RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based on AICTE Flexible Curriculum

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

IS801 –Artificial Intelligence

Unit I: Introduction to machine learning neural network- Biological Neuron, Artificial Neuron- McCulloch-Pitts Neuron, Rosenblatt Perceptron, Perceptron learning algorithm, The XOR problem.

Unit II: Artificial Neural network-Input, hidden, and output layers, Activation Functions-sigmoid, tanh,ReLU, PReLU, Linear activation.Loss Functions- MSE, MAE, Cross-Entropy, Gradient Descent, momentum, Backpropagation algorithm, Weights and bias in ANN, Weight initialization, Training, Testing and Validation, L1 and L2 regularization, Dropout, tuning hyper parameters.

Unit III: Convolutional neural network, Flattening, Padding and stride, Types of CNN layers: convolution layer, pooling layer, activation layer, Deconv layer. Transfer Learning, Dropout, Inception.Different performance metrics – Accuracy, Recall, precision, F1-score. Confusion Matrix.

Unit IV: Recurrent Neural Networks- Sequence learning with neural nets, unrolling the recurrence, training RNN- Backpropagation through time (BPTT), vanishing gradient problem, Gated recurrent unit (GRU), Long short-term memory (LSTM), Bidirectional LSTMs, bidirectional RNNs.

Unit V: Architecture of AlexNet, VGG-16, Resnet, GoogLeNet, Case Study: MNIST data set, ImageNet Competition

Textbooks:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press

2. Josh Patterson and Adam Gibson, “Deep Learning- A Practitioner’s Approach” O’Reilly Media Inc., 2017, USA.

3. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2011

4. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, First edition, 2017.

REFERENCE BOOKS:

1. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow:

Concepts, Tools, and Techniques to Build Intelligent Systems”, Shroff/O'Reilly; First edition (2017).

2. Francois Chollet, "Deep Learning with Python", Manning Publications, 1 edition (10 January 2018).

3. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data

Scientists", Shroff/O'Reilly; First edition (2016).

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Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Departmental Elective – IS802 (A) IoT Applications

Unit I: Introduction to IoT, Evolution of IoT, IPv4 with Network Address Translation, IPV6 addressing, IoT architecture reference layer. Introduction to IoT components, Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open-source hardware, Examples of IoT infrastructure.

Unit II: Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, Use of IoT devices in equipments, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Networking and wireless communication protocols used in IIoT deployments.

Unit III: Introduction to robots, Robot control system architecture; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT, Examples and case studies: Open issues and challenges.

Unit IV: Internet of Medical Things Introduction and system architecture: Introduction, IoMT Devices-On-Body Devices, In Home Devices, Community Devices, In-Clinic Devices, In Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer

Unit V: Internet of Medical Things Security Threats, Security Challenges and Potential Solutions: IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.

Text Books

1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018.
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
3. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.
4. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus
5. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017.
6. Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 2016

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Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Departmental Elective – IS802 (B) Emerging Areas in Blockchain

Course Outcomes:

1. Understand blockchain building blocks.
2. Explore the components DLT and Smart Contract.
3. Design and develop end-to-end decentralized applications.
4. Acquaint blockchain ecosystem.
5. Blockchain Ecosystem Services in real world sceneries.
6. Comprehend of emerging models.

UNIT I: Basic of Blockchain Architecture — Challenges — Applications — Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - peer-to-peer network — Abstract Models - GARAY model - RLA Model - Proof of Work (PoW) - Proof of Stake (PoS) based Chains -Hybrid models.

UNIT II: Distributed Ledger Technology: Origin of Ledgers, Features of DLT, Types of Distributed Ledger Technologies, Role of Consensus Mechanism, DLT Ecosystem, Distributed Ledger Implementations - Blockchain, Ethereum. Public and Private Ledgers - Registries, Ledgers, Practitioner Perspective: Keyless Technologies, Transparency as a Strategic Risk, Transparency as a Strategic Asset, Usage of Multiple IDs, Zero Knowledge Proofs, Implementation of Public and Private Blockchain.

UNIT III: Smart Contract: Anatomy of a Smart Contract, Life Cycle, Usage Patterns, DLT-based smart contracts, Use Cases: Healthcare Industry, Property Transfer.

UNIT IV: Decentralized Organizations 5 hours Decentralization versus Distribution, Centralized-distributed (Ce-Di) organizations, Decentralized-distributed (De-Di) organizations, Decentralized Autonomous Organizations, Aragon, DAO stack, DAO house and Colony.

UNIT V: Types of Blockchain Ecosystem One-Leader Ecosystem, Joint Venture or Consortia Ecosystems, Regulatory Blockchain Ecosystems, Components in Blockchain Ecosystem - Leaders, Core Group, Active Participants, Users, Third-Party Service Providers, Governance for Blockchain Ecosystems.

Refrences:

Text Book(s)

1 Dhillon, V., Metcalf, D., & Hooper, M. Blockchain enabled applications, 2017, CA: Apress, Berkeley.

2 Diedrich, H. Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations. 2016, Wildfire publishing, Sydney.

3. Wattenhofer. R. P. Distributed Ledger Technology: The Science of the Blockchain. 2017. Inverted Forest Publishing.

Reference Books

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A.. & Goldfeder, S. Bitcoin and cryptocurrency technologies, Book Bitcoin and cryptocurrency technologies., 2016.

2. Baset. S. A., Desrosiers, L., Gaur, N., Novotny, P., O'Dowd, A., & Ramakrishna, V. Hands-on blockchain with Hyperledger: building decentralized applications with Hyperledger Fabric and composer. 2018, Packt Publishing Ltd.

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New Scheme Based On AICTE Flexible Curricula

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Departmental Elective – IS802 (C) Big Data

Course Outcomes:

1. Students should be able to understand the concept and challenges of Big data.

2. Students should be able to demonstrate knowledge of big data analytics.

3. Students should be able to develop Big Data Solutions using Hadoop Eco System

4. Students should be able to gain hands-on experience on large-scale analytics tools.

5. Students should be able to analyse the social network graphs.

Course Content

Unit I: Introduction to Big data, Big data characteristics, Types of big data, Traditional versus Big data, Evolution of Big data, challenges with Big Data, Technologies available for Big Data, Infrastructure for Big data, Use of Data Analytics, Desired properties of Big Data system.

Unit II: Introduction to Hadoop, Core Hadoop components, Hadoop Eco system, Hive Physical Architecture, Hadoop limitations, RDBMS Versus Hadoop, Hadoop Distributed File system, Processing Data with Hadoop, Managing Resources and Application with Hadoop YARN, MapReduce programming.

Unit III: Introduction to Hive Hive Architecture, Hive Data types, Hive Query Language, Introduction to Pig, Anatomy of Pig, Pig on Hadoop, Use Case for Pig, ETL Processing, Data types in Pig running Pig, Execution model of Pig, Operators, functions,Data types of Pig.

Unit IV: Introduction to NoSQL, NoSQL Business Drivers, NoSQL Data architectural patterns, Variations of NOSQL architectural patterns using NoSQL to Manage Big Data, Introduction to MangoDB

Unit V: Mining social Network Graphs: Introduction Applications of social Network mining, Social Networks as a Graph, Types of social Networks, Clustering of social Graphs Direct Discovery of communities in a social graph, Introduction to recommender system.

Text Books:

1. RadhaShankarmani, M. Vijaylakshmi, " Big Data Analytics", Wiley, Secondedition

2. Seema Acharya, SubhashiniChellappan, " Big Data and Analytics", Wiley, First edition

Reference Books:

1. KaiHwang,Geoffrey C., Fox. Jack, J. Dongarra, “Distributed and Cloud Computing”,

Elsevier, Firstedition

2. Michael Minelli, Michele Chambers, AmbigaDhiraj, “Big Data Big Analytics”,Wiley

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New Scheme Based On AICTE Flexible Curricula

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Departmental Elective – IS802 (D) IT Project Management

Course Outcome(s):Students will be able to

- Learn activities involved in IT projects management.
- Apply agile process to project management.
- Plan application development using Scrum.
- Develop abilities to use DevOps in projects.
- Develop understanding of Containers use in projects.

UNIT – I: Project Overview and Feasibility Studies- Identification, Market and Demand Analysis, Project Cost Estimate, Financial Appraisal.

UNIT – II: Project Scheduling: Project Scheduling, Introduction to PERT and CPM, Critical Path Calculation, Precedence Relationship, Difference between PERT and CPM, Float Calculation and its importance, Cost reduction by Crashing of activity. Cost Control and Scheduling: Project Cost Control (PERT/Cost), Resource Scheduling & Resource Leveling

UNIT – III: Project Management Features: Risk Analysis, Project Control, Project Audit and Project Termination Agile Project Management: Introduction, Agile Principles, Agile methodologies, Relationship between Agile Scrum, Lean, DevOps and IT Service Management (ITIL).

UNIT – IV: Scrum: Various terminologies used in Scrum (Sprint, product backlog, sprint backlog, sprint review, retro perspective), various roles (Roles in Scrum), Best practices of Scrum.

UNIT – V: DevOps: Overview and its Components, Containerization Using Docker, Managing Source Code and Automating Builds, Automated Testing and Test Driven Development, Continuous Integration, Configuration Management, Continuous Deployment, Automated Monitoring. Other Agile Methodologies: Introduction to XP, FDD, DSDM, Crystal

Text Book(s):

1. Mike Cohn, “Succeeding with Agile: Software Development Using Scrum”, Addison Wesley, 2009
2. Pearson, Robert C. Martin, Juli, James Shore, “The Art Of Agile Development”, O'Reilly, 2013
3. John Hunt, “Agile Software Construction”, 1st Edition, Springer,20054. Somerville, “Software Engineering”, 10th edition (Chapter 3, Chapters 22 to 26), Pearson, 2017
5. Deepak Gaikwad, Viral Thakkar, “DevOps Tools from Practitioner's Viewpoint”, Wiley, 2019
6. James Turnbill, “The Docker Book”, 2019

Reference Book(s):

1. Roman Pichler, “Agile Product Management with Scrum”.
2. Ken Schwaber, “Agile Project Management with Scrum” (Microsoft Professional)
3. Andrew Stellman, Jenifer Greene, “Head First Agile”, Oreilly, 2017
4. Peggy Gregory, Casper Lassenius, Xiaofeng Wang Philippe Kruchten (Eds.), “AgileProcesses in Software Engineering and Extreme Programming”, 22nd InternationalConference on Agile Software Development, XP 2021 Virtual Event, June 14–18, 2021,Proceedings, Springer
5. Joseph Phillips, IT Project Management: On Track from Start to Finish, 3rd Edition, McGraw-Hill, 2010
6. Clinton Keith, “Agile Game Development”, Addison Wesley, 2010
7. Scott M Graffius, “Agile Scrum: Your Quick Start Guide with Step-by-Step Instructions”,CreateSpace, 2016

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New Scheme Based On AICTE Flexible Curricula

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Open Elective – IS803 (A) Game Theory with Engineering applications

Unit-I: **Overview**: What is a Game, Game Design Schema, Game Design fundamentals, Engineering application of game theory, Design Process: Iterative design, Commissions, Design & Testing of the Board Game, Introduction to meaningful play, two kinds of meaningful play- discernible& integrated.

Unit-II: Introducing design, design & meaning, Semiotics: A brief overview, four semiotic Concepts, Context Shapes interpretations.

Unit-III: Introduction to Systems, elements of a System, Framing Systems, open & closed systems, Introduction to Interactivity, a multivalent model of interactivity, interaction & choice, choice molecules, anatomy of choice, space of possibility.

Unit-IV: Defining games: overview of digital games, magic circle. Primary Schemas: conceptual framework, rule, play, culture.

Unit-V: Rules: defining rules, a deck of cards, quality of rules, rules in context, Rules on three levels: Operational, Constituative, Implicit, Identity of a Game, Specificity of Rules, Rules of Digital games. Case Studies: Tic Tac Toe, Deck of Cards.

Text Books:-

1. Brathwaite, Brenda, and Ian Schreiber. Challenges for Game Designers: Non-digital Exercises for Video Game Designers. Boston, MA: Charles River Media/Course Technology, 2009. ISBN: 97815845058081
2. Game Design Workshop: A Playcentric Approach to Creating Innovative Games by Tracy Fullerton. ISBN-10: 1482217163.
3. Challenges for Game Designers by Brenda Brathwaite (now: Romero) and Ian Schreiber. ISBN-10: 158450580X

Reference Books:-

1. Rules of Play - Game Design Fundamentals, Katie Salen and Eric Zimmerman, The MIT Press Cambridge, Massachusetts London, England, book design and photography.

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Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Open Elective – IS803 (B) Image Processing and Computer Vision

Course Objectives:

1. Understand practice and theory of computer vision. Elaborate computer visionalgorithms, methods and concepts
2. Implement computer vision systems with emphasis on applications and problemsolving
3. Apply skills for automatic analysis of digital images to construct representations of physical objects and scenes.
4. Design and implement real-life problems using Image processing and computer vision.

UNIT-I: Introduction to computer vision and Image processing (CVIP): Basics of CVIP, History of CVIP, Evolution of CVIP, CV Models, Image Filtering, Image Representations, Image Statistics Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, and Matching, Morphological Image Processing: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images, Thinning, Thickening, Region growing, region shrinking.

UNIT-II: Image Representation and Description: Representation schemes, Boundary descriptors, Region descriptors Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split& merge, Rule-based Segmentation, Motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).

UNIT-III: Region Analysis: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works For Matching: Distance relational approach, Ordered structural matching, View class matching, Models database organization

UNIT-IV: Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking AlgorithmPerspective Projective geometry, Inverse perspective Projection, Photogrammetric -from 2D to 3D, Image matching: Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching. Object Models And Matching: 2D representation, Global vs. Local features

UNIT-V: Knowledge Based Vision: Knowledge representation, Control-strategies, Information Integration. Object recognition-Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, feature extraction, Neural network and Machine learning for image shape recognition

Reference Text

1. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, AddisonWesley, 1993

2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach" Pearson

3. Milan Sonka,VaclavHlavac, Roger Boyle, "Image Processing, Analysis, and

Machine Vision" Thomson Learning.

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New Scheme Based On AICTE Flexible Curricula

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Open Elective – IS803 (C) Wireless and Mobile Computing

Course Outcomes:

1. Design and create traditional networks
2. Understand the different issues in MAC and routing issues in multi hop wireless and ad-hoc networks and existing solutions for the same.
3. Evaluate the transport layer issues in wireless networks due to error's and mobility of nodes and understand existing solutions for the same.
4. Explain the architecture of GSM.
5. Discuss the services, emerging issues and future trends in M-Commerce.

Unit 1: Review of traditional networks: Review of LAN, MAN, WAN, Intranet, Internet, and interconnectivity devices: bridges, Routers etc. Review of TCP/IP Protocol Architecture: ARP/RARP, IP addressing, IP Datagram format and its Delivery, Routing table format, ICMP Messages, Subnetting, Supernetting and CIDR, DNS. NAT: Private addressing and NAT, SNAT, DNAT, NAT and firewalls, VLANS: Concepts, Comparison with Real LANS, Type of VLAN, Tagging, IPV6: address structure, address space and header.

Unit 2: Study of traditional routing and transport: Routing Protocols: BGP- Concept of hidden network and autonomous system, An Exterior gateway protocol, Different messages of BGP. Interior Gateway protocol: RIP, OSPF. Multiplexing and ports, TCP: Segment format, Sockets, Synchronization, Three Way Hand Shaking, Variable window size and Flow control, Timeout and Retransmission algorithms, Connection Control, Silly window Syndrome. Example of TCP: Taho, Reno, Sack etc. UDP: Message Encapsulation, Format and Pseudo header.

Unit 3: Wireless LAN: Transmission Medium For WLANs, MAC problems, Hidden and Exposed terminals, Near and Far terminals, Infrastructure and Ad hoc Networks, IEEE 802.11- System arch, Protocol arch, Physical layer, Concept of spread spectrum, MAC and its management, Power management, Security. Mobile IP: unsuitability of Traditional IP; Goals, Terminology, Agent advertisement and discovery, Registration, Tunneling techniques. Ad hoc network routing: Ad hoc Network routing v/s Traditional IP routing, types of routing protocols, Examples: OADV, DSDV, DSR, ZRP etc.

Unit 4: Mobile transport layer: unsuitability of Traditional TCP; I-TCP, S-TCP, M-TCP. Wireless Cellular networks: Cellular system, Cellular networks v/s WLAN, GSM – Services, system architecture, Localization and calling, handover and Roaming.

Unit 5: Mobile Device Operating Systems: Special Constraints & Requirements, Commercial Mobile Operating Systems. Software Development Kit: iOS, Android etc.MCommerce : Structure , Pros &Cons, Mobile Payment System ,Security Issues

TEXT BOOKS RECOMMENDED:

1. Comer, “Internetworking with TCP/ IP Vol-I”, 5th edition, Addison Wesley, 2006.

2. Jochen Schiller “Mobile communication”, 2nd edition, Pearson education, 2008

REFERENCE:

1. W. Richard Stevens, “TCP/IP Illustrated Vol-I”, Addison-Wesley.

2. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education.

3. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer

4. Android Developers : http://developer.android.com/index.html

5. Apple Developer : https://developer.apple.com/

6. Windows Phone Dev Center : http://developer.windowsphone.com/

7. BlackBerry Developer : http://developer.blackberry.com/.

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New Scheme Based On AICTE Flexible Curricula

Computer Science and Engineering - Internet of Things and Cyber Security Including Block Chain Technology, VIII-Semester

Open Elective – IS803 (D) Managing Innovation and Entrepreneurship

COURSE OBJECTIVE

The aim of the course is to motivate students to innovate in business. In the first place, to achieve this goal, students will be introduced to the basic terminology, typology of innovations and historical context for better comprehension. Also issues of innovation management will be introduced. Students will become familiar with the impact of innovation, innovative processes and aspects that affect it, including applicable methods and innovation management techniques.

Course contents:

UNIT-I: Innovation, the basic definition and classification: The relationship of innovation and entrepreneurship, creation of competitive advantage based on innovation. Innovative models, Product, process, organizational and marketing innovation and their role in business development.

UNIT-II: Sources of innovation (push, pull, analogies), transfer of technology. Creative methods and approaches used in innovation management. Approaches to management of the innovation process (agile management, Six Thinking Hats, NUF test).

UNIT-III: Project approach to innovation management, method Stage Gate, its essence, adaptation of access to selected business models. In-house business development of the innovation process in the company. Open Innovation as a modern concept, the limits of this method and its benefits for business development.

UNIT-IV: Innovations aimed at humans, role of co-creation in the innovation process. The strategy of innovation process, types and selection of appropriate strategies.

UNIT-V: Measurement and evaluation of the benefits of innovation for business (financial and nonfinancial metrics, their combination and choice). Barriers to innovation in business, innovation failure and its causes, post-audits of innovative projects. Organization and facilitation of an innovation workshop.

REFERENCE BOOKS

1. CLARK, T. – OSTERWALDER, A. – PIGNEUR, Y. Business model generation: a handbook for visionaries, game changers, and challengers. Wiley Publications

2. BESSANT, J R. – TIDD, J. Managing innovation: integrating technological, market and organizational change. Wiley Publications