation-2		
10		Code Optimization		
11		Cache optimised Programming-1		
12		Cache Optimised Programming-2		
UNIT 2: Coarse Grained Parallelism (12 Hours)				
13	Unit-2 (R1: Ch 5 & 6 R2: Ch 4 & 5)	Laws of Parallelism	21%	43%
14		MultiThreaded& Multicore Architectures -1		
15		MultiThreaded& Multicore Architectures -2		
16		Introduction to OpenMP		
17		OpenMP – 1		
18		OpenMP – 2		
19		OpenMP – 3		
19		GPU Architectures – 1		

20		GPU Architectures – 2		
21		GPGPU Architectures		
22		Other Accelerators		
23		Project Discussion		
UNIT 3: Parallel Bugs & Resolution (10 Hours)				
24	Unit – 3 (R5: Ch 5)	Memory Models for Parallel Programming	21%	64%
25		Memory Consistency Models-1		
26		Memory Consistency Models-2		
27		Memory Consistency Models-3		
28		GPU Memory Models – 1		
29		GPU Memory Models – 2		
30		Data Races and Atomicity Violations		
31		Deadlocks		
32		Lock Free Structures		
33		Project Discussions		
UNIT 4: Parallel Programming Framework (12 Hours)				
34	Unit – 4 (R1: Ch 5, 6, 13 R4: Ch 2, 3)	Principles of Parallel Algorithm	19%	83%
35		Various Techniques in Parallelism		
36		Various Techniques in Parallelism		
37		Programming Paradigms		
38		Programming Paradigms		
39		Introduction to CUDA		
40		CUDA -1		
41		CUDA – 2		
42		CUDA – 3		
43		Open CL – 1		
44		Open CL – 2		
45		Open CL – 3		
UNIT 5: Parallel Programming Languages (10 Hours)				
46	Unit – 5 (R1: Ch 14, 15)	Concurrent Languages - 1	17%	100%
47		Concurrent Languages – 2		
48		C++ AMP		
49		C++ AMP		
50		Application Case Study		
51		Application Case Study		
52		Recent Trends		
53		Project Discussion		
54-56		Revision		

Literature:

Book Type	Code	Title & Author	Publication Info		
			Edition	Publisher	Year
Text Book	R1	"Programming Massively Parallel Processors", David Kirk and Wen-meiHwu	3rd	Morgan Kaufmann	2016
Reference Book - 1	R2	Computer Architecture: A Quantitative Approach: John Hennessy David Patterson	6th	Morgan Kaufmann	2017
Reference Book - 2	R3	"Computer Systems: A Programmer's Perspective", Randal E. Bryant, David R. O' Hallaron	2nd	Pearson	2016
Reference Book - 3	R4	"Introduction to Parallel Computing", Vipin Kumar, George karypis, Anshul Gupta, Ananth Grama	2nd	Addison – Wesley	2004
Reference Book - 4	R5	"Parallel Computer Architecture: A Hardware / Software Approach", David Culler, Jaswinder Pal Singh, Anoop Gupta	1st	Morgan Kaufmann	1998

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UE18CS343 – Topics in Deep Learning (4-0-0-4-4) # of Hours: 56

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
1	**Unit 1:** TensorFlowand KerasandReinforcement Learning	Artificial Neuron- A gentle understanding (T1- pg No 695-724)	21.4	21.4
2		Modelling the Neural Network (T1- pg No 725-778,839-871)		
3		Loss Function/Error Function (T1- pg No 911-939)		
4		Forward propagation (T2- pg 59-62)		
5		Backward propagation (T2 -pg 63-70)		
6		Bias and Variance Tradeoff(Course handouts)		
7		L2 Regularization(Course handouts)		
8		Batch Normalization(Course handouts)		

9		Optimizers (T2 -pg 148-204)		
10		Tensorflow and TensorBoard https://www.tensorflow.org/		
11		TensorFlow Demo https://www.tensorflow.org/		
12		Keras https://keras.io/		
13	**Unit 2: SVM**	Brief recap of the SVM problem (T3:chapter 7.1,course handout)	21.4	42.8
14		Linear non-separability problem (T3:chapter 7.1,course handout)		
15		Soft-margin SVM - Noisy Data (T3:chapter 7.1,course handout)		
16		Soft-margin SVM – dual and solution (T3:chapter 7.1,course handout)		
17		Kernel functions – linear, polynomial (T3:chapter 7.1,course handout)		
18		Kernel functions – Gaussian, other types (T3:chapter 7.1,course handout)		
19		The SMO algorithm (T3:chapter 7.1,course handout)		
20		SMO Algorithm - details (T3:chapter 7.1,course handout)		
21		Multi-class SVMs (T3:chapter 7.1,course handout)		
22		Text-classification and other scenarios (T3:chapter 7.1,course handout)		
23		SVM for Regression. (T3:chapter 7.1,course handout)		
24		SVM Revision and Numericals (T3:chapter 7.1,course handout)		
25	**Unit:3** Recurrent Neural Networks (RNN) and Unsupervised Feature Learning	Need for RNNs,Simple RNN Cells (T1 - Chapter 7)	21.4	64.2
26		RNN Toplogies,Exploding and Vanishing Gradients Static and Dynamic Unrolling through Time (T1 - Chapter 7)		
27		Variable-Length Input-Output Sequences, (T1 - Chapter 7)		
28		Training RNNs – Sequence Classifier (T1 - Chapter 7)		
29		Predicting Time Series (T1 - Chapter 7)		
30		Deep RNNs (T1 - Chapter 7)		
31		LSTM Cell and GRU Cell, (T1 - Chapter 7)		
32		Text Classification with RNN, (T1 - Chapter 7)		
33		RNN Vs Naive Bayes(course handout)		
34		Seq2Seq with Attention (T1 - Chapter 8)		
35		Bahdanauattention,Transformer Attention (T1 - Chapter 8)		

36		Unsupervised Feature Learning – Autoencoders and Variational Auto Encoders(T1 - Chapter 8)		
37	**Unit 4:** CNN, GAN and Transfer Learning	Architecture of CNNs, filters and feature maps (T2- chapter6)	17.9	82.1
38		Pooling layers, types, paddings, fully connected Layers (T2- chapter6)		
39		Case study – Image classification using Keras (class work)		
40		Case study – Image classification using Keras (class work)		
41		Capsule Networks – Introduction to Capsules (T2- chapter6)		
42		Dynamic Routing and Capsule Network Architecture (T2- chapter6)		
43		GAN - Architecture and Training Methods (T1- chapter8)		
44		Image-Generation, Hands-On Implementation Using Keras.		
45		Transfer Learning - Motivation, Variations (course handout)		
46		Use in CNNs (course handout)		
47	**Unit 5**: Paper Review and Implementation	Paper1: Study	17.9	100
48		Paper1: Study		
49		Paper1: Study		
50		Paper1: Implementation		
51		Paper1: Implementation		
52		Paper1: Implementation		
53		Paper2: Study		
54		Paper2: Study		
55		Paper2: Implementation		
56		Paper2: Implementation		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Advanced Deep Learning with Python - Ivan Vasilev, 2019		Packt Publishing	2019
Reference Text Book	T2	Hands on Deep Learning algorithm with python		Packt Publishing	2019
Reference Text Book	T3	Deep Learning with Keras: Implementing deep learning models and neural networks with the power of Python .		Packt Publishing	2017

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Department of Computer Science and Engineering
6th Sem - Course Information
Session: Jan – May, 2021

UE18CS346: Social Network Analytics (4-0-0-0-4) Hours: 56

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
1	**Unit#1** **Background and Fundamentals of network analysis:**	Introduction to Networks and Examples	**22**	**22**
2		Graph theory basics, Directions and Weights		
3		Adjacency lists and Matrices, Cliques, subnets and Cores, Connectivity and Cohesion		
4		Introduction to SNA and its applications		
5		Ego-centric Networks: homophily, Tie-strengths and structural holes		
6		Ego-centric Network extraction using Gephi. Ego-centric Network Analysis using E-Net.		
7		Representing and Measuring Networks: Degree distribution, diameters, path-lengths		
8		Clustering coefficient		
9		Centrality measures: Degree centrality, Closeness centrality		
10		Betweenness centrality, Eigenvector Centrality		
11		Link Analysis: PageRank Concepts		
12		PageRank Computation		
13	**Unit#2** **Models of Network formation**	Random Graphs: Random Network Construction	**22**	**44**
14		Giant Component, Giant Component generation demo with NetLogo and NetworkX		
15		Degree distributions		
16		Small world network: Homophily and Weak ties		
17		Watts and Strogatz - Small world network demo using NetLogo and Python		
18		Milgram's experiment, Six degrees of Kevin Bacon" game		
19		Growing Networks: Preferential Attachment Model		
20		The Barabasi-Albert model, Preferential Attachment Model demo using NetLogo		
21		Power Laws		
22		Scale-free networks		
23		Zipf's Law		

24		Fat Tails		
25	**Unit #3 Community Detection, Implications of Network Structure**	Community Structure, Community Detection Algorithm- Girvan Newman	**22**	**66**
26		Girvan Newman: Calculation of shortest-path betweenness		
27		Demo using NetworkX		
28		Community Detection-Louvain algorithm		
29		Finding overlapped Communities by Clique Percolation Method (CPM)		
30		CPM examples and Demo using CFinder		
31		Diffusion through networks, Diffusion of Innovation Theory		
32		The Bass Models		
33		Diffusion in Random networks, Giant Components, small worlds demo using NetLogo		
34		Branching process- The simplest model of contagion		
35		SIR epidemic model		
36		SIS epidemic model		
37	**Unit #4 Games on Networks**	Introduction to Game Theory	**17**	**83**
38		Game Frame, Utility function, Payoff function, Reasoning about behavior in a Game		
39		Strict, Weak and Equivalent Dominance		
40		Dominant strategies, Dominant Strategy Equilibriums and Prisoner's Dilemma		
41		Pareto Superior and Iterated deletion procedures: IDSDS		
42		Iterated deletion procedures: IDWDS and Examples		
43		Nash Equilibrium		
44		Pareto Optimality and Social Optimality		
45		Multiple equilibriums: Co-ordination Games, Hawk-Dove Game		
46		Mixed Strategies		
47	**Unit #5**	Computing Mixed Strategy Equilibria		

48	**Strategic Networks**	Computing Mixed Strategy Equilibria: Examples	**17**	**100**
49		Economic Game Theoretic Models of Network Formation		
50		Pair-wise Stability		
51		Efficient Networks, Pareto-efficient networks, and Externalities		
52		Pair-wise Nash Stability		
53		Auctions		
54		Game Theory: Problems Solving		
55		Game Theory: Problems Solving		
56		Game Theory: Problems Solving		

Text Book:

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", D Easley and J Kleinberg, Cambridge University Press, 2010.

Reference Book(s):

1. "Social and Economic Networks", Mathew O Jackson, Princeton University Press, 2010.
2. "Networks – An introduction", MEJ Neumann, Oxford University Press 2010.
3. *"Analyzing the social web"*, Jennifer Golbeck, Morgan Kaufmann, 2013.
4. "Social Media Mining-An Introduction", Reza Zafarani Mohammad Ali Abbasi Huan Liu, Cambridge University Press, 2014.

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UE18CS347: INFORMATION SECURITY- II (4:0:0:0:4) # of Hours: 56

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			% of Syllabus	Cumulative %
1-2	**Unit #1** T1: Chapter 1,2,3 R1: Chapter 1,2,3	Introduction to Information Security;	**22%**	**22%**
3-4		Security Pillars, Security Principles, Strong Passwords		
5-6		Security Development Lifecycle Security Requirements OS Security		
7-8		Set UID, Env variables, Shellshock		
9-10		LAB 1 Set UID, Environment Variable		
11-12		Shellshock attack		
13-14		Target - Case study		

15-16	**Unit #2** T1: Chapter 4,5,6 R1: Chapter 4,5,6	Buffer overflow - 1	**22%**	**44%**
17-18		Buffer overflow - 2		
19-20		LAB 2 Buffer overflow		
21-22		Return to Lib		
23-24		LAB 3 Return to lib		
25-26		Format String Attack		
27-28		LAB 4 Format String Attack		
29-30	**Unit #3** R2: Chapter 1,2,3,6,7,8	Malware	**20%**	**64%**
31-32		Threat Modelling – 1		
33-34		Threat Modelling – 2		
35-36		Threat Modelling – 3		
37-38		Privacy		
39-40		Web application Security – SQL injection		
41-42	**Unit #4** T1: Chapter 10,11,12 R1: Chapter 9,10,11	LAB 5 Web application Security – SQL injection	**22%**	**86%**
43-44		Cross site request forgery attack		
45-46		Cross site scripting		
47-48		LAB 6 XSS, CSRF		
49-50		Apple case study		
51-52	**Unit #5**	Security Testing – Static analysis	**14%**	**100%**
53-54		Fuzzy and Dynamic		
55-56		Vulnerability& Penetration testing LAB 7 Pentesting		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Computer Security – Hands on Approach", Wenliang Du	2nd	-	2019
Reference Book	R1	Computer Security – Principles and Practice", William Stallings,	3rd	-	2014
Reference Book	R2	Threat Modeling - Designing for Security	1st	Wiley	2014

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UE18CS348-HUMAN COMPUTER INTERACTION

# of Hrs: 56

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of portions covered	
			Reference Chapter	Cumulative
UNIT 1: FOUNDATIONS OF HCI (12 hours)				
1	**Chapter 1-4** **T1**	The Human: I/O channels	22%	22%
2		Memory – Reasoning and problem solving;		
3		The computer:		
4		Devices – Memory – processing and networks;		

5		Interaction: Models – frameworks		
6		Ergonomics		
7		styles		
8		elements		
9		interactivity-		
10		interactivity-		
11		Paradigms.		
12		Paradigms.		
UNIT 2: DESIGN AND SOFTWARE PROCESS (12 hours)				
13	**Chapter 5 -10 T1**	Interactive Design basics	22%	44%
14		process		
15		scenarios		
16		navigation		
17		screen design		
18		Iteration and prototyping		
19		Iteration and prototyping		
20		HCI in software process – software life cycle		
21		usability engineering – Prototyping in practice		
22		design rationale. Design rules –		
23		principles, standards, guidelines, rules ,Evaluation		
24		Techniques – Universal Design.		
UNIT 3: MODELS AND THEORIES				**(10 Hours)**
25		Cognitive models	20%	64%
26	**Chapter 12-14 T1**			
27		Cognitive models		
28		Cognitive models		
29		Socio-Organizational issues and stake holder requirements		
30		Socio-Organizational issues and stake holder requirements		
31		Socio-Organizational issues and stake holder requirements		
32		Communication models		
33		Communication models		
34		Communication models		
35		Collaboration models		
36		Collaboration models		
UNIT 4 : TASK ANALYSIS				**(10 Hours)**
37	**Chapters 15-18 T1**	Task Analysis	20%	84%
38		Task Analysis-		
39		Dialog notations		
40		Dialog notations		
41		Design,Models of the system		
42		Design,Models of the system		
43		Design,Models of the system		
44		Modeling rich interaction		
45		Modeling rich interaction		
46		Modeling rich interaction		
47		Modeling rich interaction		

UNIT 5 : OUTSIDE THE BOX:				(10 Hours)
48		groupware, augmented realities, hyper text,		
49		groupware		
50	**Chapters**	groupware		
51	**19-21**	ubiquotous computing,	16%	100%
52		ubiquotous computing,		
53	**T1**	augmented realities		
54		augmented realities		
55		hyper text,		
56		multimedia and World Wide Web		

Literature:

Book Type	Code	Title & Author	Publication Info		
			Edition	Publisher	Year
Text Book	T1	Human Computer Interaction , Dix A., Finlay J., Abowd G. D. and Beale R.,	, 3rd Edition	Pearson Education	2005
Text Book	T2	B. Shneiderman; Designing the User Interface,	Indian	Addison Wesley	2000
Text Book	T3	About Face: The Essentials of Interaction Design by Alan Cooper, Robert Reimann, David Cronin. Christopher Nooessel,	4th Edition	WILEY	2009

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