



**HSNC University Mumbai
(2020-2021)**

Ordinances and Regulations

With Respect to
Choice Based Credit System
(CBCS)

For the Programmes Under
The Faculty of Science and Technology

For the Course
Computer Science

Curriculum – First Year Postgraduate Programmes
Semester - I and Semester - II
2020-2021

Section D

Computer Science

Part 1- Preamble

MSc Computer Science syllabus is an attempt to include following ideas, among other things, into practice.

1. Course Objective

- Bring a new approach to syllabus, not a revision of the existing syllabus.
- Create a unique identity for MSc in Comp Science distinct from similar degrees in other related subjects.
- Recommend provision for specialization in MSc Computer Science degree.
- Offers focus on core Computer Science subjects.
- Incorporate advanced and most recent trends.
- Identify and nurture research temper among students.
- Offer provision for internship with industry.
- Focus, as far as possible, only on open-source software.

This syllabus for Semester I and Semester II has tried to initiate steps to meet these goals. By extending the syllabus to Semester III and Semester IV, it is assumed that these goals will be met to a larger extent.

2. Process adopted for curriculum designing

The final programme was outlined after frequent discussions, meetings, brainstorming sessions and electronic interactions with academic, alumni and industry partners.

3. Salient features Syllabus made more relevant

The syllabus proposes to have in Semester I four core compulsory courses. Semester II proposes two compulsory courses and two elective courses. Each elective has two tracks of courses based on a recent and emerging area. It is expected that a student continues to take that track for each elective in the semester III and specializes in one of those in the semester IV. In order to give an impetus to research among students, one of the courses in Semester I gives an overview on how to do research in Computer Science. Provision for case study in the practical course of the elective in the Semester II is an attempt to translate that theory into practice. It is assumed that, with this background, a student can take up a challenging research project in

Semester III and Semester IV. Introduction of new subjects such as Business Intelligence, Blockchain, and tracks titles such as Artificial Intelligence, Machine Learning, Big Data Engineering, Human Computer Interaction.

4. Learning Outcomes

The core philosophy of the syllabus is to (i) give strong foundation on core Computer Science subjects;(ii) expose the student to emerging trends in a gradual and incremental way; (iii) offer specialization on a chosen area (iv) Create a research temper among students in the whole process; (v) prepare student community for the demands of ICT industry.

5. Input from stakeholders with relevant information

Introduction of new subjects/concepts in courses to furnish students with the skills needed to contribute in an ever-evolving IT field. Inputs for industrial, academic and research experts have shaped the syllabus to be extensive and comprehensive.

Structure of the syllabus

This is the syllabus for the Semester – I and Semester –II of MSc Computer Science program of HSNC University, to be implemented from the year 2020-2021. The syllabus offers four theory courses and two practical courses each in each semester. Feature of the syllabus is the introduction of Electives in different tracks in the Semester II. Each elective has two tracks (Track A and Track B for Elective I and Track C and Track D Elective II). It is assumed that a student will continue with that Track in the Semester III and choose only one Elective in the Semester IV, the subject in which he or she wants to specialize in.

Semester I

The syllabus proposes four subjects in Semester -I. Each subject has theory and practical components.

Semester –I:

Theory courses: Four theory courses offered in Semester I are:

1. Advanced Algorithms and Data Structures
2. Business Analytics
3. Soft Computing
4. Research Methodology

Each of these courses is of four credits each and is expected to complete in 60 hours. The following table gives the details of the theory courses in Semester -I.

Semester II

The syllabus proposes four subjects in Semester - II. Each subject has theory and practical components.

Semester –II:

Theory courses: Four theory courses offered in Semester II are:

1. Blockchain
2. Network and Communication Security
3. Elective - I
 - (a) Track A: Artificial Intelligence and Machine Learning
(Fundamentals of Artificial Intelligence and Machine Learning)
 - (b) Track B: Cloud Computing (Concepts and Design of Web services)
4. Elective – II
 - (a) Track C: Big Data Engineering (Big Data Analytics and Business Intelligence)
 - (b) Track D: Human Computer Interaction
(Fundamentals of Human Computer Interaction)

A student can take either track A or track B from Elective – I. Similarly, one can take either track C or track D from Elective – II. Each of these courses (compulsory as well as elective) is of four credits each and is expected to complete in 60 hours. The details are shown in the following table.

Part 2

First Year Semester I Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credits	Internals				Total Marks
			Units	S.L.	L	T	P		SL E	CT + AT = 15 + 5	PA	SEE	
1	PS-FCS-101	Advanced Algorithms and Data Structures	4	20%*	3	0	-	04	10	20	10	60	100
2	PS-FCS-102	Business Analytics	4	20%*	3	0	-	04	10	20	10	60	100
3	PS-FCS-103	Soft Computing	4	20%*	3	0	-	04	10	20	10	60	100
4	PS-FCS-104	Research Methodology	4	20%*	3	0	-	04	10	20	10	60	100
6	PS-FCS-1P1	Advanced Algorithms and Data Structures and Business Analytics	-	-	-	-	6	04				100 (80+20)	100
9	PS-FCS-1P2	Soft Computing and Research Methodology	-	-	-	-	6	04				100 (80+20)	100
Total Lectures/ Credits								24	Total Marks				600

***One to two lectures to be taken for CONTINUOUS self -learning Evaluation.**

First Year Semester I - Units – Topics – Teaching Hours

Sr. No.	Subject Code & Title	Subject Unit Title		Hours/ Lectures	Total No. of hours/ lectures	Credit	Total Marks
1	PS-FCS-101 Advanced Algorithms and Data Structures	1	Foundations, Sorting and Order Statistics.	15	60L	4	100 (60+40)
		2	Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithms, Amortized Analysis.	15			
		3	Elementary and Advanced Data Structures, Maximum Flow, String Matching.	15			
		4	Number Theoretic Algorithms, Approximation Algorithms, NP Completeness, Linear Programming.	15			
2	PS-FCS-102 Business Analytics	1	Introduction to Business Analytics, Statistical Models in Business Analytics.	15	60L	4	100 (60+40)
		2	Business Intelligence Architecture and Capabilities.	15			
		3	Mining Social Networks	15			

		4	Applied Text Analytics, Application of Analytics.	15			
3	PS-FCS-103 Soft Computing	1	Introduction to Soft Computing, Artificial Neural Networks (ANN) Basic Concepts.	15	60L	4	100 (60+40)
		2	Pattern Classifiers, Pattern Associators, Competitive Neural Nets.	15			
		3	Backpropagation, Fuzzy Sets	15			
		4	Fuzzy Logic, Fuzzy Inference Systems.	15			
4	PS-FCS-104 Research Methodology	1	Research: What does it mean? Characteristics of Research, Research Methods versus Methodology, Research and Scientific Method, Types of Research, Research Process, Formulating a Research Problem.	15	60L	4	100 (60+40)
		2	The Research Design, Sampling Design, Collecting Data.	15			
		3	Processing and Analysis of Data, Hypothesis Testing.	15			
		4	Technical Writing	15			

5	US-FCS-1P1	1	Practical based on PS-FCS-101	3	60x2= 120 lectures per batch	2	100 (80+10+10)
		2	Practical based on PS-FCS-102	3			
6	US-FCS-1P2	1	Practical based on PS-FCS-103	3	60x2= 120 lectures per batch	2	100 (80+10+10)
		2	Practical based on PS-FCS-104	3			
			TOTAL			24	600

L: Lecture; T: Tutorials; P: Practical; Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation; CT-Commutative Test, SEE- Semester End Examination, PA-Project Assessment, AT- Attendance

Part 3 - Detailed Syllabus of Semester - I

Course Code: PS-FCS-101 Advanced Algorithms and Data Structures

Unit	Content	No. of Lectures
1	<p>1.1 Foundations: Role of Algorithms in Computing, Analyzing Algorithms, The divide-and-conquer approach, Analyzing divide-and-conquer algorithms, Growth of Functions- Asymptotic notations, Standard notations and common functions, Recurrences- The substitution method, The recursion-tree method, The master method.</p> <p>1.2 Sorting and Order Statistics: Heapsort- Heaps, Maintaining the heap property, Building a heap, The heapsort algorithm, Priority queues, Quicksort- Description of quicksort, Performance of quicksort, A randomized version of quicksort, Analysis of quicksort, Sorting in Linear Time- Lower bounds for sorting, Counting sort, Radix sort, Bucket sort, Medians And Order Statistics- Minimum and maximum, Selection in expected linear time, Selection in worst-case linear time.</p>	15
2	<p>Advanced Design and Analysis Techniques:</p> <p>2.1 Dynamic Programming: The General Method, Elements of Dynamic Programming, Longest Common Subsequence, 0/1 Knapsack, Matrix Chain Multiplication, The Subset Sum Problem, Multistage graphs, All pairs shortest paths, The Travelling Salesman Problem.</p> <p>2.2 Greedy Algorithms: The General Method, Elements of greedy strategy, Knapsack Problem, Huffman codes, Job sequencing with deadlines, Optimal merge patterns, Minimum cost spanning tree algorithms, Single Source Shortest Paths.</p> <p>2.3 Amortized Analysis: Aggregate analysis, The accounting method, The potential method, Dynamic tables.</p>	15
3	<p>3.1 Elementary and Advanced Data Structures: Stacks and Queues, Linked lists, Maps and Dictionaries, Hash Tables, Binary Trees, Tree Traversal Algorithms, Search Trees- Binary Search Trees, Balanced Search Trees, AVL Trees, Splay Trees, (2, 4) Trees, Red-Black Trees, B-Trees.</p> <p>3.2 Maximum Flow: Flow Networks, The Ford Fulkerson method, Maximum bipartite matching.</p> <p>3.3 String Matching: Naive Pattern Matching Algorithm, KMP Algorithm, Rabin Karp Algorithm.</p>	15
4	<p>4.1 Number-Theoretic Algorithms: Elementary number-theoretic notions, Greatest common divisor, Modular arithmetic, Solving modular linear equations, The Chinese remainder theorem, Powers of an element, The RSA public-key cryptosystem.</p> <p>4.2 Approximation Algorithms: The vertex cover problem, The travelling salesman problem, The set covering problem, The subset sum problem.</p> <p>4.3 NP Completeness: Polynomial Time, Polynomial time verification, NP – completeness and reducibility, NP – Complete problems.</p> <p>4.4 Linear Programming: Standard and Slack forms, Formulating problems as linear programs, The simplex algorithm.</p>	15

References:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. Horowitz, Ellis, and Sartaj Sahni, Fundamentals of Computer Algorithms, Rockville, Md: Computer Science Press.
3. Michael Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, New York: John Wiley & Sons, Inc., [2013].
4. Dr. Basant Agarwal, Benjamin Baka, Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latest features of Python 3.7, 2nd Edition (2018)
5. Grokking Algorithms: An illustrated guide for programmers and other curious people, MEAP, Aditya Bhargava

PS-FCS-102 Business Analytics

Unit	Content	No. of Lectures
1	<p>1.1 Introduction to Business Analytics: Business Analytics for competitive advantage, Foundation of Analytics, Information Management in Analytics.</p> <p>1.2 Statistical Models in Business Analytics: Review of Statistical methods, Logistic Regression, Simulation Techniques, Sampling Techniques, Forecasting Techniques, Dynamic Programming, Inventory Models, Resampling Methods.</p>	15
2	<p>2.1 Business Intelligence Architecture and Capabilities: Business Intelligence Architecture: Data - Model – Presentation, Business Intelligence capabilities - Reporting, Ad-Hoc Analysis, Dashboards, Scorecards, Event Management, Spreadsheet modeling, Overview of Data Visualization.</p>	15
3	<p>3.1 Mining Social Networks: Social Networks as Graphs, Clustering of Social-Network Graphs, Direct Discovery of Communities, Finding Overlapping Communities.</p>	15
4	<p>4.1 Applied Text Analytics: Fundamentals, Dimension Reduction (PCA, SVD). Sentiment Analysis, Opinion Mining.</p> <p>4.2 Application of Analytics: Business Verticals, Marketing, Financial and Operations Management.</p>	15

References

1. R - Gareth James, Daniela Witten, Trevor Hastie Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer Publication, 2013.
2. Cathy O’Niel and Rachel Schutt, Doing Data Science, O’Rielly Publication, 2013.
3. Allen B. Downey, Think Bayes Bayesian Statistics Made Simple, Green Tea Press Needham, Massachusetts, 2013.
4. Bing Liu, Sentiment Analysis and Opinion Mining, Morgan and Claypool Publishers, 2012.
5. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
6. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India Ltd, 1st Edition, 2011.

PS-FCS-103 Soft Computing

Unit	Content	No. of Lectures
1	<p>1.1 Introduction to Soft Computing: Soft computing characteristics, Difference between soft computing and hard computing, Applications of soft computing, Introduction to various types of soft computing techniques, Neural Networks, Fuzzy Logic, Associative Memory, Hybrid Systems, Genetic Algorithms.</p> <p>1.2 Artificial Neural Networks (ANN) Basic Concepts: Introduction- The Biological Neuron, The Artificial Neuron, Characteristics of the Brain, Computation in terms of patterns- Pattern Classification, Pattern Association, McCulloch Pitts Neural model, The Perceptron- The Structure, Linear Separability, The XOR Problem, Neural Network Architectures- Single Layer Feed Forward ANNs, Multilayer Feed Forward ANNs, Competitive Network, Recurrent Networks, Activation Functions, Learning by Neural Nets- Supervised and Unsupervised Learning, Applications of ANNs.</p>	15
2	<p>2.1 Pattern Classifiers: Hebb Nets, Perceptrons, ADALINE, MADALINE.</p> <p>2.2 Pattern Associators: Introduction, Hebb rule, Outer product rule, Auto-associative memory network, and Hetero-associative memory networks, Hopfield Networks- Architecture and Training, Bidirectional Associative Memory- Architecture, Training, Application.</p> <p>2.3 Competitive Neural Nets: The MAXNET, Kohonen Self-organizing Map (SOM), Learning Vector Quantization, Adaptive Resonance Theory.</p>	15
3	<p>3.1 Backpropagation: Multi-layer Feedforward Net – Architecture, Notational Convention, Activation Functions, The Generalized Delta Rule, The Backpropagation Algorithm.</p> <p>3.2 Fuzzy Sets: Crisp Sets: A Review- Basic Concepts, Operations on Sets, Properties of Sets, Fuzzy Sets- Fuzziness/Vagueness/Inexactness, Set Membership, Fuzzy Sets, Fuzziness vs. Probability, Features of Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations- Crisp Relations, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Extension Principle.</p>	15
4	<p>4.1 Fuzzy Logic: Crisp Logic: A Review- Propositional Logic, Predicate Logic, Rules of Inference, Fuzzy Logic Basics, Fuzzy Truth in Terms of Fuzzy Sets, Fuzzy Rules- Fuzzy If-Then, Fuzzy If-Then-Else, Fuzzy Reasoning- Fuzzy Quantifiers, Generalized Modus Ponens, Generalized Modus Tollens.</p> <p>4.2 Fuzzy Inference Systems: Introduction, Fuzzification of the Input Variables, Application of Fuzzy Operators on the Antecedant Parts of the Rules, Evaluation of the Fuzzy Rules, Aggregation of Output Fuzzy Sets Across the Rules, Defuzzification of the Resultant Aggregate Fuzzy Set- Centroid Method, Centre-of-Sums (CoS) Method, Mean-of-Maxima (MoM) Method, Fuzzy Controllers- Fuzzy Air Conditioner Controller, Fuzzy Cruise Controller.</p>	15

References:

1. S.N. Deepa, S.N. Sivanandam, Principles of Soft Computing, 3ed, Wiley:
<https://www.wileyindia.com/principles-of-soft-computing-3ed.html>
2. Samir Roy, Udit Chakraborty, Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms, 1e, Pearson.
https://www.pearsoned.co.in/web/books/9788131792469_Introduction-to-Soft-Computing_Samir-Roy.aspx
3. Frank Hoffmann, Mario Köppen, Frank Klawonn, Rajkumar Roy, Soft Computing: Methodologies and Applications, 2006, Springer.
<https://www.springer.com/gp/book/9783540257264>
4. Chuen-Tsai Sun, Eiji Mizutani, and Jyh-Shing Roger Jang, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence.
5. N. P. Padhy, S. P. Simon, Soft Computing: With MATLAB Programming, Oxford University Press (2015). <https://global.oup.com/academic/product/soft-computing-with-matlab-programming-9780199455423?cc=ie&lang=en>

PS-FCS-104 Research Methodology

Unit	Content	No. of Lectures
1	<p>1.1 Research: What does it mean? Characteristics of Research</p> <p>1.2 Research Methods versus Methodology, Research and Scientific Method.</p> <p>1.3 Types of Research: Descriptive versus Analytical, Applied versus Fundamental, Quantitative versus Qualitative, Conceptual versus Empirical. Research Process.</p> <p>1.4 Formulating a Research Problem: Reviewing Literature, formulating a Research Problem, Identifying Variables, Constructing Hypothesis</p>	15
2	<p>2.1 The Research Design: Meaning, Need for Research Design, Important Concepts, Different Research Designs, Basic Principles of Experimental Designs.</p> <p>2.2 Sampling Design: Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample.</p> <p>2.3 Collecting Data: Considering Ethical Issues in Data Collection, Methods of Data Collection.</p>	15
3	<p>3.1 Processing and Analysis of Data: Processing Operations, Some Problems in Processing, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Asymmetry (Skewness), Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association in Case of Attributes.</p> <p>3.2 Hypothesis Testing: What is a Hypothesis?, Basic Concepts Concerning Testing of Hypotheses, Procedure for Hypothesis Testing, Flow Diagram for Hypothesis Testing, Tests of Hypotheses, One sided and Two sided hypothesis, Critical region, p-value, Confidence intervals, Conducting a Hypothesis Test, Type – I and Type – II errors.</p>	15
4	<p>4.1 Technical Writing: Writing a Research Proposal, What is a Scientific Paper? Ethics in Scientific Publishing.</p> <p>4.2 Preparing the Text: How to Prepare the Title, How to List the Authors and Addresses, How to Prepare the Abstract, How to Write the Introduction, How to Write the Materials and Methods Section, How to Write the Results, How to Write the Discussion, How to State the Acknowledgments, How to Cite the References.</p> <p>4.3 Preparing the Tables and Figures: How to Design Effective Tables, How to Prepare Effective Graphs, How to Prepare Effective Photographs.</p> <p>4.4 Publishing the Paper: Rights and Permissions, How to Submit the Manuscript, How and When to Use Abbreviations, How to Write a Thesis, Outcome of Research</p>	15

References:

1. Kothari C.R., Research Methodology, New Age International Publication, New Delhi.
2. Ranjit Kumar, Research Methodology-A Step-by-Step Guide for Beginners, (4th ed.), 2014, Singapore, Pearson Education.
3. Robert, A. Day, How to Write and Publish a Scientific Paper, Cambridge University Press, Great Britain.

Part 4 - 10 practical based on the above syllabus in all subjects of Semester - I.

Course Code: PS-FCS-1P1

Total Credits: 04

Practical - I	Content	No. of lectures
Advanced Algorithms and Data Structures	<p>1. Sorting Algorithms A. Illustrate the operation of INSERTION-SORT on the array $A = \{31, 41, 59, 26, 41, 58\}$. Write a program to implement insertion sort. Find the running time of the algorithm. B. Illustrate the operation of MERGE-SORT on the array $A = \{3, 41, 52, 26, 38, 57, 9, 49\}$. Write a program to implement merge sort. Find the running time of the algorithm. C. Illustrate the operation of PARTITION on the array $A = \{13, 19, 9, 5, 12, 8, 7, 4, 11, 2, 6, 21\}$. Write a program to implement quick sort. Analyze the performance of quick sort with respect to worst case, best case and balanced partitioning. D. Given an array of numbers of length l. Write a program to generate a random permutation of the array using (i) permute-by-sorting () and (ii) permute-by-cyclic ().</p> <p>2. Dynamic Programming A. Longest Common Subsequence (LCS) problem. B. Longest Increasing Subsequence (LIS) problem. C. 0/1 Knapsack problem. D. Travelling Salesman Problem.</p> <p>3. Greedy Algorithms A. Single Source Shortest Path Problem B. Knapsack Problem C. Job Sequencing with Deadlines D. Minimum Spanning Tree algorithms</p> <p>4. Elementary Data Structures and Advanced Data Structures A. Implement two stacks in one array. Can n stacks be implemented in one array? B. Design a Data Structure ‘SpecialStack’ that supports all the stack operations: push (), pop(), isEmpty(), isFull(), findMiddle(), deleteMiddle() and additional operation getMin() in $O(1)$ time and</p>	<p>60</p>

	<p>O(1) extra space.</p> <p>C. Application of Stack: Check for balanced parentheses in an expression.</p> <p>D. Implement Queue using Stacks.</p> <p>E. Flattening a Linked List.</p> <p>F. Add 1 to a number represented as linked list</p> <p>G. Print the middle of a given linked list.</p> <p>H. Find n^{th} node from the end of a linked list.</p> <p>I. Detect loop in linked list.</p> <p>5. String Matching Algorithms</p> <p>A. Naive Pattern Matching Algorithm</p> <p>B. KMP Algorithm</p> <p>C. Rabin Karp String Matching Algorithm</p> <p>6. Implement Maximum Flow Problem by using Ford Fulkerson Algorithm.</p> <p>7. Write a program to verify (i) Euclid's theorem (ii) Fermat's theorem.</p> <p>8. Write a program to implement a greedy set cover algorithm to solve set covering problem.</p>	
<p>Business Analytics and Business Intelligence</p>	<p>1. Use Statistical functions in Spreadsheet to give simple predictions for given data sets.</p> <p>2. Explore the various financial, mathematical functions and demonstrate their use for decision making.</p> <p>3. Use given datasets to demonstrate the various charting options in Spreadsheets</p> <p>4. Create dashboards using Spreadsheets.</p> <p>5. Using R / Weka, perform Sentiment Analysis based on reviews on a dataset.</p> <p>6. Using R / Weka, using opinion mining, determine the opinion of the consumer.</p> <p>7. Perform dimensionality reduction using PCA and SVD techniques and compare their performances on given data sets.</p> <p>8. Perform clustering to find communities in simple social graphs.</p> <p>9. Study of any one Web Analytics tool.</p> <p>10. Study of any two reporting tools.</p>	<p>60</p>

Course Code: PS-FCS-1P2

Total Credits: 04

Practical - II	Content	No. of lectures
Soft Computing	<ol style="list-style-type: none">1. Simple neural network model.2. Program to implement activation functions.3. Generate AND/NOT function using McCulloch-Pitts neural net.4. Generate XOR function using McCulloch-Pitts neural net.5. Program to construct and test an auto-associative network for input vector using Hebb rule.6. Program to construct and test auto-associative network for input vector using outer product rule.7. Program to construct and test heteroassociative network for binary inputs and targets.8. Implement a back propagation network for a given input pattern.9. Program to implement kohonen self-organizing feature maps for given input pattern.10. Program to implement discrete Hopfield network and test the input pattern.11. Program to implement membership functions.12. Program to implement fuzzy set operations.13. Fuzzy inference system.	60
Research Methodology	<ol style="list-style-type: none">1. Import data from different data-sources2. Pre-processing the data / cleaning the data3. Obtain descriptive statistics of data4. Data visualization5. Hypothesis testing6. ANOVA7. Perform random sampling for the given data and analyze it8. Compute different types of correlation9. Linear regression10. Multiple linear regression	60

Part 5 - First Year Semester -II Internal and External Detailed Evaluation Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week					Credits	Internals (40)				Total Marks
			Units	S. L.	L	T	P		SLE	CT + AT = 15 + 5	PA	SEE	
1	PS-FCS-201	Blockchain	4	20 % *	4	0	-	4	10	20	10	60	100
2	PS-FCS-202	Network and Communication Security	4	20 % *	4	0	-	4	10	20	10	60	100
3	PS-FCS-203	Elective – I Track A: Artificial Intelligence and Machine Learning (Fundamentals of Artificial Intelligence and Machine Learning)	4	20 % *	4	0	-	4	10	20	10	60	100
4	PS-FCS-204	Elective – I Track B: Cloud Computing (Concepts and Design of Web services)	4	20 % *	4	0	-	4	10	20	10	60	100
5	PS-FCS-205	Elective – II Track C: Big Data Engineering (Big Data Analytics and	4	20 % *	4	0	-	4	10	20	10	60	100

		Business Intelligence)											
6	PS-FCS-206	Elective – II Track D: Human Computer Interaction (Fundamentals of Human Computer Interaction)	4	20 %*	4	0	-	4	10	20	10	60	100
5	PS-FCS-2P1	Practical of PS- FCS-201 + PS- FCS-202	-	-	-	-	8	4				100 (80+ 20)	100
6	PS-FCS-2P2	Practical of Elective – I and Elective – II	-	-	-	-	8	4				100 (80+ 20)	100
	Total Lectures/ Credits							24	Total Marks				600

L: Lecture: Tutorials P: Practical Ct-Core Theory, Cp-Core Practical, SLE- Self learning evaluation CT-Commutative Test, SEE- Semester End Examination, PA-Project Assessment, AT- Attendance

Part 6 - Detailed Syllabus of Semester - II

Course code: PS-FCS-201 Blockchain

Unit	Content	No. of Lectures
1	<p>1.1 Origin And Working Of Blockchain: How does our current financial system work?, What can be the possible solution? What is a distributed system?, What is Blockchain? How does a Blockchain work? Properties of Blockchain, Evolution of Blockchain.</p> <p>1.2 Cryptocurrency And Blockchain: Anonymity and Pseudonymity in Cryptocurrency, Programmable Money, What is inside a block?, Hash Functions and Merkle Trees, Components of Blockchain Ecosystem. Cryptography and Consensus Algorithms, Types of Blockchain, Side Chains: another Type of Blockchain, Blockchain Implementations, Blockchain Platforms</p>	15
2	<p>2.1 Bitcoin Platform: What is Bitcoin? Why use Bitcoins? Bitcoin Trading: Buying, selling and storing Bitcoins Bitcoin Ecosystem, Structure of a Bitcoin Transaction, Scripting language in Bitcoin Applications of Bitcoin script, Nodes in a Bitcoin Network</p> <p>2.2 Introduction To Ethereum: What is Ethereum?, Introducing Smart Contracts, Cryptocurrency in Ethereum, Mining in Ethereum, Consensus Mechanism in Ethereum, Platform Functions used in Ethereum, Technologies that support Ethereum. Ethereum Programming Language, Components for development of Ethereum DApps, Editors and tools, Frontend Development, Ethereum, Test Networks, ERC Tokens</p>	15
3	<p>3.1 Basic Solidity: Introducing Solidity, Sample Code, Layout of Source File, Structure of a Contract, State Variables, Functions Types, Reference Types, Units, Special Variables and Functions, Expressions and Control Structures, Function Calls Error Handling, Visibility for Functions and State Variables</p> <p>3.2 Advanced Solidity: State Modifiers, Inheritance, Constructors, Libraries, Importing Smart Contracts, Events and Logging, Error Handling and Exceptions, Common Pitfalls, Gas Limit and Loops. Sending and Receiving Ether, Recommendations, Contract ABI, Setting up the development environment</p>	15
4	<p>4.1 Hyperledger: Introduction to Hyperledger, Hyperledger architecture, Consensus, Hyperledger API and Application Model, Network Topology, Exploring Hyperledger frameworks, Business Network Deployment on Hyperledger Composer Playground</p> <p>4.2 MultiChain: What Is MultiChain?, Privacy and Permissions in MultiChain, Mining in MultiChain, Multiple configurable Blockchains using MultiChain, Setting up a Private Blockchain, Setting up a private Blockchain.</p> <p>4.3 Prospects of Blockchain:</p>	15

Blockchain prospering our world, Blockchain transforming business and professionalism, Discussing practical use-cases of Blockchain, Real case scenarios of Blockchain, How governments around the world are using Blockchain?	
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References:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.
3. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
4. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

PS-FCS-202 Network and Communication Security

Unit	Content	No. of Lectures
1	1.1 Computer Security: Principles of Security, Different Attacks: malicious and non-malicious program, Types of Computer Criminals. Operating System Security: Protected objects and methods of protection. Memory address protection: Fence, Relocation, Base/Bound Registers, Tagged Architecture, Segmentation, Paging, Directory, access control list. Database Security: Security requirements, Integrity, Confidentiality, Availability, Reliability of Database, Sensitive data, Multilevel database, Proposals for multilevel security.	15
2	2.1 Network Security: Different types of network layer attacks, Firewall (ACL, Packet Filtering, DMZ, Alerts and Audit Trails) – IDS,IPS and its types (Signature based, Anomaly based, Policy based, Honeypot based). Web Server Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET), Kerberos.	15
3	3.1 Cloud Security: How concepts of Security apply in the cloud, User authentication in the cloud; How the cloud provider can provide this-Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security- storage considerations, backup and recovery- Virtualization System Vulnerabilities, security management standards- SaaS, PaaS, IaaS availability management- access control- Data security and storage in cloud.	15
4	4.1 Mobile Security: Mobile system architectures, Overview of mobile cellular systems, GSM and UMTS Security & Attacks, Vulnerabilities in Cellular Services, Cellular Jamming Attacks & Mitigation, Security in Cellular VoIP Services, Mobile application security. Securing Wireless Networks: Overview of Wireless Networks, Scanning and Enumerating 802.11 Networks, Attacking 802.11 Networks, Bluetooth Scanning and Reconnaissance, Bluetooth Eavesdropping, Attacking & Exploiting Bluetooth, Zigbee Security & Attacks.	15

References

1. Security in Computing 4th edition, Charles P. Pfleeger, Charles P. Pfleeger, Shari Lawrence Pfleeger, Prentice Hall; 4th edition (2006)
2. Mobile and Wireless Security and Privacy, Kia Makki, Peter Reiher, Springer, (2007).
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory and practice), Tim Mather, Subra Kumaraswamy, Shahed Latif., O'Reilly Media; 1 edition (2009).
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley (2010)
5. Network Security, Charlie Kaufman, Radia Perlam, Mike Speciner, Prentice Hall, 2nd Edition (2002)
6. Cryptography and Network Security 3rd edition, Atul Kahate, Tata McGraw Hill Education Private Limited (2013)

PS-FCS-203 Elective – I

Track A: Artificial Intelligence and Machine Learning

(Fundamentals of Artificial Intelligence and Machine Learning)

Unit	Content	No. of Lectures
1	<p>1.1 Introduction to Artificial Intelligence & Machine Learning What is artificial intelligence? The AI problems, the underlying assumption, what is an AI technique? Defining the problem as a State Space Search, Production systems, problem characteristics.</p> <p>1.2 Definition of learning systems. Goals and applications of machine learning. Designing a learning system: training data, concept representation, function approximation. Well posed learning problems, perspective & issues in machine learning.</p>	15
2	<p>2.1 Learning-Standard Linear methods Statistical Learning: What Is Statistical Learning, Assessing Model Accuracy. Linear Regression: Simple Linear Regression, Multiple Linear Regressions, Other Considerations in the Regression Model, The Marketing Plan, Comparison of Linear Regression with K-Nearest Neighbors. Classification: An Overview of Classification, Why Not Linear Regression? , Logistic Regression, Linear Discriminant Analysis. A Comparison of Classification Methods</p>	15
3	<p>3.1 Selection and improvements of linear learning methods Resampling Methods: Cross-Validation, The Bootstrap. Linear Model Selection and Regularization: Subset Selection, Shrinkage Methods, Dimension Reduction Methods, Considerations in High Dimensions.</p> <p>3.2 Non-Linear Learning methods Polynomial Regression, Step Functions, Basis Functions, Regression Splines, Smoothing Splines, Local Regression, Generalized Additive Models, Tree-Based Methods: The Basics of Decision Trees. Bagging, Random Forests, Boosting.</p>	15
4	<p>4.1 Support Vector machines, Principal Component Analysis and Clustering: Support Vector Machines: Maximal Margin Classifier.</p> <p>4.2 Support Vector Classifiers: Support Vector Machines, SVMs with More than Two Classes Relationship to Logistic Regression. Unsupervised Learning: The Challenge of Unsupervised Learning, Principal Components Analysis, Clustering Methods: K-Means Clustering, Hierarchical Clustering, Practical Issues in Clustering.</p>	15

References:

1. A First course in Artificial Intelligence, Deepak Khemani, Tata McGraw Hill Education (India) private limited (2013)
2. An Introduction to Statistical Learning with Applications in R: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer 2013.
3. The Elements of Statistical Learning: Data Mining, Inference, and Prediction (Second Edition): Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer (2008)
4. Artificial Intelligence: A Modern Approach, 3e, Stuart Jonathan Russell, Peter Norvig, Prentice Hall Publications (2010).
5. Artificial Intelligence Illuminated, Ben Coppin, Jones and Bartlett Publishers Inc (2004)
6. Artificial Intelligence A Systems Approach, M Tim Jones, Firewall media, New Delhi (2008)
7. Artificial Intelligence -Structures and Strategies for Complex Problem Solving., 4/e, George Lugar, Pearson Education (2002).
8. Introduction to Machine Learning (Second Edition): Ethem Alpaydın, The MIT Press (2010).
9. Pattern Recognition and Machine Learning: Christopher M. Bishop, Springer (2006)
10. Bayesian Reasoning and Machine Learning: David Barber, Cambridge University Press (2012)
11. Machine Learning: The Art and Science of Algorithms that Make Sense of Data: Peter Flach, Cambridge University Press (2012)
12. Machine Learning for Hackers: Drew Conway and John Myles White, O'Reilly (2012)
13. Machine Learning in Action: Peter Harrington, Manning Publications (2012).
14. Machine Learning with R: Brett Lantz, Packt Publishing (2013)

PS-FCS-204 Elective – I

Track B: Cloud Computing (Concepts and Design of Web services)

Unit	Content	No. of Lectures
1	1.1 Web Service as distributed application The Service Endpoint Interface (SEI) and Service Implementation Bean (SIB), JAX-WS, Publishing Web Service, Calling Web Service from applications developed in different platform, SOAP, Message transport, Service contract, Web Services returning Richer Data types, WSDL structure	15
2	2.1 SOAP Based Web Services Structure of SOAP Message (In JAX-WS), SOAP Messaging Architecture, SOAP Header, Client-side SOAP Handler, Generating a Fault, Service-side SOAP Handler, Handler methods, Message Context and Transport Headers, Web Services and Binary Data.	15
3	3.1 REST-style Web Services What is REST? HTTP methods, Java API for RESTful Web Services (JAX-RS), JAX-RS with Jersey, CRUD RESTful Web Service, SOAP and REST in Harmony, Interoperability between the Java Platform and WCF, WSIT, Web Services Security, Wire-Level Security, WS-Security.	15
4	4.1 Amazon Web Services (AWS) Essentials Architecting on AWS, Building complex solutions with Amazon Virtual Private Cloud (Amazon VPC), Leverage bootstrapping and auto configuration in designs, Architect solutions with multiple regions, Employ Auto Scaling design patterns, Amazon CloudFront for caching, Big data services including AWS Data Pipeline, Amazon Redshift and Amazon Elastic MapReduce. AWS OpsWorks.	15

References:

1. Java Web Services Up and Running 2nd edition, Martin Kalin, O'Reilly (2013)
2. Pro PowerShell for Amazon Web Services, Brian Beach, Apress, 2014.
3. Programming Amazon EC2, Jurg van Vliet, Flavia Paganelli, O'Reilly Media, 2011
4. JAX-WS Reference Implementation (RI) Project, <https://jax-ws.java.net/>.
5. Java API for RESTful Services (JAX-RS), <https://jax-rs-spec.java.net/>.
6. RESTful Web Services in Java, <https://jersey.java.net/>.
7. AWS Training, <http://aws.amazon.com/training>

PS-FCS-205 Elective II

Track C: Big Data Engineering (Big Data Analytics and Business Intelligence)

Unit	Content	No. of Lectures
1	1.1 Introduction to Business Intelligence: Operational and Decision Support System, Data-Information-Knowledge-Decision making-Action cycle. Basic definitions- Business Intelligence; Data warehousing, Business Intelligence architecture, Use and benefits of Business Intelligence. Knowledge Discovery in Databases: KDD process model, Data Pre-processing: Cleaning: Missing Values; Noisy Values; Inconsistent values; redundant values. Outliers, Integration, transformation, reduction, Discretization: Equal Width Binning; Equal Depth Binning, Normalization, Smoothing.	15
2	2.1 Introduction to Business Data Warehouse: Definition of Data warehouse, Logical architecture of Data Warehouse, Data Warehouse model- Enterprise warehouse; Data Marts; Virtual warehouse. Populating business Data Warehousing: data integration and extract, transform, load (ETL)	15
3	3.1 Designing Business Data Warehouse: OLTP and OLAP systems, Designing business information warehouse: Principles of dimensional modelling, Data cubes, Data cube operations, data cube schemas.	15
4	4.1 Introduction to Data Mining: Data mining definitions and process: business and data understanding. Association Analysis: Definition of association rule, General issues: Support; Confidence; Lift; Conviction, Frequent Item sets: APriori Algorithm; Issues with APriori Algorithm, Data structures: Hash tree and FP tree	15

References:

1. Business Intelligence (2nd Edition), Efraim Turban, Ramesh Sharda, Dursun Delen, David King, Pearson (2013)
2. Business Intelligence for Dummies, Swain Scheps, Wiley Publications (2008).
3. Building the Data Warehouse, Inmon: Wiley (1993).
4. Data Mining: Introductory and Advanced Topics, Dunham, Margaret H, Prentice Hall (2006)
5. Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Witten, Ian and Eibe Frank, Morgan Kaufmann (2011)
6. Business Intelligence RoadMap, Larissa T. Moss, Shaku Atr, Addison-Wesley
7. Data Modeling Techniques for Data Warehousing by IBM; International Technical Support Organization, Chuck Ballard, Dirk Herreman, Don Schau, Rhonda Bell, Eunsang Kim, Ann Valencic :<http://www.redbooks.ibm.com>
8. Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems, Han J. and Kamber M. Morgan Kaufmann Publishers, (2000).
9. Data Mining with Microsoft SQL Server 2008, MacLennan Jamie, Tang ZhaoHui and Crivat Bogdan, Wiley India Edition (2009).

PS-FCS-206 Elective – II

Track D: Human Computer Interaction

(Fundamentals of Human Computer Interaction)

Unit	Content	No. of Lectures
1	1.1. Introduction: Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields. The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error.	15
2	2.1 Understanding goal directed design: Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels; Understanding users; Modeling users – personas and goals. 2.2 GUI: Benefits of a good UI; popularity of graphics; concept of direct manipulation; advantages and disadvantages; characteristics of GUI; characteristics of Web UI; General design principles.	15
3	3.1 Design guidelines: Perception, Gestalt principles, visual structure, reading is unnatural, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.	15
4	4.1 Interaction styles: Menus; windows; device-based controls, screen-based controls; Design guidelines 4.2 Communication: Text messages; feedback and guidance; graphics, icons and images; colours.	15

References:

1. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale “Human Computer Interaction”, Prentice Hall.
2. Galitz, Wilbert O. The essential guide to user interface design: an introduction to GUI design principles and techniques. John Wiley & Sons, 2007.
3. Alan Cooper, Robert Reimann, David Cronin, “About Face3: Essentials of Interaction design”, Wiley publication.
4. Johnson, Jeff. Designing with the mind in mind: simple guide to understanding user interface design guidelines. Elsevier, 2013.
5. Donald A. Normann, “Design of everyday things”, Basic Books; Reprint edition 2002
6. Rogers, Yvonne, et al. "Interaction design: beyond human-computer interaction." netWorker: The Craft of Network Computing 11.4 (2007): 34.
7. Boy, Guy A., ed. The handbook of human-machine interaction: a human-centered design approach. Ashgate Publishing, Ltd., 2012.

Part 7 - 10 practical based on the above syllabus in all subjects of Semester - II.

Course Code: PS-FCS-2P1

Total Credits: 4

Practical - I	Content	No. of lectures
Blockchain	<ol style="list-style-type: none"> 1. Simple Blockchain Implementation. 2. Block chain implementation with database. 3. Smart contract with token/coin. 4. Smart contract to solve/optimize a problem using Ethereum. 5. Develop your own Smart Contracts using Solidity on the Remix IDE using Remix browser, Coding experience on Solidity language. 6. Incorporate a front-end GUI to your solidity contracts using Truffle and web3.js. 7. Developing A DApp Using Truffle: develop a DApp service using concepts of Solidity and deploy it on a local test Blockchain, Ganache. 8. Setting up a Development Environment Using Hyperledger Composer. 9. Create and Deploy your Private Blockchain on MultiChain. 10. Case Study: Prospects of Blockchain. 	60
Network and Communication Security	<ol style="list-style-type: none"> 1. Write a program to store username and password in an encrypted form in a database to implement integrity lock. 2. Write SQL query to retrieve sensitive information from less sensitive queries 3. Write SQL query to create a view to implement concept of views and commutative filter in distributed databases. 4. Write a program to implement SSL. 5. Write a program to send an encrypted email. 6. Write a program to digitally sign MIME to create an ‘opaque’ signature. 7. Write a program to generate a DSA SSH key. 8. Write a program to implement multilevel security. 9. Write a program to demonstrate how to encrypt and decrypt the content of an XML node using 128-bit CBC AES encryption. 	60

Course Code: Course Code: PS-FCS-2P2

Total Credits:

Practical of Elective – I&II:

Practical - II	Content	No. of lectures
<p>Elective - I Track A: Artificial Intelligence and Machine Learning (Fundamentals of Artificial Intelligence and Machine Learning)</p> <p>OR</p> <p>Elective – I Track B: Cloud Computing (Concepts and Design of Web services)</p>	<p>Fundamentals of Artificial Intelligence and Machine Learning</p> <ol style="list-style-type: none"> 1. Implement a simple linear regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Boston, Auto etc] 2. Implement multiple regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Carseats, Boston etc]. 3. Fit a classification model using following: <ol style="list-style-type: none"> (i) Logistic regression (ii) Linear Discriminant Analysis (LDA) and (iii) Quadratic Discriminant Analysis (QDA) on a standard data set and compares the results. [Inbuilt datasets like Smarket, Weekly, Auto, Boston etc may be used for the purpose]. 4. Fit a classification model using K Nearest Neighbour (KNN) Algorithm on a given data set. [One may use data sets like Caravan, Smarket, Weekly, Auto and Boston]. 5. Use bootstrap to give an estimate of a given statistic. [Datasets like Auto, Portfolio and Boston etc may be used for the purpose]. 6. For a given data set, split the data into two training and testing and fit the following on the training set: <ol style="list-style-type: none"> (i) Linear model using least squares (ii) Ridge regression model (iii) Lasso model (iv) PCR model (iv) PLS model Report test errors obtained in each case and compare the results. [Data sets like College, Boston etc may be used for the purpose]. 7. For a given data set, perform the following: <ol style="list-style-type: none"> (i) Perform the polynomial regression and make a plot of the resulting polynomial fit to the data. (ii) Fit a step function and perform cross validation to choose the optimal number of cuts. Make a plot of the fit to the data. [Use a data set like Wage for the purpose]. 8. For a given data set, do the following: <ol style="list-style-type: none"> (i) Fit a classification tree (ii) Fit a regression tree [One may choose data sets like Carseats, Boston etc for the purpose]. 9. For a given data set, split the dataset into training and testing. Fit the following models on the training set and evaluate the performance on the test set: <ol style="list-style-type: none"> (i) Boosting 	<p>60</p>

	<p>(ii) Bagging (iii) Random Forest [Data sets like Boston may be used for the purpose]. 10. Fit a support vector classifier for a given data set. [Data sets like Car, Khan, Boston etc may be used for the purpose]. 11. Perform the following on a given data set: (i) Principal Component Analysis (ii) Hierarchical clustering. [Data set like NC160, USArrests etc may be used for the purpose]. Note: The above practical experiments require the R / Python Software.</p> <p>OR</p> <p>Concepts and Design of Web services</p> <p>1. Develop Time Server service that returns current time in Java and call it from clients developed in Java, PHP, Android and .NET. 2. Develop Web service in Java that returns complex data types (e.g. as List of friends). 3. Develop Web service in Java that returns matrix multiplication by Strassen’s algorithm. Two matrices will be entered at run time by the client. Server does the matrix multiplication and returns an answer to the client. 4. Demonstrate CRUD operations with suitable database using SOAP or RESTful Web service. 5. Develop Micro-blogger applications (like Twitter) using RESTful Web services. 6. Develop application to consume Google’s search / Google’s Map RESTful Web service. 7. Develop WCF service returning response in JSON type. 8. Develop application to download image/video from server or upload image/video to server using MTOM techniques. 9. Using AWS Flow Framework develop application that includes a simple workflow. Workflow calls an activity to print hello world to the console. It must define the basic usage of AWS Flow Framework, including defining contracts, implementation of activities and workflow coordination logic and worker programs to host them. 10. Using AWS Flow Framework develop application, ‘Booking’ for making a reservation, including flight and rental car.</p>	
<p>Elective – II Track C: Big Data Engineering (Big Data Analytics</p>	<p>Big Data Analytics and Business Intelligence</p> <p>1. Create tables using different applications. 2. Develop an application to design a warehouse by importing various tables from external sources. 3. Develop an application for creating a fact table and measures in a cube.</p>	

<p>and Business Intelligence)</p> <p>OR</p> <p>Elective – II Track D: Human Computer Interaction (Fundamentals of Human Computer Interaction)</p>	<p>4. Develop an application to create dimension tables in a cube and form stars schema.</p> <p>5. Develop an application to create dimension tables in a cube and form a snowflake schema.</p> <p>6. Develop an application to create a dimension table from the Parent-Child schema.</p> <p>7. Develop an application to demonstrate operations like roll-up, drill-down, slice, and dice.</p> <p>8. Develop an application to demonstrate processing and browsing data from a cube.</p> <p>9. Develop an application to pre-process data imported from external sources.</p> <p>10. Create association rules by considering suitable parameters.</p> <p>OR</p> <p>Fundamentals of Human Computer Interaction</p> <p>1. Know your client</p> <p>a. Children (4-5 years of age): An application to teach math.</p> <p>b. Teenagers: Design a digital diary for young teens to help them overcome various social pressures they deal with during their teen years. The diary should also be like a self help tool which would help them deal with incidents like bullying, peer pressure, etc.. This is an open project and you can think in any direction to make the children sail through their teen years while trying to discover life around them.</p> <p>c. Older generation: Folks from the older generation has been very wary of using their credit card on the Internet. They have various concerns when it comes to paying their bills. Also because of their old age, it will be beneficial for them to use the internet and pay their phone, electricity, gas, etc. bills</p> <p>d. Rural people: ATVM for train ticketing in rural area</p> <p>2. Understand the trouble of interacting with machines Redesign interfaces of home appliances like microwave oven, land-line phone, fully automatic washing machine</p> <p>3. Learn HCI design principles – heuristic evaluation: Identify 5 different websites catering to one specific goal (eg. Goal – on-line shopping and 5 different websites – ebay, amazon, flipkart, zovi, myntra) and perform a competitive analysis on them to understand how each one caters to the goal, the interactions and flow of the payment system and prepare a report on the same.</p> <p>4. Learn the importance of menus and navigation – website redesign News websites like CNN are always cluttered with information. It takes the user a few minutes to find his way through and maybe more minutes to look for some specific information. Redesign the news websites to make it look less cluttered, provide relevant information (a person sitting</p>	
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	<p>in Russia should not get US news as top news), intelligently dig information that he might be interested in based on his searches on the web.</p> <p>5. Learn the importance of connecting humans – service design How often have you found yourself waiting at the airport for a flight that is delayed or you’ve missed it and the next one is 4 hours from now, or waiting for a connecting flight? Design an experience for passengers to deal with the long waiting hours.</p> <p>6. Learn the use of statistical graphics – expense tracker Matt is a young engineer who just finished his summer internship at a leading Software Company in the United States. He has never been independent in handling his own finances and after this internship his father has asked him to start managing his money on his own. He is looking for a tool/app/software that would help him budget his finances, create goals and track them, categorize and track his credit card spending and also get insights on the various types of categories he’s spending on. Design a tool/app/software that would help Matt manage his personal finances given the above requirement.</p> <p>7. Learn the importance of graphics – way finding Design a map for someone who is new to the city/town/village and is trying to understand how to commute from one place to another (inspired by New York Subway Maps, London Subway Maps)</p> <p>8. Icon designing Choose a unique domain, design a few icons and show how it can be accommodated on an interface.</p> <p>9. Understand the need of colors and animation – web site for an artist A celebrity in some form of art like music, dance, painting, martial arts, etc (not actors). This site will be used to display his works and should portray his character.</p> <p>10. Understand the various input methods available for interaction – concept generation Study the various technologies for typing – standard keyboards QWERTY, T9 (predictive text), multi-touch (SYWPE, etc.), gestures and brainstorm on the various ways in which you could improve one of the existing technologies. You could choose any of the different input types.</p>	
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