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.

VIIth SEMESTER (2014-2018)

SI. No.	Course Code	Course Title	Hours per week				Credits	Course Type
			L	T	P	S		
1	UE14CS401	Object Oriented Modeling and Design	4	0	0	0	4	CC
2	UE14CS402	Software Engineering	4	0	0	0	4	CC
3	UE14CS403$	Machine Learning	4	0	0	0	4	CC
4	UE14CS404	Object Oriented Modeling and Design Laboratory	0	0	2	0	1	CC
6	UE14CS405	Machine Learning Laboratory	0	0	2	0	1	CC
7	UE14CS406	Seminar	0	0	0	4	1	EC
8	UE14CS407*	Research Methodology	2	0	0	0	2	EC
	Elective - V							
9	UE14CS412	Enterprise Resource Planning	4	0	0	0	4	EC
10	UE14CS413$	Design Patterns	4	0	0	0	4	EC
11	UE14CS414$	Algorithms for Information Retrieval	4	0	0	0	4	EC
12	UE14CS415	Content Management	4	0	0	0	4	EC
13	UE14CS417	Computer Vision	4	0	0	0	4	EC
	Elective - VI							
14	UE14CS421	Information Security	4	0	0	0	4	EC
15	UE14CS422###	Web Services	4	0	0	0	4	EC
16	UE14CS423$$	Optical Networks	4	0	0	0	4	EC
17	UE14CS424$	Algorithms for Intelligent Web	4	0	0	0	4	EC
18	UE14CS425#	Social Network Analytics	4	0	0	0	4	EC
19	UE14CS426##	Computer Systems Performance Analysis	4	0	0	0	4	EC
	Total		20	0	4	4	23/25	
* Applicable to Lateral Entry students only								
Note: Prerequisite courses - $ UE14CS251; $$ UE14CS301; # UE14CS322; ## UE14CS253; ### UE14CS353;								

UE14CS401: Object-Oriented Modeling And Design(4-0-0-0-4)

of Hrs: 52

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion Covered	
			% of syllabus	Cumulative %
1	**Unit #1: Introduction, Use Cases and Class Models:** T1-1.1 to 1.5, 2.1 to 2.3, 3.1 to 3.5, 4.1 to 4.11, T3 -Ch1,2,3, ch-17,18	Introduction to Modeling, OO Themes, Three models	20	20
2		Introduction to UML: an overview of UML,		
3		A conceptual model of the UML, Rules of the UML,		
4		Common Mechanisms in the UML, Architecture		
5		Use Case Models		
6		Class Modeling, Class diagram		
7		Link and Association Concepts, sample class model		
8		Object Constraint Language		
9		Advanced Class Modeling		
10		Application to Case Study		
11	**Unit # 2: Dynamic Models** T1-5.1 to 5.5, 6.1 to 6.6, 7.1 to 7.3, 8.1 to 8.3, 9.1 to 9.4.	Activity Models	20	40
12		Business Process Models		
13		Sequence Models		
14		ATM Case Study: Application		
15		Class/Interaction Models		
16		State Models		
17		Advanced State Models		
18		Nested State Diagrams, Nested States		
19		Relationship between Class and State Models		
20		Application to Case Study		
21	**Unit #3: System Design** T1-14, 15, 16, 17,18,19	Component and System design, Overview of System Design,	20	60
22		Estimation of performance, Making a Reuse plan,		
23		Breaking a System into Subsystems, Identifying Concurrency,		
24		Handling Global Resources and Boundary conditions. Architectural styles		
25		Class Design, Overview, Bridging the Gap, Realizing Use Cases, Designing Algorithms, Recursing Downward, Refactoring,		
26		Design Optimization, Reification of Behavior, Organizing a Class Design. Examples.		
27		Implementation Models, Fine-tuning Classes, Generalizations, Realizing Associations, Testing		

28		Deployment Models, Object-Relational Mapping,		
29		Database Design, Abbreviated ATM Model		
30		Implementing Structure and Functionality,		
31	**Unit #4: Object Oriented Design Principles:**	GRASP Design Principles	20	80
32		GRASP Design Principles, Creator, Information Expert,		
33		Low Coupling, Controller		
34		High Cohesion, Indirection		
35		Polymorphism, Protected Variations, Pure Fabrication		
36		SOLID Design Principles		
37		Single Responsibility, Open-Closed,		
38		Liskov Substitution,		
39		Interface Segregation,		
40		Dependency Inversion		
41	**Unit #5: Design Patterns**	What Design Patterns are,	20	100
42		How Design Patterns Solve Problems,		
43		How to Select a Design Pattern,		
44		and How to implement a Design Pattern.		
45		Introduction to widely used Design Patterns,		
46		Creational Patterns		
47		Abstract Factory, Builder		
48		Factory Method, Prototype		
49		Structural Patterns, Adapter, Bridge, Composite		
50		Decorator, Façade		
51		Behavioral Patterns		
52		Interpreter, Iterator, Mediator, Memento, Observer, state Strategy, Template Method		

Literature:-

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Textbook	T1	"Object-Oriented Modeling and Design with UML", Michael R Blaha and James R Rumbaugh	2nd	Pearson	-
Reference	T2	" Applying UML and Patterns", Craig Larman	3rd	Pearson	-
Reference	T3	"The Unified Modeling Language User Guide", Grady Booch, James Rumbaugh and Ivar Jacobson	2nd	Pearson	-
Reference	T4	"Design Patterns Elements of Reusable Object-Oriented Software" Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides,		Pearson	-

UE14CS402: Software Engineering (4-0-0-0-4)

of Hrs: 52

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion Covered	
			% of syllabus	Cumulative %
1-3	**Unit #1 : Introduction to Software Engineering:**	Understand the context of Software Engineering; Contrasting System Development, Product development, Software products, project engineering;	21	21
4-6	T1: Ch 1 - Ch3 T2: Ch 1 - Ch4 R1: Ch 1 - Ch3	Generic Process framework, Phases in the development of software, Product life cycle Phases, roles in product development; product development Eco-system,		
7-11		Introduction to Software development models including waterfall model, Incremental model, Evolutionary model, Agile model etc.		
12-15	**Unit #2 : Requirements Engineering and Software Project Management**	Requirements Engineering tasks, Requirements documentation/specification and management, Requirements traceability	21	42
16-19		System Modeling: Analysis of the requirements with different perspectives/various modeling techniques.		
20-22	T1: Ch 2 , Ch9 T2: Ch 21, Ch7 R1: Ch22,23,24,26, Ch 4	Planning a software development project with overview of different aspects of SE management and process maturities		
23-28	**Unit #3 : Analysis, Design & Implementation Engineering & Change/Build management:**	Software Architecture: Software Architecture, Software Life cycle, Architecture Design, Architectural Views, Architectural Styles , The Unified Modeling Language,	27	69
29-32		Design & Implementation Engineering: Classical design Methods, Object Oriented analysis and Design Methods, Introduction to Design patterns, Service oriented architecture.		

33-36	T1:Ch10,Ch11, Ch4, Ch12.2-12.5, Ch19.1-19.2 T2:Ch5.4,Ch8,Ch9 ,Ch10 R1:Ch5.1-5.5,Ch6.1-6.4	Implementation: Coding standards & guidelines, code Review/Peer Review. Patching and patch management. Change & Build Management: Elements of a Configuration Management Systems, Baselines, Repository, the SCM process, Configuration Management Plan, Management of code versions, release versions. Exposure to code management tools/Build.		
37-42	**Unit #4 :** **Software Testing** T1: Ch 13,Ch14 T2: Ch 17 & Ch18 R1: Ch 8 and Ch 24	Software Testing: Test Objectives, Testing and the Software Life cycle, Testing Strategies, Verification and Validation, Planning and Documentation, Manual test Techniques, Coverage Based Test Techniques, Fault based test techniques, Error Based Test Techniques, Comparison of Test Techniques, Test Stages, and Estimating Software Reliability	12	81
43-46	**Unit #5 : SW** **Quality & Other** **Eng. Topics** T1: Ch 6 T2: Ch 14,15,16 R1: Ch 24	Software Quality: Managing Software Quality, A taxonomy of Quality attributes, perspectives on quality, The quality system, Software Quality assurance, The Capability Maturity Model, Personal Software Process	19	100
47-52	Internet articles, books and slides will be shared during the class	CBSE, Software Metrics, Software Engineering in a Global Environment, Software Estimation, Software Engineering and Hacking, Ethics in Software Engineering		

Literature:

Book Type	Code	Title and Author	Publication info		
			Edition	Publisher	Year
Text Book	T1	Software Engineering: Principles and Practice, Hans van Vliet	3rd	Wiley India	2010
Text Book	T2	Software Engineering (A practitioners approach), Roger S Pressman	6th	McGraw Hill	2005
Reference Book	R1	Software Engineering, Ian Somerville	9th	Pearson Education	2009

UE14CS403: Machine Learning (4-0-0-0-4)

# of Hrs:52

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion Covered	
			% of Syllabus	Cumulative %
1	**Unit #1 : Introduction & Basics** T1: Ch1, Ch2 T2:Ch1,Appendix B,C T4:Ch1,Appendix A	Introduction	19	19
2		Well Posed Learning Problems , Designing Learning systems		
3		Perspectives and Issues, A Concept learning task		
4		Version Spaces and Candidate Elimination Algorithm		
5		Version Spaces and Candidate Elimination Algorithm		
6		Inductive bias		
7		Matrices		
8		Probability basics		
9		Random variates and Distributions		
10		Random variates and Distributions		
11	**Unit #2 : Classification and Regression** T1:Ch3,Ch4,C8 T2 : Ch6, Ch7	Decision Trees- Basic algorithm,	24	43
12		Hypothesis search and inductive bias		
13		Issues in Decision Tree Learning		
14		Artificial Neural networks – Perceptrons		
15		Multi-layer networks and back-propagation		
16		Back-propagation, Face recognition example		
17		Instance-based learning: k-nearest neighbor learning, Locally weighted regression		
18		Radial basis functions, case-based learning		
19		Support-vector machines – separating data with max-margin and finding max-margin		
20		Efficient optimization with SMO, full Platt SMO		
21		Improving performance with Ada-boost – classifiers using multiple samples, training		
22		Creating a weak learner, implementing the full Ada-boost		
23	**Unit #3 : Stochastic Learning** T1: Ch6, Ch9 T4: Ch15	Bayesian Learning – Bayes theorem, Concept learning	19	62
24		Maximum likelihood, Bayes optimal classifier		
25		Gibbs algorithm, Naïve Bayes classifier		
26		Document and Text classification		
27		Document and Text classification		
28		Genetic Algorithms – Representing hypothesis, Genetic operators and Fitness function and selection		
29		Hidden Markov models – discrete Markov processes		
30		Hidden Markov models – 3 basic problems,		
31		Finding State sequence, Learning model parameters		

32		Continuous observations and HMM as a graphical model, Model selection in HMMs.		
33	**Unit #4 : Un-supervised Learning** T2: Ch10,Ch11, Ch12	Un-supervised Learning: K-means clustering	19	81
34		k-means clustering, improving cluster performance with postprocessing		
35		Bisecting k-means, clustering points on a map.		
36		Density-based clustering - The DBSCAN (Density-based spatial clustering of applications with noise)		
37		DBSCAN		
38		Apriori algorithm - Association analysis, the apriori principle.		
39		Finding frequent itemsets, mining association rules		
40		FP-growth – FP trees, building an FP-tree		
41		Mining frequent items from an FP-Tree		
42		Real world examples – twitter feed, clickstream		
43	**Unit #5 : Dimensionality Reduction and Recent Trends in ML** T2: Ch13, Ch14	Dimensionality reduction techniques	19	100
44		Principal component analysis		
45		PCA example		
46		Singular value decomposition - applications		
47		Matrix factorization		
48		Collaborative filter-based recommendation systems		
49		Deep Learning		
50		Reinforcement Learning		
51		Convolutional Neural networks (CNN)		
52		Generative Adversarial Networks(GAN)		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text Books	T1	Machine Learning - Tom M. Mitchell	-	McGrawHill Education	2013
	T2	Machine Learning in Action - Peter Harrington	1st	DreamTech Press (India)	2015
	T3	Pattern Recognition and Machine Learning - Christopher Bishop	1st	Springer	2011
	T4	Introduction to Machine Learning - EthemAlpaydin	1st	PHI Learning	2017
	T5	Appropriate handouts for introduction to Linear Algebra, Random Variates, Recent Trends in ML	-	-	-

Note: Pre-requisite for "Machine Learning"(UE14CS403) is that students should have cleared "Design and Analysis of Algorithms" (UE15CS251)

UE14CS405: Object Oriented Modeling and Design(0-2-0-0-1)

Week #	Program #	List of programs
1		Instruction class
2	Program #1	Use Case Diagrams – Identify Actors and associated Use Cases
3	Program #2	CRC (Class, Responsibility, Collaborators) and Data Dictionary for the identified classes
4	Program #3	Class Diagrams – Identify Classes and the relationships between them (associations, generalizations, and aggregations)
5	Program #4	Sequence and Collaboration Diagrams for significant Use Cases
6	Program #5	State Diagrams for significant classes
7	Program #6	Component and Deployment Diagrams
8	Program #7	Database Schema design based on the Class Diagram
9	Program #8	Application of GRASP principles
10	Program #9	Application of SOLID principles
11	Program#10	Design Patterns 1
12	Program#11	Design Patterns 2
13	Program#12	Design Patterns 3

UE14CS405: Machine Learning Laboratory (0-2-0-0-1)

Week #	Program #	List of programs
1		Instruction class
2	Program #1	Implement Monty Hall Paradox using large scale Random Variate generation. Learn how to generate random variables as per a distro (Normal/Gaussian and Poisson)
3	Program #2	Find solutions to two large Ax= b systems with and without Linear dependence and compute Basis and Eigen Vectors/Values.
4	Program #3	Construct/Visualize a Decision Tree using Information Gain (Entropy) attributes on a (at least) 32- size data set with (at least) 8- Attributes
5	Program #4	Implement a k- Near Neighbor finding and sorting algorithm for a data set size of (at least 1024) on 3 different metrics
6	Program #5	Implement a 3 layer neural network (32 input, 8 hidden and 4 output neurons) to train and classify alphabets/digits
7	Program #6	Implement a Genetic Algorithm based character/digit recognition
8	Program #7	Build a Unigram,Bigram and trigram model for a given text document
9	Program #8	Implement Naive Bayes Spam/Sentiment Classifier
10	Program #9	Implement K means and Agglomerative clustering
11	Program#10	On a real/online store purchase data set, implement FP-Growth Tree based itemset mining
12	Program#11	Implement PCA and estimate accuracy
13	Program#12	Implement SVD and estimate accuracy

UE14CS407: Research Methodology (2-0-0-0-2)

Class #	Chapter Title/Reference Literature	Topics To Be Covered	% Of Portions Covered	
			% Of Syllabus	Cumulative %
1	**Unit #1:** T1:1	What is research? Why research?	15.38	15.38
2		Project vs. Thesis, Research outcomes		
3		Research outcomes		
4		Benefits,Researchvs. innovation vs. Creativity		
5	**Unit #2** T1:1	Steps in Research, Research Process	15.38	30.76
6		Scientific Methodology Formulation of Problem Statement		
7		Review of Literature		
8		Variables in research		
9	**Unit #3** T1: 10,6,12	Hypothesis formulation	30.76	61.52
10		Experimental designs		
11		Experimental designs		
12		Data collection		
13		Data collection		
14		Analysis – Statistical analysis		
15		Analysis – Statistical analysis		
16		Analysis – Statistical analysis		
17	**Unit #4** T1:19	Discussion writing	23.07	84.59
18		Discussion writing		
19		Characteristics of Abstract of a scientific article		
20		Characteristics of Abstract of a scientific article		
21		Ethics in research		
22		Ethics in research		
23	**Unit #5** T1:19	Significance of Report Writing	15.38	100
24		Different Steps in Writing Report		
25		Layout of the Research Report		
26		Layout of the Research Report		

Literature:

Text book	Title & Author	Publication Info	
		Edition	Year
T1	Research Methodology: Methods and Techniques	3	2014

UE14CS412: Enterprise Resource Planning(4-0-0-0-4)

of Hrs:52

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			% of syllabus	Cumulative %
1, 2	**Unit #1** - 10 Hr T1:1,2,3	**ERP Overview:** Introduction, Value Chain Framework, Problems with Disintegrated Data in an Organization, Role of ERP Systems in an Organization	20	20
3, 4		Evolution of ERP Systems, Three-tier Architecture for ERP Systems, Stages Theory and Its Application to Evolution of ERP Are ERP Systems Different from Traditional Information Systems?		
5, 6		Scope of ERP systems,General Model of Business and Role of ERP, Major ERP Players, Implementations in India.Case Studies.		
7, 8		Life Cycle of an ERP Implementation Project: Introduction, Life Cycle of an ERP Project, ERP Teams. Case Studies.		
9, 10		Benefits and Cost of an ERP System: Introduction, Benefits, Cost of an ERP Implementation, Cost-benefit Analysis (CBA).Case Studies.		
11, 12	**Unit #2** - 10 Hr T1: Ch. 4,Ch. 7 T2:Ch. 10	**Change Management:**Introduction, People Issues: Are You Ready for ERP? Factors That Influence Pre-implementation Attitude, How to Enhance Attitude?	20	40
13, 14		Change Management Strategies to Handle Organizational Issues, Creating a Change Management Strategy to Handle, Organizational Issues, Tools for Assessing the Organizational Changes. Case Studies.		
15, 16		**Re-Engineering:**Introduction, Processes and their Characteristics, Life Cycle of a BPR Project, Life Cycle of an IT-driven BPR Project, Re-engineering Examples, Case Studies.		

17, 18		**Business Process Modeling (BPM) and Business Modeling:** BPM Introduction, Business Process Hierarchy, Standards for Business Processes and Modeling,		
19, 20		Process Modeling Maturity and Multi-dimensional Modeling, Process Modeling software, Business Modeling, Integrated Data Modeling.		
21, 22	**Unit #3** - 12 Hr T2: Ch. 20 Ch. 21 Ch. 31	_ERP Functional Modules:_**Human Capital Management:** Introduction, Human Capital Management Systems, Leading HR Solutions from ERP Vendors	20	60
23, 24		Strategic vs. Operational HR processes and HR Outsourcing, Employee Health and Safety.		
25, 26		**Financial Management:** Introduction, ERP Financial Application,		
27, 28		Financial Modules in Detail,Emerging Areas of Financial Management.		
29, 30		**Procurement and Inventory Management:** Procurement process, Types of procurement, Maturity model, Master data, KPIs		
31, 32		Inventory Management process, IM Pyramid, IM in ERP, KPIs		
33, 34	**Unit #4** - 10 Hr T2: Ch. 22 T1: Ch. 8 Ch. 9	**Production Planning and Execution:** Understanding MRP II Concepts, How ERP PP module supports MRP II processes, Critical Master Data elements, Managing different production scenarios.		
35, 36		**ERP Selection:**Introduction, ERP System Selection Team, ERP Solution and Vendor Selection, Information Gathering, Preliminary Filtering, Parameters for ERP Selection,	20	
37, 38		Prepare and Release Request for Proposal (RFP), Gap Analysis,		80

		AHP for ERP Selection.Case Studies.		
39, 40		**Managing an ERP Project:**Introduction, Success of an ERP System is Multi-dimensional, Critical Success Factors		
41, 42		Risk Associated with an ERP Project, Measuring Performance of ERP System Using Balanced Scorecard. Case Studies.		
43, 44	**Unit #5** - 10 Hr T1: Ch. 10	**ERP and Related Technologies:** Introduction, EDI, Supply Chain Management (SCM), Customer Relationship Management (CRM)	20	100
45, 46	T2: Ch. 31 T1:	Product Life cycle Management (PLM), Data warehouse, Data Mining.		
47, 48	Ch. 10 Ch. 11 Appx. A Appx. B	**Introduction to Commercial ERP Software:**Introduction, Indian Market, SAP, Oracle, Peoplesoft, JD Edwards, MS Dynamics.		
49, 50		Implementations in India; Articles and Cases.		
51, 52		Guest Lecture		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	**Enterprise Resource Planning: A Managerial Perspective,** Veena Bansal	1st	Pearson Education India	2013
Text book	T2	**Enterprise Resource Planning- Text & Cases**, Rajesh Ray		Tata McGraw Hill	2011
Ref book	R1	**ERP,** Alexis Leon	3rd	McGraw Hill Education	2014

UE14CS414:Algorithms for Information Retrieval (4-0-0-0-4)

# of Hrs:52

Class #	Chapter Title/ReferenceLiterature	TopicToBeCovered	%Of PortionsCovered	
			% of syllab	Cumulative %
1.	**Unit #1– IntrodutiontoIR** T1:1,2,3	Introduction	19	19
2.		ArchitectureofIRsystems		
3.		IRModels–BooleanandExtendedBoolean		
4.		Vocabulary,PostingLists		
5.		Preprocessing:Tokenization,Stemminget		
6.		Algorithmstosearchinposting lists		
7.		Positionaland PhraseQueries		
8.		Searchstructurefordictionaries		
9.		Wildcardqueries		
10.		SpellingandPhoneticCorrections		
11.	**Unit #2– IndexingandSearch** T1:4,56	InvertedIndexConstruction	19	38
12.		IndexingAlgorithms		
13.		Distributed,DynamicIndexing		
14.		IndexCompression		
15.		HeapsLaw,ZipfLaw		
16.		DictionaryandPostingsCompression		
17.		Scoring–TermWeighting		
18.		VectorSpaceModel		
19.		ComputingVectorScores		
20.		Variantoftf-idffunctions		
21.	**Unit #3– Evaluation/OtherIRModels** T1:7,8	EfficientScoringandRanking	19	57
22.		ComputingScoresinsearchengine		
23.		PerformanceMeasurements,TestCollecti		
24.		Precision,Recall,F-Measure		
25.		MAP,Precision atk, R-Precision		
26.		NDCG,Kappa statistic		
27.		OtherIRModels		
28.		ProbabilisticModel		
29.		ProbabilisticModel		
30.		AlgebraicModels		
31.	**Uni t#4-WebSearch** T1:19,20,21	WebSearchBasics	19	76
32.		EconomicModel		
33.		SearchUserExperience		
34.		WebCrawling		
35.		WebIndexes		
36.		LinkAnalysis		
37.		PageRankAlgorithm		
38.		PageRankAlgorithm		
39.		HubsandAuthorities		

40.		CompleteSearchEngine		
41.		MachineLearninginIR		
42.		MachineLearninginad-hoc retrieval		
43.		TextClassificationproblem		
44.	**Unit #5-**	Classification		
45.	**MachineLearninginIR**	Classification		
46.		Classification	24	100
47.		TextClusteringproblem		
48.	T1:13,14	Clustering		
49.	16,17	Clustering		
50.		OtherMLapproachesinIR		
51.		AdvancedTopics		
52.		AdvancedTopics		

Literature:

Book Type	Code	Title&Author	PublicationInfo		
			Editi	Publisher	Ye
TextBook	T1	Introduction toInformation Retrievalby ChristopherD.Manning,PrabhakarRaghavan,and HinrichSchütze	1	CambridgeUniversityPress	2009

Note: Pre-requisite for "Advanced Algorithms"(UE14CS414) is that students should have cleared "Design and Analysis of Algorithms" (UE14CS251)

UE14CS415: Content Management Systems(4-0-0-0-4)

# of Hrs: 52

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion Covered	
			% of syllabus	Cumulative %
1	**Unit #1 :**	What is content	17.0%	17.0%
2	**Introduction,**	What is content - continued		
3	**Web Browser**	Content is - data,		
4	**as interface,**	information and content,		
5	**HTML and**	information and content, - contd		
6	**XHTML**	Content format, structure, functionality is content		
7		What is content management?		
8	**T1:**1: 7-16,	major parts of a CM system		
9	2:24-39, 4:80-100, 5:105-135	Roots and branches of CM.		
10	**Unit #2 :**	**Logical Design of a CMS**	19.0%	36.0%
11	**Style Sheets**	the wheel of CM		
12	**and Javascript**	the wheel of CM		
13	**I**	the wheel of CM		
14		Metadata		
15	**T1:**	Metadata		
16	6:140-168,	Metadata		
17	7:174-199,	Catalog audience		
18	8:209-220, 235-240,	Catalog audience		
19	9:251-285	Catalog audience		
20	**Unit #3**	Designing Publications	24.0%	60.0%
21	**:Javascript II**	Designing Publications		
22	**and Web**	Designing Publications		
23	**servers**	Designing Content Components		
24		Designing Content Components		
25	**T1:**	Designing Content Components		
26	10: 294-326,	Designing Content Components		
27	11:338-355,	Accounting for authors		
28	12:378-417,	Accounting for authors		
29	686-706	Accounting for authors		

30		Accounting for Acquisition sources		
31		Accounting for Acquisition sources		
32	**Unit #4 :**	Designing content access structures		
33	**Object and**	Designing content access structures		
34	**Event Models**	Designing workflow and staffing models		
35	**and Data**	Designing workflow and staffing models		
36	**Binding**	Building a content management system		
37		Building a content management system	21.0%	81.0%
38	**T1:**	Content markup languages		
39	13: 429-445,	Content markup languages		
40	14: 451-471,	Content markup languages		
41	16: 511-532	Content markup languages		
42		Processing content		
43		**Building collection systems**		
44	**Unit #5 :**	Building Management Systems		
45	**Perl/CGI and**	Building Management Systems		
46	**PHP**	Building Management Systems		
47		Building Management Systems		
48		Building Management Systems	19.0%	100%
49	**T1:**	Building Management Systems		
50	25: 844-888,	Building Publishing Systems		
51	26: 898-948	Building Publishing Systems		
52		Building Publishing Systems		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	Content Management Bible, Bob Boiko,	2nd	Wiley India	2005

UE14CS417: Computer Vision (4-0-0-0-4)

# of Hrs: 52

Class No.	Chapter Title / Reference Literature	Topics to be covered	% of Portions Covered	
			% of syllabus	Cumulative %
1	**UNIT #1** **Introduction to Computer Vision**	Brief history of Computer Vision	19.23	19.23
2				
3		The digital camera		
4				
5		Point operators		
6				
7		Linear filtering		
8				
9		Neighborhood operators and basics of frequency domain processing		
10				
11	**UNIT #2** **Feature detection and matching and segmentation**	Introduction , points	19.23	38.46
12				
13		Lines		
14				
15				
16		split		
17		merge		
18				
19		mean-shift		
20				
21	**UNIT #3** **Computational photography**	Introduction, Photometric calibration	19.23	57.69
22				
23		high dynamic range imaging,		
24				
25		super		
26		resolution and blur removal		
27		basics of image matting		
28				
29		texture analysis		
30				
31	**UNIT #4** **Stereo and 3D reconstruction**	stereo: an introduction,	23.08	80.77
32				
33		epipolar geometry,		
34				
35		sparse and		
36		dense correspondence		

37		local methods		
38				
39				
40		feature tracking and optical flow		
41				
42				
43	**UNIT #5 Recognition**	Introduction	19.23	100
44				
45		Object detection		
46				
47		face recognition,		
48				
49		category recognition		
50				
51		context and scene understanding		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	"Computer Vision: Algorithms and Applications", Richard Szeliski	2nd	Springer	2010
Text book	T2	"Computer Vision – A Modern Approach", Forsythe and Ponce	2nd	Pearson	2011
Text book	T3	"Dictionary of Computer Vision and Image Processing", R. B. Fisher, T. P. Breckon, K. Dawson-Howe, A. Fitzgibbon, C. Robertson, E. Trucco, C. K. I. Williams.Chichester		West Sussex : John Wiley & Sons Inc.	2014

UE14CS421: Information Security (4-0-0-0-4)

# of Hrs: 52

Class #	Chapter Title / Reference Literature	Topics to be covered	% of Portion Covered	
			% of Syllabus	Cumulative %
1	**Unit #1 Introduction, HTTP Security** R1	Introduction	20	20
2		HTTP Security: Overview of HTTP Security,		
3		MITM attacks and solutions,), X-Frame-Options, X-XSS-Protection,		
4		HTTP security headers: CSP (Content-Security-Policy), HSTS (HTTP Strick Transport Security), HPKP (HTTP Protocol Key Pining)		
5		X-Content-Type-options, CORS (Cross Origin Resource Sharing).		
6		HTTP/2 and security challenges.		
7		HTTP Security considerations: Transfer of sensitive information and its encoding. Privacy issues, and HTTP Authentication.		
8		Security Misconfiguration for the application, frameworks, application server, web server, database server, and platform.		
9		Sensitive Data Exposure, protection of sensitive data, such as credit cards, tax IDs, and authentication credentials.		
10		Protection mechanism such as Encryption.		
11	**Unit #2 Network Security** T1: Ch1, 5	Network security: Introduction	20	40
12		Common attacksand Defensemechanism		
13		Network Security Protocols in Practice,		
14		IPsec: A Security Protocol at the Network Layer		
15		SSL/TLS: Security Protocols at the Transport Layer		
16		SSL/TLS (contd)		
17		SSH: Security Protocols for Remote Logins,		
18		SSH (contd)		
19		HPAC: Header Compress for HTTP/2		
20		HPAC (contd)		
21	**Unit #3 Wireless Network Security** T1: Ch 6	Wireless Network Security: Introduction	20	60
22		Introduction (contd)		
23		Wireless Communications		
24		802.11 WLAN Standards Wifi Protected Access (WPA)		
25		IEEE 802.1x		
26		IEEE 802.11i/WPA2		
27		Bluetooth Security		
28		ZigBee Security		
29		Wireless Mesh Network Security		

30		Examples		
31	**Unit #4** **Secure** **programming** T2: Part II	Secure Programming: C++ Catastrophe	20	80
32		Calls to Delete, constructors,		
33		Lack of Reinitialization		
34		ignorance of STL, pointer initialization		
35		Testing techniques and defensive measures		
36		Failure to Handle Errors Correctly		
37		Yielding Too Much Information, Ignoring Errors		
38		Misinterpreting Errors ,Using Useless Return Values		
39		Using Non-Error Return Values		
40		Examples		
41	**Unit #5** **Platform** **Security** T2: Part II, III R1	Platform security: Code integrity and code signing	20	100
42		Secure boot, measured boot, and root of trust.		
43		Security threats from peripherals, e.g., DMA, IOMMU.		
44		Executing Code with Too Much Privilege, examples, and defensive measures.		
45		Failure to Protect Stored Data, Weak Access Controls on Stored Data, Weak Encryption of Stored Data.		
46		Use of Weak Password-Based Systems, Password Compromise Password		
47		change policies, password failure error display policies		
48		Retrieval of forgotten passwords.		
49		Default Passwords and Replay Attacks		
50		Storing Passwords and alternatives, Password Verifiers Zero knowledge		
		Brute-Force Attacks Against Password Verifiers		
51		Examples		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Introduction to Network Security, Kissel, Wang	2nd	John Wiley & Sons	2015
Text Book	T2	24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them, Viega, LeBlanc, Howard	7th	McGrawHill	2009
	R1	Handout of relevant material			

UE14CS422: Web Services (4-0-0-0-4)

# of Hrs: 52

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			% of Syllabus	Cumulative %
1.	**Unit #1** Introduction T1: Ch. 1+ Notes	Need for web services	19	19
2.		Defining web services		
3.		Explaining the characteristics of a web service		
4.		Explaining the use of both XML and JSON in web services		
5.		Identifying the two major approaches to developing web services		
6.		Explaining the advantages of developing web services within a Java EE container		
7.		Web Services and SOA		
8.		overview of HTTP		
9.		REST		
10.		Simple Example		
11.	**Unit #2** RESTful Web Services: The Service Side T1: Ch. 2	RESTful service as an HTTP Servlet	19	38
12.		RESTful service as an HTTP Servlet		
13.		RESTful service as a JAX-RS resource		
14.		RESTful service as a JAX-RS resource		
15.		Generating XML and JSON responses		
16.		Generating XML and JSON responses		
17.		Restlet resources		
18.		Restlet resources		
19.		WebServiceProvider		
20.		WebServiceProvider		
21.	**Unit #3** RESTful Web Services: The Client Side T1: Ch. 3	Clients against Amazon E-Commerce Service	19	57
22.		Clients against Amazon E-Commerce Service		
23.		RESTful clients and WADL documents		
24.		RESTful clients and WADL documents		
25.		JAX-RS client API		
26.		JAX-RS client API		
27.		JSON for Javascript clients		
28.		JSONP and Web Services		
29.		jQuery		
30.		AJAX Polling		

31.		SOAP-based Services		
32.		SOAP-based Services		
33.		Java clients		
34.		Java clients		
35.		WSDL Service Contract		
36.	**Unit #4**	WSDL Service Contract	19	76
37.	SOAP-Based Web Services	SOAP-based clients against Amazon E-Commerce Services		
38.	T1: Ch. 4	SOAP-based clients against Amazon E-Commerce Services		
39.		Asynchronous Clients.		
40.		Asynchronous Clients.		
41.		Wire-level Security – service		
42.		Wire-level Security – client-side		
43.		HTTPS – encryption		
44.		HTTPS – decryption		
45.		HTTPS - handshake		
46.	**Unit #5**	Container-managed security		
47.		Container-managed security	24	100
48.	Web Services Security	WS-Security.		
49.	T1: Ch. 6	WS-Security.		
50.		OAuth		
51.		OAuth		
52.		Tutorial		

Literature

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Web Services Up and Running, Martin Kalin	2nd	OReilly	2013

Note: Pre-requisite for ”Web Services”(UE14CS422) is that students should have cleared “Web Technologies-II” (UE14CS353)

UE14CS423: Optical Networks (4-0-0-0-4)

# of Hrs.:52

Class	Chapter Title/ Reference Literature	Topics To Be Covered	% of portions covered	
			% of syllabus	Cumulative %
1	**Unit #1** **Introduction** 1.1-1.8(Book 1) **Propagation of signals in Optical Fibers** 2.1-2.3,2.6-2.7(Book 1)	Telecommunication network architecture	15%	15%
2		Circuit and packet switching, Optical Networks		
3		Optical layer, Optical packet switching		
4		Transmission basics, Network evolution.		
5		Loss and bandwidth		
6		Intermodal dispersion		
7		Optical fiber as a waveguide		
8		Solitons, Other Fiber technologies		
9	**Unit #2** **Components** 3.1-3.8(Book 1)	Couplers	23%	38%
10		Isolators and circulators		
11		Multiplexers and filters		
12		Multiplexers and filters		
13		Optical amplifiers		
14		Optical amplifiers		
15		Transmitters		
16		Detectors		
17		Switches		
18		Switches		
19		Wavelength Converters		
20		Wavelength Converters		
21	**Unit #3** **Client layers of optical layer** T1:6.1-6.8 **WDM network elements**	SONET/SDH	23%	61%
22		Optical transport network		
23		Generic framing procedure		
24		Ethernet		
25		IP		
26		MPLS		
27		Resilient packet rings		
28		SAN.		
29		Optical line terminals		

30	T1:7.1-7.4	Line amplifiers		
31		Add/Drop multiplexers		
32		Cross connects		
33	**Unit #4** **WDM network design** T1:10.1-10.4 **Access Networks** T1: 11.1-11.3	Cost trade offs	15%	77%
34		LTD and RWA problems		
35		LTD and RWA problems		
36		Dimensioning wavelength routing networks		
37		Statistical dimensioning models		
38		Network architecture overview		
39		Enahnced HFC		
40		Fiber to the curb		
41	**Unit #5** **Fiber Optic Braodband Access Networks and Technologies** T2: 2.1-2.5 **IEEE Passive Optical Networks** T2: 3.1-3.2.1,3.2.2	Introduction and brief history of fiber in the loop (FITL)	24%	100%
42		Introduction and brief history of fiber in the loop (FITL)		
43		Introduction to PON Systems		
44		FITL Technology considerations		
45		PON Network protection		
46		PON Network protection		
47		IEEE 802.3ah EPON		
48		IEEE 802.3ah EPON		
49		802.3av 10G EPON		
50		802.3av 10G EPON		
51		Comparison of EPON, 10G EPON		
52		Comparison of EPON, 10G EPON		

Literature

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Optical Networks, Sasaki, Sivarajan, Ramaswamy	3rd	Elsevier	2010
	T2	Broadband Access: Wireline and wireless-Alternatives for Internet Services, Gorshe, Raghavan, Starr, Galli	-	John Wiley and Sons	2014

Note: Pre-requisite for "Optical Networks"(UE14CS423) is that students should have cleared "Computer Networks" (UE14CS301)

UE14CS424 : Algorithms For The Intelligent Web(4-0-0-0-4)

# of Hrs : 52

Class #	Chapter / Reference Literature	Topics to be Covered	% of portions covered	
			% of syllabus	**Cumulative %**
1 - 4	**Unit #1: Introduction and Search Algorithms (13 hrs)** T1 : 1.1 to 2.7 & Readings	Introduction to algorithms	20	20
5		Intro to Web and Intelligent Web Applications		
6		Examples of Intelligent Web Applications		
7		Intro to AI and Machine Learning		
8		Intro to Search and Information Retrieval		
9		Lucene as a Search Engine		
10		Improving Search Results		
11		Link Analysis and PageRank		
12		Other Search Algorithms		
13		Scalability Issues in Search		
14	**Unit #2 : Recommendation Algorithms (08 hrs)** T1 : 3.1 to 3.5 & Readings	Distance and Similarity	20	40
15		Recommendation algorithms		
16		Types of Recommendations		
17		Workings of Sample Systems		
18		Workings of Sample Systems		

19		Data Normalization and Correlation Coefficients		
20		Revision for T1		
21		Test 1		
22	**Unit #3: Clustering Algorithms (08 hrs)** T1 : 4.1 to 4.7 & Readings	Intro to Clustering	20	60
23		Grouping in SQL		
24		Clustering Algorithms		
25		Types of Clustering Algorithms		
26		Example Algorithms		
27		Example Algorithms		
28		Applications of Clustering		
29		Scalability Issues in Clustering		
30	**Unit #4 : Classification Algorithms (09 hrs)** T1 : 5.1 to 6.5 & Readings	Classification Theory	20	80
31		Category Lists, Taxonomy, Folksonomy and Ontology		
32		Classification by Tagging		
33		Automatic Classification and Routing		
34		Types of Classification Algorithms		
35		Hybrid Classifiers		
36		Sample Applications		
37		Practical Issues in Classification		

38		Test 2		
39	**Unit #5 : Intelligent Web Applications (14 hrs)**	Design of an Intelligent Web Application	20	100
40		User Requirements		
41		Selecting Algorithms		
42		Data Design		
43		Design for Performance		
44	T1 : 7.1 to 7.6	Architecture of an Intelligent Web Application		
45		Implementation Issues		
46		Summary and Conclusion		
47-52	& Readings	Student project demos/presentations		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	Algorithms of the Intelligent Web by HaralambosMarmanis, Dmitry Babenko	First (Indian) edition	Manning Publishers	2011
Readings		Additional papers and reading material assigned during the course			

Note: Pre-requisite course for "Algorithms for Intelligent Web"(UE14CS424) is that students should have cleared "Design and Analysis of Algorithms" (UE14CS251)

UE14CS425 : Social Network Analytics (4-0-0-0-4)

# of Hrs:52

Class #	Chapter Title/ Reference Literature	Topics to be Covered	% of Portion Covered	
			% of syllabus	Cumulative %
		Unit 1 :		
1	**Unit #1: Background and Fundamentals of network analysis** Text books: T1,T2,T3 Online Resources	Introduction to Networks and Examples, Graphs & Adjacency matrices	18%	18%
2		One and two-mode networks, Ego-centric and Socio-centric Networks, Social Network Visualization and Analysis Tools.Social networks Datasets (Eg: snap.stanford.edu/data/)		
3	**Unit #1: Representing and Measuring Networks** Text books: T1,T2,T3 Online Resources	Diameter and Average path length, Clustering, Centrality measures - Degree, Closeness and Betweenness centrality		
4		Eigenvector Centrality, Pagerank: PageRank Algorithm and PageRank Computation		
		Week-2 Activity: Calculate and interpret node centrality for real-world networks (your Facebook graph, Twitter networks, etc.)		
		Unit 2 :		
5	**Unit #2: Models of Network formation** Text books: T1,T2,T3 Online Resources	Random Graphs, Degree distribution,Giant Component, Preferential attachment	26%	44%
6		Small world networks, Homophily, Properties, Examples and Applications of small-world networks.		
		Week-3 Activity: Create random networks, calculate component distribution, average shortest path, evaluate impact of structure on ability of information to diffuse		
7	**Unit #2: Models of Network formation** Text books: T1,T2,T3 Online Resources	Power Laws, Fat Tails		
8		Scale-free networks		
		Week-4 Activity: Paper Reading: Power laws, Pareto distributions and Zipf's law by M. E. J. Newman. Origins of power-law degree distribution in the heterogeneity of human activity in social networks		
9	**Unit #2: Models of Network formation**	Community: Clustering, community structure, Community Detection Algorithms, overlapping communities		

10	Text books: R3 Online Resources	Clique, k-Clique Communities,Clique Percolation Method		
		Week-5 Activity: detect and interpret disjoint and overlapping communities in a variety of networks (scientific collaborations, political blogs, cooking ingredients, etc.)		
		Unit 3 :		
11	**Unit #3: Implications of Network Structure Diffusion through Networks.** Text books: R2 Online Resources	Diffusion through Networks:The Bass Model, Diffusion in Random networks, Giant Components	18%	62%
		Activity: Evaluate whether several real-world networks exhibit small world properties, simulate decentralized search on different topologies, evaluate effect of small-world topology on information diffusion.		
12		Models to study disease and information spreads, Cascades (epidemics) on networks. Contagion		
		Activity: Evaluate via simulation the impact of network structure on the above processes		
13		Assortativity, Percolation and Robustness of Networks, Effects of communities and centralities on diffusion		
14		SNA and online social networks (videos) Concepts: how services such as Facebook, LinkedIn, Twitter, CouchSurfing, etc. are using SNA to understand their users and improve their functionality		
		Activity: read recent research by and based on these services and learn how SNA concepts were applied		
		Unit 4 :		
15	**Unit #4: Collective Intelligence – Applications of Social Networks.** Text books: R4 Online Resources	Students choose any one of the Collective Intelligence Applications and develop a prototype. Project Implementation that is using open APIs of networks such as Facebook and Twitter.	22%	84%
16		Collaborative Filtering		
17		Reputation Systems		
18		Crowd-sourcing		
19		Prediction Markets		
20		Online Auctions		
		Unit 5 :		
21	**Unit #5: Strategic Networks.**	Economic Game Theoretic Models of Network Formation, Connections Model,	16%	100%

22	**Games on Networks.** Text books: T1,T2,T3 Online Resources	Pair-wise Stability, Efficient and Pareto-efficient networks, Externalities and Co-author Models, Pair-wise Nash Stability, Complements and Substitutes.		
23		Introduction to Games, Reasoning about behavior in a Game, Prisoner's Dilemma, Best response and Dominant Strategies,		
24		Nash Equilibrium, Multiple equilibriums: Co-ordination Games, Hawk-Dove Game, Mixed Strategies, Pareto Optimality and Social Optimality.		
25		Project Presentation		
26		Project Presentation		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	"Introduction to Social Network Methods", Robert A. Hanneman, University of California Riverside	-		
Text book	T2	Social and Economic Networks, Mathew O Jackson	-	Princeton University press	2008
Text book	T3	D. Easley and J. Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World	-	Cambridge University press	2010
Reference Book	R1	Exploratory Social Network Analysis with Pajek: de Nooy, Mrvar, Batagelj,	2nd	Cambridge University Press,	2011
Reference Book	R2	Information Diffusion In Social Networks: Observing and Affecting What The Society Cares About: Divyakant Agrawal, CerenBudak, Amr El Abbadi			
Reference Book	R3	L. Tang and H. Liu, "Community Detection and Mining in Social Media," Synthesis Lectures on Data Mining and Knowledge Discovery	vol. 2, pp. 1-137		2010
Reference Book	R4	M. A. Russell, Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites	1st	O'Reilly Media	2011

Note: Pre-requisite for "Social Network Analytics" (UE14CS425) is that students should have cleared "Data Analytics" (UE14CS322)

UE14CS426: Computer Systems Performance Analysis(4-0-0-0-4)

# of Hrs:52

Class #	Chapter / Reference Literature	Topics to be Covered	% of Portion Covered	
			% Of syllabus	Cumulative %
1	**Unit #1 : Introduction** T1: 1.1-1.4, 2.1 2.2 3.1, 3.2 3.3-3.5	Outline of Topics. The Art of Performance Evaluation. Performance Projects.	16%	16%
2		Common Mistakes in performance evaluation		
3		A systematic approach to performance evaluation		
4		Selecting an evaluation technique. Selecting the performance metrics.		
5		Commonly used performance metrics, Utility classification of performance metrics, Setting Performance Requirements		
6	**Unit #2: Workloads, Workload Selection and Characteristics** T1: 4.1-4.4 4.5-4.6 5.1-5.6 6.1-6.5 6.6 6.7-6.8	**Types of Work loads**, addition instructions, Instruction mixes, Kernels; Synthetic programs,	16%	32%
7		Application benchmarks, Popular benchmarks		
8		**Workload Selection:** Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection		
9		**Work load characterization Techniques**: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms,		
10		Principle Component Analysis		
11		Markov Models, Clustering		
12	**Unit #3 :Monitors, Program Execution Monitors and Accounting Logs , Capacity Planning & Benchmarking**	Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors,	20%	52%
13		Distributed System Monitors, ,		
14		Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs,		
15		Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions		

16	T1: 7.1-7.6, 7.7 8.1-8.3,8.4-8.5, 9.1-9.5,9.6-9.8	Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers;		
17		Remote-Terminal Emulation; Components of an RTE; Limitations of RTEs.		
18	**Unit #4: Experimental Design and Analysis** T1: 16.1-16.3 17.1-17.3 17.4-17.5 23.1-23.3	**Introduction**: Terminology, Common mistakes in experiments, Types of experimental designs	12%	68%
19		2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects;		
20		Allocation of variance; General 2k Factorial Designs		
21		General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods..		
22	**Unit #5 : Queuing Models, Queuing Networks** T1:30.1-30.2 30.3-30.4 31.1-31.2 31.3 31.4 -31.5	**Introduction**: Queuing Notation; Rules for all Queues	16%	84%
23		Little's Law, Types of Stochastic Process**.**		
24		Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue		
25		M/M/m Queue		
26		M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems		

Literature:

Book Type	Code	Author & Title	Publication info		
			Edition	Publisher	Year
Text book	T1	The Art of Computer Systems Analysis		Joh Wiley & Sons	2013
Reference book	R1	"Computer Systems Performance Evaluation and Prediction", Paul J Fortier, Howard E Michel		Elsevier	2003
Reference book	R2	"Probability and Statistics with Reliability, Queuing and Computer Science Applications", Trivedi K S.	2nd	Wiley India	2001

Note: Pre-requisite for "CSPA"(UE14CS426) is that students should have cleared "MPCA" (UE14CS253)