RAMAKRISHNA MISSION VIDYAMANDIRA

Syllabus M.Sc. Computer Science & Machine Intelligence

Course Code: CC16 Credit: 4

Course Type: Core Course Theory

Course Outcome:

By the end of the course, the students will be able gain knowledge on basic principles of blockchain technology, cryptocurrencies and their applications over different sectors. Additionally, students will also have the basic knowledge on one of the well-adopted permissionless blockchain platforms - Ethereum and one permissioned blockchain platform - Hyperledger.

Key Learning Objectives:

The course is intended to

- Understand the basics of blockchain technology and key concepts like cryptography, cryptocurrency especially bitcoin and cryptowallets.
- Gain a deep insight into blockchain consensus mechanisms.
- Understand Ethereum Blockchain, Smart Contract and Hyperledger Fabric.
- Learn different governmental and non-governmental use cases of blockchain.

CC16: Introduction to Blockchain Technology [60L]

Introduction to Blockchain Technology: [5L]

Introduction, Properties of blockchain, Blockchain Myths, Model of Decentralization, Distributed Ledger, Block Header and Block in Blockchain, Block Mining, Block Propagation, Blockchain Transaction

Cryptography Primitives: [10L]

Basic Concepts of Cryptography, Encryption and Decryption using Private and Public Key Cryptography, Cryptographic Hash Function and Properties, Hash as Message Digest, Uses of Hash Function, SHA-256, Types of Hashing, Hash Pointer, Markle Tree, Construction of Hashchain, Blockchain as Hashchain, RSA, Digital Signature

Evolution of the Blockchain Technology: [15L]

Distributed System, Blockchain as Distributed System, Distributed Consensus, Cryptocurrencies, Evolution of Cryptocurrencies, Design Goals for Cryptocurrencies, Popularity of Cryptocurrencies, Cryptowallet, Types of Wallets, Desktop Wallet, App Based Wallet, Browser Based Wallet, Metamask, Transfer of Cryptocurrency in Metamask, Bitcoin Mining, Success of Bitcoin as Cryptocurrency, Dapps

Blockchain Consensus: [20L]

Permissionless Models, Permissioned Models, Consensus and its Challenges, Byzantine Fault, Consensus Problem, Different Consensus Mechanisms - Nakamoto Consensus (Proof of Work), Limitations of Proof of Work (PoW), 51% Attack, Proof of Stake (PoS), Proof of Activity (PoAc), Proof of Burn (PoB), Proof of Authority (PoAu), Proof of Elapsed Time (PoET), Proof of Importance (PoI), Ethereum, Go Ethereum, DApps in Ethereum, Ethereum Smart Contracts (Permissionless Model), Solidity, Byzantine Generals Problem, Byzantine Agreement Protocol, Practical Byzantine Fault Tolerance (PBFT), Enterprise Blockchain, Hyperledger Fabric (Permissioned Model)

Blockchain Applications: **[10L]**

Land Registry Records, Governmental Use Cases of Blockchain, Blockchain for Decentralized Marketplace, Cross Border Payments, Know Your Customer (KYC)

Texts/References:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps by Daniel Drescher, Apress.
2. The Science of the Blockchain by Roger Wattenhofer, Inverted Forest Publishing.
3. Mastering Bitcoin: Programming The Open Blockchain by Andreas M. Antonopoulos, Shroff/O'Reilly.
4. Bitcoin and Cryptocurrency Technologies - A Comprehensive Introduction by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University Press
5. Cryptography and Network Security by Behrouz A. Forouzan, McGraw Hill.
6. Cryptography and Network Security: Principles and Practice by William Stallings, Pearson.

Journals/Periodicals:

1. Blockchain: Research and Applications
2. Journal of Blockchain Research (intlpress.com)
3. International Journal of Blockchain Applications and Secure Computing
4. Frontiers in Blockchain

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Syllabus M.Sc. Computer Science & Machine Intelligence

Course Code: CC16 Credit: 4

Course Type: Core Course Theory

OBJECTIVES:

• To become familiar with digital image fundamentals
• To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
• To learn concepts of degradation function and restoration techniques.
• To study the image segmentation and representation techniques.
• To become familiar with image compression and recognition methods

OUTCOMES:

At the end of the course, the students should be able to
• Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
• Operate on images using the techniques of smoothing, sharpening and enhancement.
• Understand the restoration concepts and filtering techniques.
• Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

CC16: Introduction to Image Processing

UNIT I DIGITAL IMAGE FUNDAMENTALS [8L]

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT [13L]

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION [13L]

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION [13L]

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION [13L]

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description,

Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, _Digital Image Processing‘, Pearson, Third Edition, 2010.
2. Anil K. Jain, _Fundamentals of Digital Image Processing‘, Pearson, 2002.

REFERENCES:

1. Kenneth R. Castleman, _Digital Image Processing‘, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, _Digital Image Processing using MATLAB‘, Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, _Multidimensional Digital Signal Processing‘, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, _Digital Image Processing‘, John Wiley, New York, 2002
5. Milan Sonka et al _Image processing, analysis and machine vision‘, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

RAMAKRISHNA MISSION VIDYAMANDIRA

Syllabus M.Sc. Computer Science & Machine Intelligence

Course Code: CC18 Credit: 2

Course Type: Core Course Practical

Course Outcome:

By the end of the course, the students will be able gain knowledge on basic principles of research. It will gives research legitimacy and provides scientifically sound findings. It also provides a detailed plan that helps to keep researchers on track, making the process smooth, effective and manageable.

Key Learning Objectives:

At the end of this course, the students should be able to:

- understand some basic concepts of research and its methodologies
- identify appropriate research topics
- select and define appropriate research problem and parameters
- prepare a project proposal (to undertake a project)
- organize and conduct research (advanced project) in a more appropriate manner
- write a research report and thesis
- write a research proposal (grants)

CC18: Research Methodology and Presentation Lab [30L]

Foundations of Research: **[5L]**

Meaning, Objectives, Motivation, Utility; Concept of theory, empiricism, deductive and inductive theory; Characteristics of scientific method Understanding the language of research Concept, Construct, Definition, Variable; Research Process.

Interpretation of Data and Paper Writing: **[10L]**

Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. How to write research proposal for grants?

Use of tools/techniques for Research: **[15L]**

Methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for Paraphrasing, summarizing and detection of Plagiarism,

Texts/References:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari