Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for M. Sc. In Data Analytics
(Effective for Academic Session 2019-2020)

Semester IV

ELECTIVE SET 1

Paper: Internet of Things (IOT)
Code: MDSE 401A
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable the students to:

Understand data analytics in a typical **IoT** system. design a simple **IoT** system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software. build and test a complete working **IoT** system

UNITS	COURSE CONTENT
1	Internet in general and Internet of Things: layers, protocols, packets, services, performance parameters of a packet network as well as applications such as web, Peer-to-peer, sensor networks, and multimedia. Transport services: TCP, UDP, socket programming.
2	Network layer: forwarding & routing algorithms (Link, DV), IP-addresses, DNS, NAT, and routers. Local Area Networks, MAC level, link protocols such as: point-to-point protocols, Ethernet, WiFi 802.11, cellular Internet access, and Machine-to-machine.
3	Mobile Networking: roaming and handoffs, mobile IP, and ad hoc and infrastructure less networks. Real-time networking: soft and real time, quality of service/information, resource reservation and scheduling, and performance measurements.
4	IoT definitions: overview, applications, potential & challenges, and architecture.

References:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ―From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
2. Vijay Madisetti and Arshdeep Bahga,―Internet of Things (A Hands-on- Approach)‖, Edition, VPT, 2014.
3. Jeeva Jose, Internet of Things, Khanna Publishing House

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Paper: Green Computing
Code: MDSE 401B
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable students to:

Practice effective computing resources and the environment. Maximize energy efficiency and promote the biodegradability are the main objective of this technology**.**

UNITS	COURSE CONTENT
1	Logistics, Introduction to Green Computing & Background, Energy Management in Embedded Systems and Sensor Networks, Energy Management in Mobile Systems and Smartphones, Greening Desktop and Laptop PCs, Energy Efficient Networking and Communication, Greening Data Centers and Servers, IT Enabled Smart Buildings, Sensing within Buildings (Occupancy), Sensing within Buildings (Energy and Water), Managing the Data Deluge and ―App Platforms‖ for Smart Buildings, Energy Management in Smart Homes, Modeling, Prediction and Control for Smart Buildings, Security and Privacy.

References:

1. The Green Computing Book: Tackling Energy Efficiency at Large Scale by Wu Chun
2. Green Computing: Tools and Techniques for Saving Energy, Money and Resources by Bud E. Smith
3. Architecture and Buildings, A.K. Jain, Khanna Publishing House

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Paper: Optimization Techniques
Code: MDSE 401C
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable the students to:
Develop a knowledge in the field of optimization techniques their basic concepts, principles, linear programming and queuing theory**.**

UNITS	COURSE CONTENT
1	Introduction and Basic Concepts: Historical Development; Engineering applications of Optimization; Art of Modeling, Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems, Classification of optimization problems, Optimization techniques – classical and advanced techniques Optimization using Calculus: Stationary points; Functions of single and two variables; Global Optimum, Convexity and concavity of functions of one and two variables, Optimization of function of one variable and multiple variables; Gradient vectors; Examples, Optimization of function of multiple variables subject to equality constraints; Lagrangian function, Optimization of function of multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values, Kuhn-Tucker Conditions; Examples
2	Linear Programming: Formulating maximization/minimization problems, Graphical solution, simplex methods, Special cases of LP, Duality of LP and its interpretation, Dual simplex methods, Post Optimality/sensitivity analysis, Applications of LP. Transportation and Assignment problems: VAM method, Checking for optimally using MODI method, Unbalanced problem and degeneracy, Hungarian method for assignment problem, Traveling salesman problem. Waiting lines: Characteristics of a queuing system, Arrival and service patterns, Single and multiple channel, Queue models with Poisson arrival and exponential service times.
3	Simulation Modeling: Monte Carlo simulation, Using random numbers, Applications in inventory analysis, Waiting lines, Maintenance and finance areas. Replacement models: Types of replacement problems, Replacement of assets that deteriorate with time
4	Network Analysis: Network definition and Network diagram, probability in PERT analysis, project time cost trade off, introduction to resource smoothing and allocation

References:

1. Operations Research by A Ravindran, Don T Philips and James J Solberg.

2. Operations Research by Hamdy A Taha

3. Engineering Optimization: Theory and Practice", by SS Rao, New Age International Pvt Ltd., New Delhi, 2000.

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ELECTIVE SET 2

Paper: Soft Computing
Code: MDSE 402A
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable the students to:

Develop the skills to gain a basic understanding of **neural network** theory and fuzzy logic theory**.**

UNITS	COURSE CONTENT
1	Neural Networks: Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Multilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks Hebbian Learning.
2	Fuzzy Set Theory: Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set-theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules,Introduction to Fuzzy Reasoning – Extension Principle and Fuzzy Relations
3	Genetic Algorithm: Difference between Traditional Algorithms and GA, The basic operators, Schema theorem, convergence analysis, stochastic models, applications in search and optimization. Encoding, Fitness Function, Reproduction, Cross Over, Mutation, Application of Genetic Algorithm.
4	Neuro Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

References:

1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.
2. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
3. S. V. Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, IEEE Press - PHI, 2004.
4. S. Rajasekaran & G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI, 2003.
5. S. N. Sivanandam & S. N. Deepa, Principles of Soft Computing, Wiley - India,

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Paper: Data Security and Authentication
Code: MDSE 402B
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable the students to:

provide an introduction to the basic concepts of computer and data **security we well as the authentication process for access to data .**

UNITS	COURSE CONTENT
1	Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms , A Model for Network Security, Classical Encryption Techniques, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography, Cryptographic Tools, Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data, User Authentication, Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Malicious Software, Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—SPAM Email, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing, Spyware, Payload—Stealthing— Backdoors, Rootkits, Countermeasures, Firewalls and Intrusion Prevention Systems, the Need for Firewalls, Firewall Characteristic, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems.

References:

1. Cryptography and Network Security: Principles and Practice by William Stalings 6thEdition published by PHI (2011)
2. Computer security principles and practice, William Stallings, Lawrie Brown, third edition, Prentice-Hall, 2011
3. Cryptography and Network Security, V.K. Jain, Khanna Publishing House, 2017.

Paper: Game Theory
Code: MDSE 402C
Contacts Hours / Week: 3L+1T
Credits: 4

Objectives:

To enable the students to:

evaluate **Game Theory** principles in workplace settings

UNITS	COURSE CONTENT
1	Mathematical formulation of conflict decision problems as a game, extensive and normal forms of a game, finite games and linear programming, the minimax theorem and the value of game, optimal strategies, finite games of perfect information, games with an infinite number of moves, games of timing, games of sequence generation and prediction, differential games, management games for decisionmaking under conditions of competition and uncertainty

References:

1. Introduction to Game Theory by Martin J Osborne
2. Game theory an introduction by Steven Tadilis
3. Coimbatorics and Graph Theory, S.B. Singh, Khanna Publishing House

Paper: Major Project
Code: MDSE 481
Contacts Hours / Week: 3L+1T
Credits: 4

Topics:

1. Social Media Analytics
2. Brand Sentiment Analytics
3. Supply Chain Analytics
4. Predictive Maintenance
5. Financial Analytics
6. Image Analytics

Paper: Grand Viva
Code: MDSE 482
Contacts Hours / Week: 3L+1T
Credits: 4