Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Computer Science & Engineering

Name of the Course: Ph. D. Course Work Paper No. 3

(Syllabus to be implemented from w.e.f. June 2021)

Punyshlok Ahilyadevi Holkar Solapur University, Solapur
Computer Science & Engineering
Ph.D. Course Work Syllabus December 2021
Course/Paper-3 (Advanced Knowledge in Core domain of Concerned Subjects)

Note –

1. Candidate shall select any one elective in consultation with guide from below list

a. Data Science & Machine Learning

b. Network Security and Cloud Computing

c. Image Processing

Elective a. Data science & Machine Learning

Unit-I	**Introduction to Data Science** Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting Introduction to AI, Intelligent agents, Machine Learning Introduction Introduction to Programming Tools for Data Science Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK	14 Hrs 1 Credits 20 Marks
Unit-II	**Mathematical Foundations:** Linear Algebra: Vectors, Matrices Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P-hacking, Bayesian Inference **AI** Searching Techniques, Planning techniques, Knowledge Representation. Uncertainty. Clustering , Classification, Association rule mining **Machine Learning,** Back propagation Algorithm, Decision Tree, Genetic Algorithms, K means algorithm, Reinforcement Learning, Convolution Neural networks.	*18 Hrs* *2 Credit* *30 Marks*
Unit-III	**Artificial Neural Networks :** Neurons and biological motivation, linear threshold units, Perceptrons: representational limitation and gradient descent training, multilayer networks and back propagation, convolution neural networks and deep learning **Data Analytics** Big Data, Importance of Big Data, Data collection, Data pre-processing, Descriptive and Prescriptive data analysis, Regression analysis. Data analytics tools, Applications. Hadoop Introduction to Hadoop, MapReduce, The Hadoop Distributed Filesystem, Hadoop I/O, HIVE, HBase, Pig.	18 Hrs 2 Credit 30 Marks

Unit – IV	**Case Studies of Data Science Application** Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis. Deep Learning, Applications. Visualizing Data: Bar Charts, Line Charts, Scatterplots Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction	10 Hrs 1 Credit 20 Marks

Total Credit = 06 ; Total Marks = 100 UA(University Assessment) + 50 CA(Continuous Assessment) ; Total Hrs = 60

References :

1. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill
2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A Modern Approach", Pearson Education, 2nd Edition.
3. Deepak Khemani: “A First Course in Artificial Intelligence”, Mc Graw Hill
4. Saroj Kaushik: “Artificial Intelligence” Cengage Publication
5. Machine Learning by Tom M. Mitchell, McGraw Hill Publications
6. “Business Analytics” by James R Evans, Pearson
7. Hastie, Trevor, et al.The elements of statistical learning.Vol. 2. No. 1. New York:springer, 2009.
8. Montgomery, Douglas C., and George C. Runger.Applied statistics and probability forengineers. John Wiley & Sons, 2010
9. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber, MorganKaufman, ISBN 978-81-312-0535-8, 2nd Edition
10. “Fundamentals of Business Analytics”, by R. N. Prasad, Seema Acharya,ISBN: 978-81-256-3203-2,Wiley-India
11. Barrie Sosinsky, “Cloud Computing Bible”, Wiley India
12. Antohy T Velte, et.al, “Cloud Computing : A Practical Approach”, McGraw Hill.
13. Michael Miller, “Cloud Computing”, Que Publishing.
14. Tim Malhar, S.Kumaraswammy, S.Latif, “Cloud Security & Privacy”, SPD,O’REILLY
15. Scott Granneman, “Google Apps”, Pearson
16. Gerti Kappel, Birgit Proll, “Web Engineering”, John Wiley and Sons Ltd, 2006.
17. Guy W. Lecky-Thompson, “Web Programming”, Cengage Learning, 2008.
18. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly Media
19. Data Sciences, Jain V.K., Khanna Publishing House, Delhi.

Elective b. Network Security and Cloud Computing

Unit-I	**Routing protocols in Wireless Ad hoc networks** Issues in designing a routing protocol for ad hoc wireless networks, Classification of routing protocols, Table driven protocols: Destination Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP). On-demand routing protocol: Dynamic Source Routing (DSR), Ad Hoc On-Demand Distance Vector Routing (AODV), Hybrid routing protocol: Zone Routing Protocol (ZRP). **Multicast Routing in Ad-hoc Wireless Networks** Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols, and Mesh-Based Multicast Routing Protocols.	14 Hrs 1 Credit 20 Marks
Unit-II	**IoT elements and Data Analytics for IoT** Sensor Technology, Participatory Sensing, Industrial IoT, and Automotive IoT, Actuator, Sensor Data Communication Protocols, RFID, WSN Technology. Data Analytics for IoT: Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study. **IoT standards and Layer ½ Connectivity** Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.	18 Hrs 2 Credit 30 Marks
Unit-III	**Overview of Cloud Computing** Brief history and evolution – History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities. **Cloud Computing Infrastructure & Virtualization** Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Cloud storage diversity and vendor lock-in, Service level agreements. Basics of virtualization, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing.	18 Hrs 2 Credit 30 Marks

Unit – IV	**Understanding Computer Network Security** Securing the Computer Network Forms of Protection, Security Standards. Security Threats to Computer Networks: Sources of Security Threats, Security Threat Motives, Security Threat Management, Security Threat Correlation, Security Threat Awareness. Virus and Content Filtering**:** Scanning, Filtering, and Blocking, Virus Filtering, Content Filtering, Spam. Computer Network Vulnerabilities**:** Sources of Vulnerabilities, Vulnerability Assessment. Firewalls: Types of Firewalls, Configuration, and Implementation of a Firewall. **System Intrusion Detection and Prevention: Intrusion** Detection, Intrusion Detection Systems (IDSs), Types of Intrusion Detection Systems, The Changing Nature of IDS Tools, Other Types of Intrusion Detection Systems, Response to System Intrusion, Challenges to Intrusion Detection Systems, Implementing an Intrusion Detection System, Intrusion Prevention Systems (IPSs), Intrusion Detection Tools. Computer and Network Forensics**:** Computer Forensics, Network Forensics, Forensics Tools.	10 Hrs 1 Credit 20 Marks

Total Credit = 06 ; Total Marks = 100 UA + 50 CA ; Total Hrs = 60

References :

1. C. Siva Ram Murthy and B.S. Manoj ―Ad Hoc Wireless Networks: Architectures and Protocols‖, Prentice-Hall PTR,2004.
2. Internet of Things: A Hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press
3. IoT Architecture and Design Principles, Raj Kamal, McGraw Hill Education.
4. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent
5. 5.Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, 2011 Cloud Computing, By Michael Miller, 2008.
6. Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009.
7. Computer Network Security- Theory and Practice by Jie Wang, 2009 edition, Higher Education Press, Beijing, and Springer-Verlag.
8. A Guide to Computer Network Security by Joseph Migga Kizza, 2009 Edition, Springer-Verlag London Limited.

Elective c. Image Processing

Unit-I	**Image Processing: Basics** Digital image fundamentals, data structures for image analysis, image pre-processing, spatial and frequency domain filtering, image transforms, image restoration, color image processing	10 Hrs 1 Credit 20 Marks
Unit-II	**Image Processing: Advanced** Morphological image processing, image segmentation, region identification, contour and region-based shape representation and description, statistical pattern recognition, optimization techniques in recognition, neural nets, fuzzy systems, image compression	18 Hrs 2 Credit 30 Marks
Unit-III	**Computer Vision: Basics** Image understanding: scale invariant feature transform (SIFT), fitting via random sample consensus (RANSAC), classification-based segmentation, contextual image classification, histograms of oriented gradient (HOG), boosted cascades of classifiers, random forests, hidden Markov models, Markov random fields	18 Hrs 2 Credit 30 Marks
Unit-IV	**Computer Vision: Advanced** 2-D feature based alignment using least-squares, application to panography, face detection, face recognition using eigenfaces, image category recognition using Bag of Words (BoW)	14 Hrs 1 Credit 20 Marks

Total Credit = 06 ; Total Marks = 100 UA + 50 CA ; Total Hrs = 60

References :

1. Digital Image Processing, R. C. Gonzalez, R. E. Woods, Pearson education (Asia) Pte. Ltd. /Prentice Hall of India, 2018, 4th Edition.
2. Sonka, M., Hlavac, V., & Boyle, R. (2014). Image Processing, Analysis, and Machine Vision. Cengage Learning. 4th Edition.
3. Richard Szeliski. Computer Vision: Algorithms and Applications. Texts in Computer Science. London: Springer-Verlag, 2011.
4. David Forsyth and Jean Ponce. Computer Vision: A Modern Approach. 2 edition. Boston: Pearson Education India, 2015.