

Syllabus for PET Examination - PhD (Management)

Computer Application

Subject Specific

1. Artificial Intelligence, Machine Learning & Data Science

- Artificial Intelligence Fundamentals: Intelligent agents and problem-solving, approaches, Search algorithms (BFS, DFS, A*), Knowledge representation and reasoning, Expert systems
- Data Science Concepts: Fundamentals of python, Numpy, Pandas, Matplotlib. Data preprocessing and data cleaning, Exploratory Data Analysis (EDA), Feature engineering and selection, Data visualization concepts, Handling missing and imbalanced data
- Machine Learning Basics:
 - Model evaluation and validation techniques, Bias-variance trade off, Confusion Metrics, Performance metrics (Accuracy, Precision, Recall, F1-score, ROC)
 - Supervised Learning Techniques: Regression, Linear and Logistic Regression, Decision Trees and Random Forest, Support Vector Machines, k-Nearest Neighbours, Naïve Bayes
 - Unsupervised Learning Techniques: Clustering (K-Means, Hierarchical, DBSCAN), Dimensionality Reduction (PCA), Association Rule Mining
 - Introduction of semi supervised and reinforcement learning.
- Deep Learning: Artificial Neural Networks and backpropagation, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN, LSTM)
- Ethical and Responsible AI: Ethical issues and fairness in AI, Explainable and Responsible AI, Applications of AI in various domains

2. Blockchain & Emerging Technologies

- Blockchain Fundamentals and Architecture: Distributed ledger technology, Structure of blocks and blockchain architecture, Cryptographic hash functions and Merkle trees, Types of blockchain: Public, Private, Consortium.
- Cryptography and Security Foundations: Symmetric and asymmetric encryption
- Digital signatures, Public Key Infrastructure (PKI), Role of cryptography in blockchain security.
- Smart Contracts and Development Concepts: Concept, features, and lifecycle of smart contracts, Overview of Solidity programming concepts, Smart contract execution environment, Deployment concepts using blockchain networks.

- Tokens, Digital Assets, and Decentralized Applications : Tokens and Digital Assets, Tokenization concepts - ERC standards (ERC-20, ERC-721), Fungible and Non-Fungible Tokens (NFTs), Applications of tokens and NFTs, Decentralized Applications (DApps), Architecture and components of DApps, Interaction between user interface, blockchain, and smart contracts, Role of wallets and blockchain nodes.
- Blockchain Platforms and Smart Contract Security : Blockchain Platforms and Infrastructure, Overview of major blockchain platforms: Ethereum, Polygon, Binance Smart Chain, Public test networks and their purpose, Blockchain network services and node providers (conceptual overview).
- Smart Contract Security and Best Practices: Common vulnerabilities (reentrancy, overflow/underflow, access control issues), Secure development principles, Role of standard libraries and security frameworks, Basic concepts of testing and auditing.

Emerging Technologies

- Image Processing and Computer Vision: Basics of digital image processing: image representation, enhancement, and filtering, Image segmentation and feature extraction techniques, Fundamentals of computer vision: object detection, image classification, and pattern recognition, Applications using machine learning and deep learning in medical imaging, surveillance, and autonomous system
- Internet of Things (IoT) : IoT architecture and components, Communication protocols, Security and privacy challenges.
- Cloud Computing : concept computer network, Service models (IaaS, PaaS, SaaS, Deployment models (Public, Private, Hybrid), Virtualization and containerization, Cloud security concepts
- Cybersecurity Fundamentals: Network security principles, Common threats and vulnerabilities, Risk management and security practices
- Big Data: Introduction to Big Data, Big Data architecture with distributed storage concepts like HDFS, Big Data Processing Frameworks, Big Data Analytics, Applications of Big Data in business and decision-making.

Recommended Reference Books:

Artificial Intelligence, Machine Learning & Data Science

1. Artificial Intelligence Fundamentals – Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig, Pearson Education, 4th Edition.
2. Data Science (Python, NumPy, Pandas, EDA, Visualization) – Python for Data Analysis – Wes McKinney, O'Reilly Media, 3rd Edition.
3. Machine Learning Basics (Supervised & Unsupervised) – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow – Aurélien Géron, O'Reilly Media, 2nd Edition.
4. Deep Learning – Deep Learning – Ian Goodfellow, Yoshua Bengio & Aaron Courville, MIT Press.
5. Ethical and Responsible AI – Artificial Intelligence Basics: A Non-Technical Introduction – Tom Taulli, Apress.

Blockchain & Emerging Technologies

1. Mastering Blockchain – Imran Bashir, Packt Publishing, 3rd Edition.
2. Blockchain Basics: A Non-Technical Introduction in 25 Steps – Daniel Drescher, Apress.
3. Mastering Ethereum – Andreas M. Antonopoulos & Gavin Wood, O'Reilly Media.
4. Hands-On Smart Contract Development with Solidity and Ethereum – Kevin Solorio, Randall Kanna & David Hoover, Packt Publishing.
5. Digital Image Processing – Rafael C. Gonzalez & Richard E. Woods, Pearson Education, 4th Edition.
6. Internet of Things: A Hands-On Approach – Arshdeep Bahga & Vijay Madisetti, Universities Press, 1st Edition.
7. Cloud Computing: Concepts, Technology & Architecture – Thomas Erl, Ricardo Puttini & Zaigham Mahmood, Prentice Hall/Pearson, 1st Edition.
8. Computer Security: Principles and Practice – William Stallings & Lawrie Brown, Pearson Education, 4th Edition.
9. Hadoop: The Definitive Guide – Tom White, O'Reilly Media, 4th Edition.
10. Quantum Computing for Computer Scientists – Noson S. Yanofsky & Mirco A. Mannucci, Cambridge University Press, 1st Edition.