SCHEME FOR ADDITIONAL 20 CREDITS FOR BTECH CSE WITH HONORS

B. Tech CSE with Honors			Contact Hrs.			Marks			Credits
Basket	**Code**	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
Basket-I	BCSEH1-001	Advanced Computer Networks	3	1	0	40	60	100	4
	BCSEH1-002	Advanced Operating Systems	3	1	0	40	60	100	4
	BCSEH1-003	Advanced Data Structures & Algorithms	3	1	0	40	60	100	4
	BCSEH1-004	Computer Networks & Security	3	1	0	40	60	100	4
	BCSEH1-005	Wireless Sensor Networks	3	1	0	40	60	100	4
Basket-II	BCSEH1-006	Python Programming	3	0	0	40	60	100	3
	BCSEH1-051	Python Programming Laboratory	0	0	2	60	40	100	1
	BCSEH1-007	Introduction to AI & Machine learning	3	1	0	40	60	100	4
	BCSEH1-008	Deep Learning and Neural Networks	3	1	0	40	60	100	4
	BCSEH1-009	Data Analytics	3	1	0	40	60	100	4
	BCSEH1-010	Data Science	3	1	0	40	60	100	4
	BCSEH1-011	Natural Language Processing	3	1	0	40	60	100	4
Basket-III	BCSEH1-012	Introduction to Internet Of Things (IOT)	3	1	0	40	60	100	4
	BCSEH1-013	Introduction to Security of Cyber-Physical Systems	3	1	0	40	60	100	4
	BCSEH1-014	Ubiquitous Sensing, Computing and Communication	3	1	0	40	60	100	4
	BCSEH1-015	Embedded Systems for IoT	3	1	0	40	60	100	4
	BCSEH1-016	IoT with Arduino, ESP, and Raspberry Pi	3	1	0	40	60	100	4

Select at least one subject from each basket.

Note: The students may opt one/two subjects from the MOOCs/ SWAYAM as per University Notification & as per the AICTE Model Curriculum as modified from time to time.

ADVANCED COMPUTER NETWORKS

Subject Code: BCSEH1-001 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE

To familiarize students with different networking concepts and its emerging techniques.

COURSE OUTCOMES

1. To be able to understand basic networking concepts.
2. To measure network traffic and learn routing techniques.
3. To learn about wireless sensor networks.
4. To learn overlay networks and various emerging technologies.

COURSE CONTENTS

UNIT I (15Hrs)

Basic networking concepts revisited: Introduction to networks,Review of the Internet architecture, layering and link layer, network layer, intra and inter domain routing, end-to-end layer, congestion control, wired and wireless MAC

UNIT II (15Hrs)

Modeling and measurement: Network traffic modeling, network measurement, simulation issues, network coding techniques

Routing and router design, scheduling and QoS, integrated and differentiated services, RSVP, BGP, MPLS.

UNIT III (15Hrs)

Wireless networks: Wireless Networks and mobility supports, MAC protocol, routing, AODV, group communication, multicast, mobility, mobile IP, TCP and MAC interactions

Flow and congestion control, TCP variants, TCP modeling, active queue management

UNIT IV (15Hrs)

Overlay networks: RON, P2P, CDN, Web caching, cross-layer optimizations,

Emerging network types: data center, DTN, 4G mobile networks (LTE, Wi-Max), online social networks (OSN), wireless sensor networks (WSN) – cross-layer sensor data dissemination

Emerging applications – VoIP, SIP, video over P2P

RECOMMENDED BOOKS

1. J.F. Kurose and K.W. Ross, Computer networking: A top-down approach, 6th edition, Adison Wesley.
2. L.L. Peterson and BS. Davie, Computer Networks ISE: A System Approach, 5th edition, Morgan Kaufman.
3. B.A. Forouzan, Data communication & networking, 5th Edition, Tata Mc-Graw Hills.

ADVANCED OPERATING SYSTEM

Subject Code: BCSEH1-002 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

To be able to learn the concepts of advance operating systems.

COURSE OUTCOMES:

1. To learn process synchronization and deadlocks.
2. To learn the concepts of distributed operating systems.
3. To learn distributed OS Implementation and multiprocessor systems.
4. To understand security and protection.

COURSE CONTENTS:

UNIT-I (15 hrs.)

Process Synchronization: Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes (CSP)

Process deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock

UNIT-II (15 hrs.)

Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport‟s logical clock, Global states, Chandy-Lampert‟s global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport‟s Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing.

UNIT-III (15 hrs.)

Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls.

Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.

UNIT-IV(15 hrs.)

Performance, Coprocessors, RISC & data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks & Saturation, Feedback loops, Coprocessors, RISC.

Security & Protection: Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses.

Recommended Books:

1. M. Milenkoviac, “Operating Systems Concepts and Design”, Tata McGraw Hill, 2/e, 1992.
2. H. M. Deitel, “Operating System”, Prentice Hall, 3/e, 2003.

3. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in operating Systems", Tata McGraw Hill, 2001.
4. M. J. Bach, "Design of the Unix Operating System", Prentice-Hall of India, 1986.
5. Charles Crowley, "Operating System: A Design-oriented Approach", Irwin Publishing, 1996.

ADVANCED DATA STRUCTURES & ALGORITHMS

Subject Code: BCSEH1-003 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

To be able to understand various concepts of advanced data structures**.**

COURSE OUTCOMES:

- Understand and apply linear data structures-List, Stack and Queue.
- Understand the graph algorithms.
- Learn different algorithms analysis techniques.
- Apply data structures and algorithms in real time applications

COURSE CONTENTS:

UNIT I (16 hrs.)

LINEAR DATA STRUCTURES: Introduction - Abstract Data Types (ADT) – Stack – Queue – Circular Queue - Double Ended Queue - Applications of stack – Evaluating Arithmetic Expressions - Other Applications - Applications of Queue - Linked Lists - Singly Linked List - Circularly Linked List - Doubly Linked lists – Applications of linked list – Polynomial Manipulation.

UNIT II (15 hrs.)

NON-LINEAR TREE STRUCTURES: Binary Tree – expression trees – Binary tree traversals – applications of trees – Huffman Algorithm - Binary search tree - Balanced Trees - AVL Tree - B-Tree - Splay Trees – HeapHeap operations- -Binomial Heaps - Fibonacci Heaps- Hash set.

UNIT III (15 hrs.)

GRAPHS: Representation of graph - Graph Traversals - Depth-first and breadth-first traversal - Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra‟s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms.

UNIT IV (14 hrs.)

ALGORITHM DESIGN AND ANALYSIS Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort - Binary Search - Greedy Algorithms – Knapsack Problem – Dynamic Programming – Optimal Binary Search Tree - Warshall‟s Algorithm for Finding Transitive Closure.

RECOMMENDED BOOKS:

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education, 2015
2. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007

3. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms/C++", Second Edition, University Press, 2007
4. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education 2015
5. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press 2015
6. John R.Hubbard, "Data Structures with Java", Pearson Education, 2015
7. M. A. Weiss, "Data Structures and Algorithm Analysis in Java", Pearson Education Asia, 2013

COMPUTER NETWORKS AND SECURITY

Subject Code: BCSEH1-004 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

To learn the concepts of computer networks and implement security techniques.

COURSE OUTCOMES:

1. To learn data communication techniques among various layers.
2. To learn mobile and wireless networks.
3. To learn the different concepts of network security.
4. To learn to manage database security.

COURSE CONTENTS:

UNIT-I (15 hrs.)

Data and Computer Communication Networks: Data Communication, Transmission Methodologies, Data Link Layer, Multiple Access & Local Area Networks, Connecting Devices and Backbone Networks, Network Layer and Transport Layer, Application Layer.

UNIT-II (15 hrs.)

Mobile & Wireless Networks Wireless networking, wireless LANS & PANS, ad-hoc wireless networks & security, wireless sensor networks, Cellular Mobile Wireless Networks, Evolution of Modern Mobile Wireless Communication System.

UNIT-III (13 hrs.)

Cryptography and Network Security Introduction to the Concept of Security, Cryptographic Techniques, Computer-based Symmetric and Asymmetric Key Cryptographic Algorithms, Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

UNIT-IV (17 hrs.)

Database Security Data management technologies, Information security, Information Management Technologies, Security policies, Policy enforcement & related issues, Design principles, Multi-level relational data models.

Software Security: Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge.

WIRELESS SENSOR NETWORKS

Subject Code: BCSEH1-005 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

To be able to architect sensor networks for various application setups. To Devise appropriate data dissemination protocols and model links cost**.** Make better understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.

COURSE OUTCOMES:

After completion of course, students would be able to:

1. Describe and explain radio standards and communication protocols for wireless sensor networks.
2. Explain the function of the node architecture and use of sensors for various applications.

COURSE CONTENTS:

UNIT-I (17 hrs.)

Introduction to Wireless Sensor Networks: Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors, Network Architecture: Traditional layered stack, Cross-layer designs, Sensor Network Architecture Hardware Platforms: Motes, Hardware parameters.

UNIT-II (16 hrs.)

Introduction to ns-3: Introduction to Network Simulator 3 (ns-3), Description of the ns-3 core module and simulation example. Medium Access Control Protocol Design: Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled.

UNIT-III (15 hrs.)

MAC Protocol: Introduction to analysis of MAC Protocols.

Routing Protocols: Introduction, MANET protocols Routing Protocols for WSN: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast.

UNIT-IV (12 hrs.)

Security: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.

RECOMMENDED BOOKS:

1. Takahiro Hara, Vladimir I. Zadorozhny and Erik Buchmann, ‘Wireless Sensor Network Technologies for the Information Explosion Era’, Springer, 2010.
2. W. Dargie and C. Poellabauer, ‘Fundamentals of Wireless Sensor Networks –Theory and Practice’, Wiley, 2010.
3. Kazem Sohraby, Daniel Minoli and TaiebZnati, ‘Wireless Sensor Networks -Technology, Protocols, and Applications’, Wiley Interscience, 2007.

PYTHON PROGRAMMING

Subject Code: BCSEH1-006 **L T P C** **Duration – 45 hrs.**
3 0 0 3

COURSE OBJECTIVE:

To understand python concepts and its implementation.

COURSE OUTCOMES:

1. To be able to understand basic concepts of python and its data types.
2. To learn various control structures.
3. To learn python modules and functions.
4. To learn concept of classes and objects.

COURSE CONTENTS:

UNIT-I (12 hrs.)

Introduction to Python Programming Language: Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.

Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.

Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non-Associative Operators.

UNIT-II (11 hrs.)

Control Structures: Decision making statements, Python loops, Python control statements. Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).

Data Analysis: Using the following packing Pandas, Numpy, Scipy

UNIT-III (11 hrs.)

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.

UNIT-IV (11 hrs.)

Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

RECOMMENDED BOOKS:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.
3. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.
4. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.

PYTHON PROGRAMMING LABORATORY

Subject Code: BCSEH1-051

L	T	P	C
0	0	2	1

COURSE OBJECTIVE: Students will be able to learn primary fundamentals of python programming and potential of python is to achieve modern computing requirements.

COURSE OUTCOMES:

1. Students will learn about the data types implementation.
2. To be able to implement different operators
3. To be able to work with lists.
4. To be able to work with dictionaries.

PRACTICALS:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python.
3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format Sun May 29 02:26:23 IST 2017
5. Write a program to create, append, and remove lists in python.
6. Write a program to demonstrate working with tuples in python.
7. Write a program to demonstrate working with dictionaries in python.
8. Write a python program to find largest of three numbers.
9. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula : c/5 = f-32/9]
10. Write a Python program to construct the following pattern, using a nested for loop

INTRODUCTION TO AI AND MACHINE LEARNING

Subject Code: BCSEH1-007 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

1. To review and strengthen important Mathematical concepts required for AI & ML
2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.

COURSE OUTCOMES:

After completion of course, students would be:

1. Design and implement machine learning solutions to classification, regression and clustering problems
2. Evaluate and interpret the results of the different ML techniques

COURSE CONTENTS:

UNIT-I (15 hrs.)

Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming,

UNIT-II (15 hrs.)

Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning

UNIT-III (15 hrs.)

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice

UNIT-IV (15 hrs.)

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting

Lab Work:

1. Implementation of logical rules in Python.
2. Using any data apply the concept of: a) Liner regression b) Gradient decent c) Logistic regression
3. To add the missing value in any data set
4. Perform and plot under fitting and overfitting in a data set
5. Implement a movie recommendation system.

RECOMMENDED BOOKS: Sr. No. Book Detail

1. Tom Mitchell, Machine Learning, McGraw Hill, 2017
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011

3. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011
4. Yuxi (Hayden) Liu, "Python Machine Learning By Example", Packet Publishing Limited, 2017.
5. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft

DEEP LEARNING AND NEURAL NETWORKS

Subject Code: BCSEH1-008 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.

COURSE OUTCOMES:

1. Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
2. Implement deep learning algorithms and solve real-world problems.

COURSE CONTENTS:

UNIT-I (15 hrs.)

Introduction: Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network.

UNIT-II (15 hrs.)

Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.

Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

UNIT-III (15 hrs.)

Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.

Probabilistic Neural Network: Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders.

UNIT-IV (15 hrs.)

Deep Learning research: Object recognition, sparse coding, computer vision, natural language processing.

Deep Learning Tools: Caffe, Theano, Torch.

RECOMMENDED BOOKS:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..

2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

DATA ANALYTICS

Subject Code: BCSEH1-009 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

The purpose of this course is to introduce the students with Data Storage Systems and important algorithms that form the basis of Data Processing. The course also introduces the students with major application areas of Data Analytics.

COURSE OUTCOMES:

1. To be able to understand concepts of big data.
2. To understand distributed file systems.
3. To learn scalable algorithms.
4. To implement big data applications.

COURSE CONTENTS:

UNIT-I (15 hrs.)

Introduction to Big Data: Introduction to Big Data The four dimensions of Big Data: volume, velocity, variety, veracity, Drivers for Big Data, Introducing the Storage, Query Stack, Revisit useful technologies and concepts, Real-time Big Data Analytics

UNIT-II (15 hrs.)

Distributed File Systems: Hadoop Distributed File System, Google File System, Data Consistency Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model (Facebook's Cassandra), Graph storage models

UNIT-III (15 hrs.)

Scalable Algorithms: Mining large graphs, with focus on social networks and web graphs. Centrality, similarity, all-distances sketches, community detection, link analysis, spectral techniques. Map-reduce, Pig Latin, and NoSQL, Algorithms for detecting similar items, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items

UNIT-IV (15 hrs.)

Big Data Applications: Advertising on the Web, Web Page Quality
Ranking,Mining Social-Networking Group, Human Interaction with Big-Data. Recommendation systems with case studies of Amazon's

RECOMMENDED BOOKS:

1. Mining of massive datasets, Anand Rajaraman, Jure Leskovec, and Jeffrey Ullman
2. An Introduction to Information Retrieval, Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze
3. Data-Intensive Text Processing with MapReduce, Jimmy Lin and Chris Dyer.

DATA SCIENCE

Subject Code: BCSEH1-010 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

The main objectives of this course are:

1. To provide with the knowledge and expertise to become a proficient data scientist.
2. To demonstrate an understanding of statistics and machine learning concepts that are vital for data science.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Create competitive advantage from both structured and unstructured data
2. Predict outcomes with supervised machine learning techniques.
3. Unearth patterns in customer behaviour with unsupervised techniques.

COURSE CONTENTS:

UNIT-I (17 hrs.)

Introduction to Data Science: What is data science, relation to data mining, machine learning, big data and statistics.

Getting To Know Your Data: From data to features- Interactive group discussion,Representing problems with matrices, Representing problem with relations Computing simple statistics- Means, variances, standard deviations, weighted averaging, modes, quartiles. Simple visualizations-Histograms, Boxplots, Scatterplots, Time series, Spatial data

UNIT-II (16 hrs.)

Overview of Tasks & Techniques: Prediction: The prediction task-Definition, Examples, Format of input / output data Prediction algorithms- Decision trees, Rule learners, Linear/logistic regression, Nearest neighbour learning. Support vector machines Properties of prediction algorithms and practical exercises, Combining classifiers

Evaluation and Methodology of Data Science: Experimental setup- Training, tuning, test data, Holdout method, cross-validation, bootstrap method Measuring performance of a model- Accuracy, ROC curves, precisionrecall curves, Loss functions for regression Interpretation of results, Confidence interval for accuracy, Hypothesis tests for comparing models, algorithms

UNIT-III (14 hrs.)

Data Engineering: Attribute selection- Filter methods, Wrapper methods Data discretization- Unsupervised discretization, Supervised discretization Data transformations- PCA and variants
Overview of Tasks & Techniques: Probabilistic Models: Introduction- Probabilities, Rule of Bayes and Conditional Independence Naive Bayes- Application to spam filtering Bayesian Networks- Graphical representation, Independence and correlation Temporal models- Markov Chains, Hidden Markov Models.

UNIT-IV (13 hrs.)

Overview of Tasks & Techniques: Exploratory Data Mining: Introduction to Exploratory Data Mining Association discovery- What is association discovery?, What are the challenges?, In detail: Apriori Clustering- What is clustering?, What are the challenges?, In detail: agglomerative clustering

RECOMMENDED BOOKS:(Sr. No., Book Detail, Year of Publication)

1. Joel Grus, Data Science from Scratch: First Principles with Python, O"Reilly Media.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning, Springer Texts in Statistics.
3. I. Witten, E. Frank, M. Hall. Data Mining: Practical Machine Learning Tools and Techniques (3rd Edition),

NATURAL LANGUAGE PROCESSING

Subject Code: BCSEH1-011 **L T P C** **Duration – 60 hrs.**
3 1 0 4

COURSE OBJECTIVE:

The students should be able to study language and the tools that are available to efficiently study and analyze large collections of text. They should learn about and discuss the effects of electronic communication on our language.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Learn natural language processing with manual and automated approaches.
2. Learn computational frameworks for natural language processing.

COURSE CONTENTS:

UNIT-I (15 hrs.)

INTRODUCTION

A computational framework for natural language, description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, The different analysis levels used for NLP (morphological, syntactic,

semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.

UNIT-II (15 hrs.)

WORD LEVEL AND SYNTACTIC ANALYSIS Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine-readable dictionaries and lexical databases, RTN, ATN

UNIT-III (16 hrs.)

SEMANTIC ANALYSIS Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.

NATURAL LANGUAGE GENERATION Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.

UNIT-IV (14 hrs.)

INFORMATION RETRIEVAL AND LEXICAL RESOURCES Information Retrieval: Design features of Information Retrieval Systems, Classical, Nonclassical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net,Frame Net, Stemmers, POS Tagger

RECOMMENDED BOOKS:

1. Natural Language understanding by James Allen, Pearson Education 2008.
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall 1995.
3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press 2000.
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education 2008.
5. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley 1989.

INTRODUCTION TO INTERNET OF THINGS

Subject Code: BCSEH1-012 **L T P C** **Duration – 60Hrs.**
3 1 0 4

COURSE OBJECTIVE:

The purpose of this course is to impart knowledge on IoT Architecture and various protocols, study their implementations

COURSE OUTCOMES:

1. To Understand the Architectural Overview of IoT

2. To Understand Raspberry.
3. To Understand the various IoT Protocols (Datalink, Network)
4. To understand sensor applications.

COURSE CONTENTS:

UNIT I (12 hours)

OVERVIEW: Introduction to IOT, how does it work? Difference between Embedded device and IoT device, Properties of IoT device, IoT Ecosystem, IoT Decision Framework, IoT Solution Architecture Models, Major IoT Boards in Market , Privacy issues in IOT

UNIT II (11 hours)

Setting Up Raspberry Pi/Arduino to Create Solutions Explore Raspberry Pi, setting up Raspberry Pi, showing working of Raspberry Pi using Secure Shell (SSH) Client and Team Viewer, Understand Sensing actions, Understand Actuators and Microelectromechanical Systems (MEMS).

UNIT III (12 hours)

IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS: Communication Protocols used in IoT Types of wireless communication, Major wireless Short-range communication devices, properties, comparison of these devices (Bluetooth, Wireless Fidelity(WiFi), ZigBee, Low-power Wireless Personal Area Network(6LoWPAN)), Major wireless Long-range communication devices, properties, comparison of these devices (Cellular IoT, Low-Power Wide-Area Network(LPWAN))

UNIT IV (10 hours)

Sensors Applications of various sensors: Google Maps, Waze, WhatsApp, Ola Positioning sensors: encoders and accelerometers, Image sensors: cameras Global positioning sensors: Global Positioning System (GPS), Global Navigation Satellite System (GLONASS), Indian Regional Navigation Satellite System (IRNSS).

RECOMMENDED BOOKS:

1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1 st Edition, VPT, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications

INTRODUCTION TO SECURITY OF CYBER PHYSICAL SYSTEMS

Subject Code: BCSEH1-013 **L T P C** **Duration – 60Hrs.**
3 1 0 4

COURSE OBJECTIVE:
This course help students to have an understanding of basics of security and issues related to it and biometric techniques available and how they are used in today's world. They will learn security issues in web and how to tackle them.

COURSE OUTCOMES:
1. To learn the basics of security and various types of security issues.
2. To study different cryptography techniques available and various security attacks.
3. Explore network security and how they are implemented in real world.
4. To get an insight of various issues of Web security and biometric authentication.

COURSE CONTENTS:

UNIT-I (20 Hrs.)
Introduction-Overview of Security and Privacy in Information System.
Applied Cryptography & Intrusion Detection, Architecture of Applied Cryptography, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class), Intrusion Detection and Information Theory.

UNIT-II (15 Hrs.)
Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.

UNIT-III (15 Hrs.)
Software-Defined Networks, Introduction of Software-Defined Networks, Security for Software-Defined Networks, Privacy Leakages for Software-Defined Networks, Case Studies: How to Attack Software-Defined Networks.

UNIT-IV (10 Hrs.)
Cyber-Physical Systems (CPS), CPS - Platform components, CPS implementation

RECOMMENDED BOOKS:
1. Li Da Xu, Shancang Li, "Securing the Internet of Things", Syngress.
2. Alasdair Gilchrist, "IoT Security Issues", De Gruyter
3. Sean Smith, "The Internet of Risky Things", Sean Smith, Shroff/O'Reilly

UBIQUITOUS SENSING, COMPUTING AND COMMUNICATION

Subject Code: BCSEH1-014 **L T P C** **Duration – 60Hrs.**
3 1 0 4

COURSE OBJECTIVE:
This course will give basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wireline protocols, Mobile to Electronics integration, Mobile to enterprise integration. It also helps to have an understanding of basics of open source/commercial electronics platform for IoT

COURSE OUTCOMES:

1. To understand merging technological options, platforms and case studies of IoT implementation in home & city automation
2. Determine the Market perspective of IoT.

COURSE CONTENTS:

UNIT-I (10 Hrs.)

Introduction, Overview, Challenges in IoT, Networking Basics of IoT, NFC, Wireless LAN

UNIT-II (20 Hrs.)

Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications, Location based social networks (LBSN), LBSN Recommendation

Context-aware computing: Context and Context-aware Computing, Issues and Challenges, Developing Context-aware Applications, System Architecture

UNIT-III (15 Hrs.)

Privacy and security in ubiquitous computing, Energy constraints in ubiquitous computing Wearable computing, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper, Mobile social networking & crowd sensing, Event based social network.

UNIT-IV (15 Hrs.)

Mobile affective computing: Human Activity and Emotion Sensing, Health Apps, Mobile p2p computing, Smart Homes and Intelligent Buildings, Mobile HCI, Cloud centric IoT, Open challenges, Architecture, Energy Efficiency, Participatory sensing, Protocols, QoS, QoE.

RECOMMENDED BOOKS:

1. John Krumm, Ubiquitous Computing Fundamentals, CRC Press/.

2. N. Jeyanthi, Ajith Abraham, Hamid Mcheick, "Ubiquitous Computing and Computing Security of IoT".

3. Dirk Slama, "Enterprise IoT", Shroff/O'Reilly

EMBEDDED SYSTEMS FOR IOT

Subject Code: BCSEH1-015 **L T P C** **Duration – 60Hrs.**
3 1 0 4

COURSE OBJECTIVE:

This course will help students to know the basic concept and architecture of embedded systems and different design platforms used for an embedded system for IoT applications.

COURSE OUTCOMES:

1. Understand the embedded system concepts and architecture of embedded systems.
2. Understand the different hardware/software co-design techniques for microcontroller-based embedded systems, apply techniques in IoT applications.
3. To be able to design web/cloud based IoT applications.

COURSE CONTENTS:

UNIT-I (15 Hrs.)

Purpose and requirement specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.

UNIT-II (10 Hrs.)

Design of Embedded Systems: Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture.

UNIT-III (15 Hrs.)

Inputs and Outputs: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, BusIn, BusOut, and BusInOut, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768)

UNIT-IV (20 Hrs.)

IoT Enabling Technologies: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED, Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, ThingWorx, GE Predix, Xively, macchina.io, Carriots.

RECOMMENDED BOOKS:

1. Klaus Elk, "Embedded Software for the IoT".
2. Perry Xiao, "Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed".
3. Elizabeth Gootman et. al, "Designing Connected Products", Shroff/O'Reilly

IOT WITH ARDUINO,ESP, AND RASPBERRY Pi

Subject Code: BCSEH1-016 **L T P C** **Duration – 60Hrs.**
3 1 0 4

COURSE OBJECTIVE:

To give students hands-on experience using different IoT architectures and to provide skills for interfacing sensors and actuators with different IoT architectures

COURSE OUTCOMES:

1. Understand Arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud
2. Understand commonly used IOT protocols such as REST API, MQTT through IOT based demonstration.
3. Understand analog sensor and digital sensor Interfacing with IOT devices

COURSE CONTENTS:

UNIT-I (10 Hrs.)

IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3)

UNIT-II (15 Hrs.)

Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, inerrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module

UNIT-III (20 Hrs.)

ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API-GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).

UNIT-IV (15 Hrs.)

Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.

RECOMMENDED BOOKS:

1. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
2. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
3. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Media, Inc.".
4. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd.