E.G.S.PILLAYENGINEERINGCOLLEGE

(Autonomous)

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Chennai AccreditedbyNAAC with "A"Grade|Accredited byNBA
(CSE, EEE, MECH, ECE, CIVIL, IT)

NAGAPATTINAM–611002

B.E. – Computer Science and Engineering
Full Time Curriculum and Syllabus

SEMESTER VIII									
Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
						CA	**ES**	**Total**	
Theory Course									
	Elective VII(**Bio Informatics)**	3	0	0	3	40	60	100	PE
	Elective VIII(**Data Centre and Virtualization)**	3	0	0	3	40	60	100	PE
	Elective IX(**Social Network Analysis**)	3	0	0	3	40	60	100	PE
Laboratory Course									
1704CS851	Project Work	0	0	18	9	50	50	100	EEC
Total		**9**	**0**	**18**	**18**	170	230	400	

List of Programme Electives for B.E. – Computer Science and Engineering

Course Code	**Course Name**	**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
						CA	**ES**	**Total**	
ELECTIVE - VII									
1703CS801	Deep Learning	3	0	0	3	40	60	100	PE
1703CS802	Natural Language Processing	3	0	0	3	40	60	100	PE
1703CS803	Soft Computing	3	0	0	3	40	60	100	PE
1703CS804	**Bio Informatics**	3	0	0	3	40	60	100	PE
1703CS805	Human Computer Interaction	3	0	0	3	40	60	100	PE
ELECTIVE - VIII									
1703CS806	Enterprise Resource Planning	3	0	0	3	40	60	100	PE
1703CS807	**Data Centre and Virtualization**	3	0	0	3	40	60	100	PE
1703CS808	Growth Hacking	3	0	0	3	40	60	100	PE
1703CS809	Information Retrieval	3	0	0	3	40	60	100	PE
1703CS810	Cyber Forensics	3	0	0	3	40	60	100	PE

ELECTIVE - IX									
1703CS811	Internet of Things	3	0	0	3	40	60	100	PE
1703CS812	Mainframe Computing	3	0	0	3	40	60	100	PE
1703CS813	Multicore Architecture	3	0	0	3	40	60	100	PE
1703CS814	Graph Theory And Its Applications	3	0	0	3	40	60	100	PE
1703CS815	**Social Network Analysis**	3	0	0	3	40	60	100	PE

ELECTIVE – VII

1703CS801	DEEP LEARNING	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Artificial Intelligence

Course Objectives:

1. Gain knowledge in Basics of Machine Learning
2. Understand and Apply Optimization on Deep Models and Networks
3. Understand and Analyze Recurrent and Recursive Networks

Unit I	INTRODUCTION	8 Hours

Introduction : Historical Trends in Deep Learning - Linear Algebra: Scalars - Vectors - Matrices - Tensors - Matrices - Norms – Eigen decomposition -Probability and Information Theory: Random variable and distributed Probability - Bayes Rule - Information Theory and structured probabilistic models

Unit II	MACHINE LEARNING BASICS	10 Hours

Numerical Computation: Overflow and Underflow - Gradient based Optimization - Constrained Optimization - Learning Algorithms: Capacity – Over fitting - Under fitting - Bayesian Classification - Supervised - unsupervised algorithms - Building machine learning algorithm.

Unit III	ADVANCED NEURAL NETWORKS	9 Hours

Deep Feed forward Networks : Gradient based learning - Hidden Units - Architectural design - Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustness - Semi supervised learning - Multitask learning - Ad serial training.

Unit IV	OPTIMIZATION ON DEEP MODELS	9 Hours

Optimization for training Deep Models: Challenges in Neural Networks optimization - Basic Algorithms - Algorithms Adaptive learning Rates - Approximate Second Order Methods - Optimization Strategies and Meta Algorithms - Convolutional Networks: Motivation - Structured Output - Unsupervised features - Neuroscientific basics for Convolutional Networks

Unit V	RECURRENT AND RECURSIVE NETWORKS	9 Hours

Computational graphs - Recurrent Neural networks - Bidirectional RNN - Deep Recurrent Networks - Echo State Networks - Practical Methodology - Applications: Large Scale Deep Learning - Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks

	Total:	45 Hours

Further Reading:

Deep Learning Research - Linear Factor Models

Course Outcomes:

After completion of the course, Student will be able to

CO1	Analyze Deep learning Mathematical Models.
CO2	Explore the Basic fundamentals of Machine Learning Algorithms.
CO3	Elucidate the Deep Feed forward Networks
CO4	Apply knowledge for Optimization on Deep Models and Convolutional Networks
CO5	Elucidate the Recurrent and Recursive Networks and Natural language Processing

References:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville.Deep Learning.2017
2. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classication. Wiley-Interscience, 2013
3. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4. Academic Press, 2008
4. Russell, S. and Norvig, N. Articial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence. 2003
5. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 1995
6. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning. Springer. 2001.
7. Koller, D. and Friedman, N. Probabilistic Graphical Models. MIT Press. 2009
8. http://nptel.ac.in/courses/110106064/36

1703CS802	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Artificial Intelligence

Course Objectives:

1. To provide a self-contained introduction to the central issues of Natural Language Processing (NLP)
2. To introduce various practical skills associated with the design and implementation of NLP systems

Unit I **INTRODUCTION** **9 Hours**

Knowledge in Speech and Language Processing- Ambiguity- Models and Algorithms- Language, Thought, and Understanding- The State of the Art and The Near-Term Future – Regular Expressions- Basic Regular Expression Patterns- Disjunction, Grouping, and Precedence- Using an FSA to Recognize Sheep talk- Formal Languages

Unit II **MORPHOLOGY AND FINITE-STATE TRANSDUCERS** **9 Hours**

Inflectional Morphology - Derivational Morphology- Finite-State Morphological Parsing- The Lexicon and Morph tactics - Morphological Parsing with Finite-State Transducers- Combining FST Lexicon and Rules- Lexicon-free FSTs: The Porter Stemmer- Human Morphological Processing- Speech Sounds and Phonetic Transcription- The Phoneme and Phonological Rules

Unit III **SYNTAX PARSING** **9 Hours**

Tag sets for English - Part of Speech Tagging- Rule-based Part-of-speech Tagging- Stochastic Part-of- speech Tagging- Transformation-Based Tagging- Context-Free Grammars for English - Context-Free Rules and Trees- The Noun Phrase . The Verb Phrase and Sub categorization- Grammar Equivalence & Normal Form- Finite State & Context-Free Grammars

Unit IV **SEMANTICS** **9 Hours**

Computational Desiderata for Representations- Meaning Structure of Language- First Order Predicate Calculus- Elements of FOPC- The Semantics of FOPC- Syntax-Driven Semantic Analysis- Attachments for a Fragment of English

Unit V **INFORMATION RETRIEVAL** **9 Hours**

Selection Restriction-Based Disambiguation- Limitations of Selection Restrictions- Robust Word Sense Disambiguation- Machine Learning Approaches- Dictionary-Based Approaches- The Vector Space Model- Term Weighting- Term Selection and Creation- Homonymy, Polysemy and Synonym

Total: 45 Hours

Further Reading:

Regular Languages and FSAs , Phonological Rules and Transducers, Grammars & Human Processing, Relations Among Lexemes and Their Senses, Improving User Queries

Course Outcomes:

After completion of the course, Student will be able to

CO1	Explain the concept of language processing and algorithms.
CO2	Exemplify the Morphology and Finite-State Transducers.
CO3	Implement the logic of syntax parsing methods.
CO4	Represent the semantics for language processing.
CO4	Summarize the approaches for information retrieval.

References:

1. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall; 2 edition, 2014
2. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media; 1st edition, 2009
3. Roland R. Hausser, Foundations of Computational Linguistics: Human- Computer Communication in Natural Language, Paperback, MIT Press, 2014
4. Foundations of Statistical Natural Language by Christopher D. Manning and Hinrich Schuetze, MIT Press, 1999
5. Statistical Machine Translation by philipp koehn, Cambridge University Press, 2012
6. http://nptel.ac.in/courses/106101007/

1703CS803	SOFT COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

1. Learn the various soft computing frame works.
2. Be familiar with design of various neural networks.
3. Be exposed to fuzzy logic.
4. Learn genetic programming.

Unit I **INTRODUCTION** **9 Hours**

Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

Unit II **NEURAL NETWORKS** **9 Hours**

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

Unit III **FUZZY LOGIC** **9 Hours**

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

Unit IV **GENETIC ALGORITHM** **9 Hours**

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem-advances in GA

Unit V **HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS** **9 Hours**

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers

Total: 45 Hours

Further Reading:

1. Reinforcement learning
2. Applications of neuro fuzzy system

Course Outcomes:

After completion of the course, Student will be able to

1. Apply various soft computing frame works.
2. Design of various neural networks.
3. Use fuzzy logic.
4. Apply genetic programming.
5. Discuss hybrid soft computing

References:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.
3. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.

1703CS804	BIO INFORMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To let the students know the recent evolution in biological science
2. To let the students know the Genome Databases
3. To let the students know the Sequence alignments

Unit I	GENOMICS	9 Hours

Genes, Genomes, Human Genome Project, Rough and Final Draft of Human Genome Project, Goals of Human Genome Project, Vectors: plasmids, Cosmids, bacteriophage, M13 vectors, BAC, YAC and synthetic plasmids. Enzymes: DNA polymerase, restriction endonucleases, topisomerase I and DNA ligase, reverse transcriptase, kinase, alkaline phosphatase, nuclease, RNAse. Application of gene technology, Gene Silencing, Geneknock out and gene therapy

Unit II	GENOME DATABASES AND GENE EXPRESSION AND DNA MICROARRAY	9 Hours

Nucleic acid sequences. Sequence databases: GeneBank, European Molecular Biology Laboratory (EMBL) Nucleotide sequence databank, Introduction, Basic steps for gene expression, genome information and special features, coding sequences (CDS), untranslated regions (UTR's), cDNA library, expressed sequence tags (EST).Tools for microarray analysis; soft-finder, xCluster, MADAM, SAGE, Applications of microarray technology.

Unit III	PROTEOMICS	9 Hours

Proteins and Enzymes; Proteomics classification; tools and techniques in proteomics; gel electrophoresis, gel filtration, PAGE, isoelectric focusing, affinity chromatography, HPLC, ICAT, fixing and spot visualization, Mass spectroscopy for protein analysis, MALDI-TOF, Electro spray ionization (EST), Tandem mass spectroscopy (MS/MS) analysis; tryptic digestion and peptide fingerprinting (PMF).

Unit IV	SEQUENCE ALIGNMENTS	9 Hours

Introduction, Protein sequences, physicochemical properties based on sequence, sequence comparison. Pair-wise sequence alignment, gaps, gap-penalties, scoring matrices, Smith-Waterman and Needleman-Wunsch algorithms for sequence alignments, multiple sequence alignment, comparision, composition and properties, useful programs, ClustalW, BioEDIT, BLASTp, Phylogenetic analysis tools- Phylip, ClustalW, Online phylogenetic analysis.

Unit V	IMMUNOINFORMATICS	9 Hours

Complement fixation, structure and classes of antibodies, genetic basis of antibody diversity. Understanding MHC I and II: structure and antigen presentation, T and B lymphocytes activation and role in humoral and cell mediated immunity. Vaccines live and attenuated, killed, multi-subunit and DNA vaccines. Hypersensitivity and auto immune diseases. ELISA, RIA, Hybridoma Technology.

Total:	45 Hours

Further Reading:

1. Introduction about Genetic Algorithms
2. Computing tools for Bio informatics

Course Outcomes:

After completion of the course, Student will be able to

1. Practice life-long learning of applied biological science
2. The students would have learnt about tools used in Bio informatics & how to use them.

References:

1. Biotechnology: Current Progress Volume 1 by P. N. Cheremisinoff and L. M. Ferrante. Technomic Publishing Co. Inc

2. Bergey's Manual of Systematic Bacteriology (2nd Ed.), Volumes1 to 4 Springer

3. The Search for Bioactive Compounds from Microorganisms by S. Omura

4. DNA Cloning : A practical approach D.M. Glover and D.B. Hames, RL Press, Oxford, 1995

5. Genetic Engineering : An Introduction to Gene Analysis and Exploitation in Eukaryotes, S. M. Kingsman, Blackwell Scientific Publications, Oxford, 1998

1703CS805	HUMAN COMPUTER INTERACTION	L	T	P	C
		3	0	0	3

PREREQUISITE :	
	1.Programming Paradigms
	2.Mobile Application development
Course Objectives:	
	1. Be familiar with the design technologies for individuals and persons with disabilities.
	2. Learn the guidelines for user interface

Unit I	**INTRODUCTION**	**9 Hours**
Importance of user Interface - definition, Importance of good design, Benefits of good design, A brief history of Screen design, The graphical user interface - popularity of graphics, The concept of direct manipulation, Graphical system, Characteristics, Web user - Interface popularity, characteristics- Principles of user interface.		
Unit II	**DESIGN PROCESS**	**9 Hours**
Design process - Human interaction with computers, Importance of human characteristics, human consideration in design, Human interaction speeds, and understanding business functions.		
Unit III	**SCREEN DESIGN**	**9 Hours**
Design goals - Screen planning and purpose, Organizing screen elements, Ordering of screen data and content - screen navigation and flow - Visually pleasing composition - amount of information - focus and emphasis - presentation information simply and meaningfully - information retrieval on web - statistical graphics - Technological consideration in interface design.		
Unit IV	**WINDOWS AND MULTIMEDIA**	**9 Hours**
Windows - New and Navigation schemes selection of window, selection of devices based and screen based controls; Components - text and messages, Icons and increases - Multimedia, colors, uses problems, choosing colors.		
Unit V	**SOFTWARE TOOLS AND DEVICES**	**9 Hours**
Software tools - Specification methods, interface - Building Tools - Interaction Devices - Keyboard and function keys pointing devices - speech recognition digitization and generation - image and video displays - drivers.		
	Total:	**45 Hours**

Course Outcomes:	
After completion of the course, Student will be able to	
CO1	Design effective HCI for individuals and persons with disabilities
CO2	Assess the importance of user feedback
CO3	Explain the HCI implications for designing multimedia/ ecommerce.
CO4	Develop meaningful user interface
CO5	Explain the HCI implications for e-learning and Web sites

References:

1. Wilbert O Galitz, "The Essential Guide to user Interface Design", Second Edition, Wiley India Education.
2. Ben Schneiderman, "Designing the User Interface", Fourth Edition, Pearson Education, Asia.
3. A Dix, Janet Finlay, G D Abowd and R Beale, "HumanComputer Interaction", Third Edition, Pearson Publishers,2008.
4. Jonathan Wolpaw and Elizabeth Winter Wolpaw, "BrainComputer Interfaces", Principles and Practice, First Edition, Oxford Publishers, 2012.
5. http://nptel.ac.in/courses/106103115/

ELECTIVE - VIII

1703CS806	ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	3

Course Objectives:

1. Learn basic functions in organizations
2. Be exposed to business processes and Information systems
3. Learn ERP models and Implementation issues

Unit I	**OVERVIEW OF BUSINESS FUNCTIONS**	**9 Hours**

Business function in an organization, material management, scheduling, shop floor control. Forecasting, accounting & finance, human resources, productivity management.

Unit II	**TYPICAL BUSINESSS PROCESSES**	**9 Hours**

Core processes, product control, sales order processing, purchase, administrative process, human resource, finance support processes, marketing, strategic planning, research & development problems in traditional functional view. Need for integrated process view, information as a resource, motivation for ERP.

Unit III	**EVOLUTION OF INFORMATION SYSTEM**	**9 Hours**

EDP (electronic data processing) system, management information systems (MIS), executive information systems, information needs of organization, ERP as an integrator of information needs at various levels, decision making involved at the above level.

Unit IV	**ERP MODELS /FUNCTIONALITY**	**9 Hours**

Sales-order-processing, MRP, scheduling, forecasting, maintenance, distribution, finance, features of each of the models description of data flows across module, overview of the supporting databases, technologies required for ERP.

Unit V	**IMPLEMENTATION ISSUES**	**9 Hours**

Pre Implementation issues, financial justification of ERP, evaluation of commercial software during implementation issues, reengineering of various business process, education & training, project management, post implementation issues, performance measurement.

Total:	**45 Hours**

Course Outcomes:

After completion of the course, Students will be able to

1. Discuss about the business functions in a atypical organization
2. Apply typical business processes
3. Explain information system and MIS
4. Use ERP models for processing
5. Analyze implementation issues

References:

1. V. Rajaraman : Analysis & Design of Information Systems, PHI
2. K. M. Hussain & D. hussain ; Information systems, Analysis, Design & Implementation, TMH.
3. MONAK & BRADY : Concepts in ERP, vikas pub.

1703CS807	DATA CENTRE AND VIRTUALIZATION	L	T	P	C
		3	0	0	3

PREREQUISITE :	
	1. Computer Networks
	2. Computer Organization and Architecture
Course Objectives:	
	1. Understand the Phases of Journey to the Cloud.
	2. Describe the Key Elements of Classic Data Center.
	3. Understand the Concepts of Virtualized Data Center

Unit I	**JOURNEY TO THE CLOUD**	**8 Hours**
Business Drivers for Cloud Computing, Definition of Cloud Computing, Characteristics of Cloud Computing as per NIST, Steps Involved in Transitioning from Classic Data Center to Cloud Computing Environment		
Unit II	**CLASSIC DATA CENTER (CDC)**	**9 Hours**
Overview of Classic Data Center, Compute, Storage and Networking, Object Based and Unified Storage Technologies, Business Continuity Overview, Backup, Replication Technologies and CDC Management.		
Unit III	**VIRTUALIZED DATA CENTER (VDC)**	**11 Hours**
Compute virtualization, Storage Virtualization, Network Virtualization Techniques, Methods for Implementing Desktop Virtualization, their Benefits, and Considerations, Application Virtualization Methods, Benefits, and Considerations.		
Unit IV	**BUSINESS CONTINUITY IN VIRTUALIZED DATA CENTER**	**8 Hours**
Overview of Business Continuity in Virtualized Data Center, Fault Tolerance Mechanism in Virtualized Data Center, Backup and Recovery of Virtual Machines (VMs), VM Replication and Migration Technologies.		
Unit V	**CLOUD INFRASTRUCTURE AND MANAGEMENT**	**9 Hours**
Cloud Computing Primer, Overview of Cloud Computing, Cloud Services and Deployment Models, Economics of Cloud, Cloud Infrastructure Framework, Infrastructure Management and Service Creation Tools, Cloud Service Management, Cloud Migration Considerations		
	Total:	**45 Hours**

Further Reading:	
	Cloud evolution-VMware Virtualization Tools- Google Infrastructure- Google Cloud Security
Course Outcomes:	
	After completion of the course, Student will be able to
CO1	Explore the basics of cloud computing.
CO2	Explain the Classic Data Center and its applications.
CO3	Build a virtualized Data Center using cloud.
CO4	Manage the Cloud infrastructure and services.
CO5	Demonstrate the Cloud Migration Considerations

References:

1. Cloud Infrastructure and Services EMC2 Bangalore Book
2. Anthony T Velte, Cloud Computing: A practical Approach, Tata McGraw Hill, 2011
3. Halper Fern, Kaufman Marcia, Bloor Robin, Hurwit Judith, Cloud Computing for Dummies, Wiley India, 2013
4. http://nptel.ac.in/courses/106105167/

1703CS808	GROWTH HACKING	L	T	P	C
		3	0	0	3

Course Objectives:

1. Learn how to build traction using the right set of tools
2. To beat the startups in their game, you need to think like one.
3. Learn about Digital Marketing techniques and Lean Startups

Unit I	**GROWTH HACKING BASICS**	**9 Hours**

Growth Hacking Basics, Definition of "growth hacking" , Role of a Growth Hacker, Growth Hacking History and Hall of Fame- some stellar growth hacks, Customer Lifecycle, Growth Hacking Funnel: Introduction to A2R2 Growth Framework

Unit II	**ATTRACTION HACKS**	**9 Hours**

Attraction Hacks, Channel: Real World, Digital ; Paid, Earned,Multi Channel Targeting,Case Study- Attraction Hack,Tools for attraction Hacks,Deep Dive: Scraping the web/ building email list

Unit III	**ACTIVATION HACKS**	**9 Hours**

Activation Hacks, Aha Moment!, Conversion rate Optimization- UX/ UI, Case Study- Activation Hack, Tools for Activation Hacks, Deep DiveUI/ UX for Conversion, Create Plan to Attract and Activate Visitors/ Customers

Unit IV	**RETENTION HACKS**	**9 Hours**

Core Product Value, Product Discovery/ Learn Path, Case Study- Retention Hack, Early Adopters and Focused groups, Tools for Activation Hacks, Deep Dive + AMA: User Curation, Create Plan to Retain Customers

Unit V	**REAP (AMPLIFICATION) HACKS + LEAN ITERATIONS**	**9 Hours**

Viral Product and Viral Campaigns, Product Virality, Viral Campaigns, Case Study- Reap Hack, Tools for Amplification, Lean Startup/ Product- concepts, Lean Marketing, Setting up and Measuring Experiments, Setting Goals and Measuring, Create Virality Plan

Total:	**45 Hours**

Course Outcomes:

After completion of the course, Students will be able to

1. Use Growth techniques for customer acquisition
2. Apply Growth Hacking for Customer Acquisition.
3. Define various stages of Customer Life Cycle and be able to identify what stage customer is at.
4. Apply A2R2 (Attract, Activate, Retain, Reap) Growth Hacking Framework for Customer Acquisition.
5. Know tools for Growth Hacking at different stages in customer lifecycle
6. Create a growth hack strategy in order to optimize an existing product / company's conversion funnel.

References:

1. Nir Eyal, "Hooked : How do build habit forming products", 2015
2. Morgan Brown, "Hacking growth", 2015.

1703CS809	INFORMATION RETRIEVAL	L	T	P	C
		3	0	0	3

PREREQUISITE :	
	1. Artificial Intelligence.
	2. Data mining.

COURSE OBJECTIVES:	
	Learn the information retrieval models.
	Be familiar with Web Search Engine.
	Be exposed to Link Analysis.
	Understand Hadoop and Map Reduce
	Learn document text mining techniques

UNIT I	INTRODUCTION AND MODELLING	9 Hours

Motivation, Basic Concepts, Past-Present and Future, the Retrieval Process, Introduction, A Taxonomy of Information retrieval Models, Retrieval: Ad hoc and Filtering, A Formal Characteristics of IR Models, Classic Information Retrieval, Alternative Set Theoretic Models, Alternative Probabilistic Models, Structured Text Retrieval Models, Models for Browsing

UNIT II	QUERY LANGUAGES AND OPERATIONS	9 Hours

Introduction, Keyword-Based Querying, Pattern Matching, Structural Queries, Query Protocols, Introduction, User Relevance Feedback, Automatic Local Analysis, and Automatic global Analysis, Introduction, Document Preprocessing, Document Clustering, Text Compression, Comparing Text Compression Techniques

UNIT III	INDEXING AND SEARCHING	9 Hours

Introduction, Inverted Files, Other Indices for Text, Boolean queries, Sequential Searching, pattern Matching, Structural Queries, Compression, Introduction, Challenges, Characterizing the Web, Search Engines, Browsing, Met searchers, Finding the Needle in the Haystack, Searching Using Hyperlinks

UNIT IV	USER INTERFACES AND VISUALIZATION	9 Hours

Introduction, human-Computer Interaction, The Information Access Process, Starting Points, Query Specification, Context, User Relevance Judgments, Interface Support for the Search Process

UNIT V	INDEXING AND |SEARCHING	9 Hours

Spatial Access Methods, A Generic Multimedia Indexing Approach, One Dimensional Time Series, Two Dimensional Color Images, Automatic Feature Extraction.

TOTAL:	45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :	
	1.Document Text Mining
	2.Web Search Engine

COURSE OUTCOMES:	
	After completion of the course, Student will be able to
CO1	Gain the knowledge of solving computational search problems.
CO2	Understand the inadequacies of different information retrieval techniques
CO3	Understand how to evaluate search engines.
CO4	Able to comprehend and appreciate the different applications of information retrieval techniques in the Internet or Web environment.
CO5	Apply document text mining techniques.

REFERENCES:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems:Theory and Implementation, Kluwer Academic Press, 1997.

2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.

3. Information Storage & Retrieval By Robert Korfhage – John Wiley &Sons.

4.Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

5. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.

6. nptel.ac.in/courses/106101007/

1703CS810	CYBER FORENSICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. Learn the security issues network layer and transport layer.
2. Be exposed to security issues of the application layer.
3. Learn computer forensics.
4. Be familiar with forensics tools.
5. Learn to analyze and validate forensics data.

Unit I	**NETWORK LAYER SECURITY &TRANSPORT LAYER SECURITY**	**9 Hours**

IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec.Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

Unit II	**E-MAIL SECURITY & FIREWALLS**	**9 Hours**

PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

Unit III	**INTRODUCTION TO COMPUTER FORENSICS**	**9 Hours**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

Unit IV	**EVIDENCE COLLECTION AND FORENSICS TOOLS**	**9 Hours**

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

Unit V	**ANALYSIS AND VALIDATION**	**9 Hours**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

	Total:	**45 Hours**

Course Outcomes:

After completion of the course, Students will be able to

1. Discuss the security issues network layer and transport layer.
2. Apply security principles in the application layer.
3. Explain computer forensics
4. Use forensics tools.
5. Analyze and validate forensics data.

References:

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. Richard E.Smith, “Internet Cryptography”, 3rd Edition Pearson Education, 2008.
3. Marjie T.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall, 2013.

ELECTIVE – IX

1703CS811	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the concepts of Internet of Things
2. To introduce network and communication protocols of IoT
3. To build IoT applications.

Unit I	**INTRODUCTION TO IOT**	**9 Hours**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software defined Network(SDN)

Unit II	**NETWORK AND COMMUNICATION ASPECTS**	**9 Hours**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Unit III	**CHALLENGES OF IOT**	**9 Hours**

Design challenges, Development challenges, Security challenges, Other challenges

Unit IV	**APPLICATIONS OF IOT**	**9 Hours**

Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit V	**DEVELOPING IOTs**	**9 Hours**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Total: 45 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the concepts of Internet of Things
2. Analyze basic protocols in wireless sensor network
3. Design IoT applications in different domain and be able to analyze their performance
4. Implement basic IoT applications on embedded platform

References:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

1703CS812	MAINFRAME COMPUTING	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Familiarity with the terminology and concepts of contemporary operating systems and computer hardware
2. Basic understanding of relational databases and programming languages
3. Basic knowledge about advanced system architecture.

Course Objectives:

1. To learn the concepts of mainframe and its functionalities.
2. To have a good knowledge in System Management and Automatic Computing.
3. To have a keen idea in COBOL Programming Constructs.

Unit I **INTRODUCTION** **9 Hours**

Mainframe Concepts – an Evolving Architecture - MVS overview- System Initialization – Storage Management – Job Management – Managing work – Data Management – I/O Processing – Termination and Recovery.

Unit II **TSO/ISPF** **9 Hours**

TSO Commands – Job control language *(*JCL*)* - General syntax of JCL statements –JOB statements – EXEC statements –DD statements – Additional parameters on JOB, EXEC and DD statements – Utilities.

Unit III **VSAM** **9 Hours**

VSAM data set organization structure – IDCAMS comments – JCL for VSAM – Buffering – Alternative index – Repro – Backup and Recovery – Export and Import.

Unit IV **COBOL** **9 Hours**

COBOL/370 Structured programming constructs – Fundamentals of COBOL – Data definition – Conditional statements – Perform statements – Compiler option – Table definition – COBOL call and parameter passing – File Handling.

Unit V **SYSTEM MANAGEMENT AND AUTONOMIC COMPUTING** **9 Hours**

Introduction – system data – workload management – operations management – performance management – autonomic computing principles – autonomic computing concepts – z/OS implementation of autonomic computing – self healing – self configuring – self protecting – self optimizing.

Total: 45 Hours

Further Reading:

1. Managing the system to Service Level Agreement and architecture
2. Mainframe workloads and the major middleware applications in use on mainframes today

Course Outcomes:

After completion of the course, Student will be able to

CO1	1. Explain basic concepts of the mainframe, including its usage, and architecture
CO2	2. Execute TSO/ISPF Commands on a Mainframe
CO3	3. manage various user data types using VSAM
CO4	4. Understand the fundamentals of COBOL programming
CO5	5. Understand the system management and automatic computing

References:

1. Alexis Leon, “IBM Mainframe Handbook”, 1st Edition, Vikas Publishing House, 2003. (UNITS I - III)
2. M.K. Roy and Debabrata Ghosh Dastidar, “COBOL Programming”, John Wiley & Sons,2008.(UNIT IV)
3. Saba Zamir and Chander Ranade, “The MVS JCL Primer”, McGraw-Hill, 2007. (UNITS II & III)
4. Mike Ebbers,Frank Byrane, Pilar Gonzalez Adrados, Rodney Martin and Jon Veilleux “Introduction to the New Mainframe: Large-Scale Commercial Computing”, Vervante, 2006. (UNIT V)
5. Lydia Parziale, Edi Lopes Alves, Klaus Egeler, Clive Jordan, et al., “Introduction to the NewMainframe: z/VM Basics”, IBM Redbooks Publication, 2007.
6. Gary D. Brown and S.A.M. Smith, “MVS/VSAM for the Application Programmer”, 10thEdition, John Wiley & Sons, 1993.
7. Introduction to the new Mainframe:z/OS Basics : http://www.redbooks.ibm.com

1703CS813	MULTICORE ARCHITECTURE (Common to B.E / B.Tech – CSE, IT & ECE)	L	T	P	C
		3	0	0	3

PREREQUISITE :	
	1. Basics of Computer architecture
	2. Basics of Processors
COURSE OBJECTIVES:	
	1. Understand the challenges in parallel and multi-threaded programming
	2. To understand the different types of multicore architectures
	3. Learn about the various parallel programming paradigms, and solutions

UNIT I	**INTRODUCTION TO POWER DEVICES**	**9 Hours**
Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design - Case Studies of Multicore Architectures.		
Unit II	**MULTI-CORE PROCESSORS**	**9 Hours**
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues.		
Unit III	**DLP IN VECTOR, SIMD AND GPU ARCHITECTURES**	**9 Hours**
Vector Architecture - SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units - Detecting and Enhancing Loop Level Parallelism - Case Studies.		
Unit IV	**PARALLEL PROGRAM CHALLENGES**	**9 Hours**
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).		
Unit V	**ARCHITECTURES FOR EMBEDDED SYSTEMS**	**9 Hours**
Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – The Digital Signal Processor – Case Studies		
	TOTAL:	**45 HOURS**

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :	
	1. Embedded Multiprocessors
	2. Embedded Real Time Systems
COURSE OUTCOMES:	
	After completion of the course, Student will be able to
CO1	Understand the Program Parallel Processors
CO2	Basics of embedded systems
CO3	Program Parallel Processors. Develop programs using OpenMP and MPI.
CO4	Compare and contrast programming for serial processors and programming for parallel processors.
CO5	Program Parallel Processors. Develop programs using OpenMP and MPI. Compare and contrast programming for serial processors and programming for parallel processors.

REFERENCES:

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011
3. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, 5th edition, 2012.
4. Richard Y. Kain, “Advanced Computer Architecture a Systems Design Approach”, Prentice Hall, 2011
5. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

1703CS814	GRAPH THEORY AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

PREREQUISITE :	
	1. Data Structures
	2. Computer Networks
	3. Discrete Mathematics

COURSE OBJECTIVES:	
	1. To comprehend graphs as modeling and analysis tool
	2. To introduce various data structures with graph theory
	3. To learn fundamentals behind principle of counting and combinatory

UNIT I	INTRODUCTION	9 Hours

Graphs – Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits – Connectedness– Components – Euler Graphs – Hamiltonian paths and circuits – Trees – Properties of Trees– Distance and Centers in Tree – Rooted and Binary Trees.

UNIT II	TREES, CONNECTIVITY & PLANARITY	9 Hours

Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network Flows – 1-Isomorphism – 2-Isomorphism – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

UNIT III	MATRICES, COLOURING AND DIRECTED GRAPH	9 Hours

Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem – Directed Graphs – Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs.

UNIT IV	PERMUTATIONS & COMBINATIONS	9 Hours

Fundamental Principles of Counting - Permutations and Combinations - Binomial Theorem - Combinations with Repetition - Combinatorial Numbers - Principle of Inclusion and Exclusion - Derangements - Arrangements with Forbidden Positions.

UNIT V	GENERATING FUNCTIONS	9 Hours

Generating Functions - Partitions Of Integers - Exponential Generating Function - Summation Operator - Recurrence Relations - First Order and Second Order – Non- Homogeneous Recurrence Relations - Method of Generating Functions.

TOTAL:	45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :	
	1. Applications of interval graphs.
	2. Advanced graph theory
	3. Connection to Traffic phasing.

COURSE OUTCOMES:	
	After completion of the course, Student will be able to
CO1	Write programs involving basic graph algorithms
CO2	Write programs for graph coloring
CO3	Differentiate the potential use of directed and undirected graphs
CO4	Outline the concepts of permutations and combinations
CO5	Prove the graph with mathematical proof.

REFERENCES:

1. Narsingh Deo, Graph theory, Prentice Hall India, 2008.
2. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001
3. H. Cormen, C. E. Leiserson and R. L. Rivest, “Introduction to Algorithms,” McGraw-Hill, 2007
4. Baase, Computer algorithms, Pearson India 2008.
5.“Graph Theory” by Frank Harary,

1703CS815	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To give the introduction about semantic web and ontology
2. To apply the concept community structure and human behaviors in social networks
3. To implement visualization of social networks.

Unit I **Introduction** **9 Hours**

Graph theory basics-Semantic web-development of social network analysis-key concepts and measures in network analysis -global structure-macro structure-personal networks-blogs and communities-web based networks

Unit II **Knowledge representation** **9 Hours**

Ontologies in semantic web-resource description framework-graph visualizations-notations-SPARQL-web ontology language-UML comparison-ER comparison-xml comparison-web based knowledge representation

Unit III **Modeling and aggregating** **9 Hours**

state of the art in network-ontological representation-conceptual model-representing identity-determining equality-evaluating smashing-advanced representations-extracting evolution of web community from a series of web archive – detecting communities in social networks – definition of community – evaluating communities – methods for community detection and mining – applications of community mining algorithms – tools for detecting communities social network infrastructures and communities – decentralized online social networks – multi – relational characterization of dynamic social network communities.

Unit IV **Speculation of human behavior** **9 Hours**

understanding and predicting human behavior for social communities – user data management – inference and distribution – enabling new human experiences – reality mining – context – awareness – privacy in online social networks – trust in online environment – trust models based on subjective logic – trust network analysis – trust transitivity analysis – combining trust and reputation – trust derivation based on trust comparisons – attack spectrum and countermeasures.

Unit V **Applications** **9Hours**

graph theory – centrality – clustering – node-edge diagrams – matrix representation – visualizing online social networks, visualizing social networks with matrix-based representations – matrix and node-link diagrams – hybrid representations – applications – cover networks – community welfare –collaboration networks – co-citation networks.

Total: 45 Hours

Course Outcomes:

After completion of the course, Student will be able to

CO1	Interpret the concept of semantic web and ontology
CO2	Interpret the basic concepts of random graph model
CO3	Paraphrase the metrics of centrality with real world example
CO4	Interpret the human behaviors and trust model of social network
CO5	Paraphrase the concept of network resilience, ego centric networks, clustering and cohesive subgroups

References:

1. Analyzing Social Networks by Stephen P. Borgatti SAGE Publications Ltd.; 1 edition ,2013
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.
3. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition Springer, 2011.