PSIT401: Blockchain

M. Sc (Information Technology)		Semester – IV	
Course Name: Blockchain		Course Code: PSIT401	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Internal	--	40

Course Objectives:

- To provide conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
- To cover the technological underpinnings of blockchain operations as distributed data structures and decision-making systems, their functionality and different architecture types.
- To provide a critical evaluation of existing "smart contract" capabilities and platforms, and examine their future directions, opportunities, risks and challenges.

Unit	Details	Lectures	Outcome
I	**Blockchain:** Introduction, History, Centralised versus Decentralised systems, Layers of blockchain, Importance of blockchain, Blockchain uses and use cases. **Working of Blockchain:** Blockchain foundation, Cryptography, Game Theory, Computer Science Engineering, Properties of blockchain solutions, blockchain transactions, distributed consensus mechanisms, Blockchain mechanisms, Scaling blockchain **Working of Bitcoin:** Money, Bitcoin, Bitcoin blockchain, bitcoin network, bitcoin scripts, Full Nodes and SVPs, Bitcoin wallets.	12	CO1

II	**Ethereum:** three parts of blockchain, Ether as currency and commodity, Building trustless systems, Smart contracts, Ethereum Virtual Machine, The Mist	**12**	**CO2**

	browser, Wallets as a Computing Metaphor, The Bank Teller Metaphor, Breaking with Banking History, How Encryption Leads to Trust, System Requirements, Using Parity with Geth, Anonymity in Cryptocurrency, Central Bank Network, Virtual Machines, EVM Applications, State Machines, Guts of the EVM, Blocks, Mining's Place in the State Transition Function, Renting Time on the EVM, Gas, Working with Gas, Accounts, Transactions, and Messages, Transactions and Messages, Estimating Gas Fees for Operations, Opcodes in the EVM. **Solidity Programming:** Introduction, Global Banking Made Real, Complementary Currency, Programming the EVM, Design Rationale, Importance of Formal Proofs, Automated Proofs, Testing, Formatting Solidity Files, Reading Code, Statements and Expressions in Solidity, Value Types, Global Special Variables, Units, and Functions,		
III	**Hyperledger:** Overview, Fabric, composer, installing hyperledger fabric and composer, deploying, running the network, error troubleshooting. **Smart Contracts and Tokens:** EVM as Back End, Assets Backed by Anything, Cryptocurrency Is a Measure of Time, Function of Collectibles in Human Systems, Platforms for High-Value Digital Collectibles, Tokens as Category of Smart Contract, Creating a Token, Deploying the Contract, Playing with Contracts.	**12**	**CO3**
IV	**Mining Ether:** Why? Ether's Source, Defining Mining, Difficulty, Self-Regulation, and the Race for Profit, How Proof of Work Helps Regulate Block Time, DAG and Nonce, Faster Blocks, Stale Blocks, Difficulties, Ancestry of Blocks and Transactions, Ethereum and Bitcoin, Forking, Mining, Geth on Windows, Executing Commands in the EVM via the Geth Console, Launching Geth with Flags, Mining on the Testnet, GPU Mining Rigs, Mining on a Pool with Multiple GPUs. **Cryptoecnomics:** Introduction, Usefulness of cryptoeconomics, Speed of blocks, Ether Issuance scheme, Common Attack Scenarios.	**12**	**CO4**
V	**Blockchain Application Development:** Decentralized Applications, Blockchain Application Development, Interacting with the Bitcoin Blockchain, Interacting Programmatically with Ethereum—Sending Transactions, Creating a Smart Contract, Executing Smart Contract Functions, Public vs. Private Blockchains, Decentralized Application Architecture, **Building an Ethereum DApp:** The DApp, Setting Up a Private Ethereum Network, Creating the Smart Contract, Deploying the Smart Contract, Client	**12**	**CO5**

	Application, **DApp deployment:** Seven Ways to Think About Smart Contracts, Dapp Contract Data Models, EVM back-end and front-end communication, JSON-RPC, Web 3, JavaScript API, Using Meteor with the EVM, Executing Contracts in the Console, Recommendations for Prototyping, Third-Party Deployment Libraries, **Creating Private Chains.**		

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning Blockchain A Beginner's Guide to Building Blockchain Solutions	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda	Apress		2018
2.	Introducing Ethereum and Solidity	Chris Dannen	Apress		2017
3.	The Blockchain Developer	Elad Elrom	Apress		2019
4.	Mastering Ethereum	Andreas M. Antonopoulos Dr. Gavin Wood	O'Reilly	First	2018
5.	Blockchain Enabled Applications	Vikram Dhillon David Metcalf Max Hooper	Apress		2017

PSIT403a: Deep Learning

M. Sc (Information Technology)		Semester – IV	
Course Name: Deep Learning		**Course Code: PSIT403a**	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	**Marks**
Evaluation System	**Theory Examination**	2½	60
	Internal	--	40

Course Objectives:

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To enable the students to know deep learning techniques to support real-time applications

Unit	Details	Lectures	Outcome
I	**Applied Math and Machine Learning Basics:** Linear Algebra: Scalars, Vectors, Matrices and Tensors , Multiplying Matrices and Vectors , Identity and Inverse Matrices, Linear Dependence and Span , norms, special matrices and vectors, eigen decompositions. **Numerical Computation:** Overflow and under flow, poor conditioning, Gradient Based Optimization, Constraint optimization.	**12**	**CO1**
II	**Deep Networks:** Deep feedforward network , regularization for deep learning , Optimization for Training deep models	**12**	**CO2**
III	Convolutional Networks, Sequence Modelling, Applications	**12**	**CO3**
IV	Deep Learning Research: Linear Factor Models, Autoencoders, representation learning	**12**	**CO4**
V	Approximate Inference, Deep Generative Models	**12**	**CO5**

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year

1.	Deep Learning	Ian Goodfellow, Yoshua Bengio, Aaron Courvile	An MIT Press book	1st	2016
2.	Fundamentals of Deep Learning	Nikhil Buduma	O'Reilly	1st	2017
3.	Deep Learning: Methods and Applications	Deng & Yu	Now Publishers	1st	2013
4.	Deep Learning CookBook	Douwe Osinga	O'Reilly	1st	2017

M. Sc (Information Technology)		**Semester – IV**	
Course Name: Deep Learning Practical		**Course Code: PSIT4P3a**	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	**Marks**
Evaluation System	**Practical Examination**	2	50
	Internal	--	-

List of Practical:
10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop.

Course Outcomes:
After completion of the course, a student should be able to:
CO1: Describes basics of mathematical foundation that will help the learner to understandthe concepts of Deep Learning.
CO2: Understand and describe model of deep learning
CO3: Design and implement various deep supervised learning architectures for text & imagedata.
CO4: Design and implement various deep learning models and architectures.
CO5: Apply various deep learning techniques to design efficient algorithms for real-worldapplications.

PSIT404c: Storage as a Service

M. Sc (Information Technology)		Semester – IV	
Course Name: Storage as a Service		**Course Code: PSIT404c**	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	**Marks**
Evaluation System	**Theory Examination**	2½	60
	Internal	--	40

Course Objectives:

- Understand the need for Storage Area Network and Data protection to satisfy the information explosion requirements.
- Study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics.
- To get an insight of Storage area network architecture, protocols and its infrastructure.
- To study and discuss the applications of SAN to fulfill the needs of the storage management in the heterogeneous environment.
- Study and understand the management of Storage Networks
- To understand different techniques of managing store.

Unit	Details	Lectures	Outcome
I	Introduction to Information Storage Information Storage Data Types of Data Big Data Information Storage Evolution of Storage Architecture Data Center Infrastructure Core Elements of a Data Center Key Characteristics of a Data Center Managing a Data Center Virtualization and Cloud Computing Data Center Environment Application Database Management System (DBMS) Host (Compute) Operating System	**12**	**CO1**

	Memory Virtualization Device Driver 20 Volume Manager File System Compute Virtualization Connectivity Physical Components of Connectivity Interface Protocols IDE/ATA and Serial ATA 28 SCSI and Serial SCSI Fiber Channel Internet Protocol (IP) Storage Disk Drive Components Platter Spindle Read/Write Head Actuator Arm Assembly Drive Controller Board Physical Disk Structure Zoned Bit Recording Logical Block Addressing Disk Drive Performance Disk Service Time Seek Time Rotational Latency Data Transfer Rate Disk I/O Controller Utilization Host Access to Data Direct-Attached Storage DAS Benefit and Limitations Storage Design Based on Application Requirements and Disk Performance Disk NativeCommand Queuing Introduction to Flash Drives Components and Architecture of Flash Drives Features of Enterprise Flash Drives Concept in Practice: VMware ESXi Data Protection: RAID RAID Implementation Methods Software RAID Hardware RAID Array Components RAID Techniques Striping Mirroring Parity RAID Levels RAID 0 RAID 1 Nested RAID RAID 3 RAID 4 RAID 5 RAID 6 RAID Impact on Disk Performance Application IOPS and RAID Configurations RAID Comparison Hot Spares		
II	**Intelligent Storage Systems** Components of an Intelligent Storage System Front End Cache Structure of Cache Read Operation with Cache Write Operation with Cache Implementation Cache Management Cache Data Protection Back End Physical Disk Storage Provisioning Traditional Storage Provisioning LUN Expansion: MetaLUN Virtual Storage Provisioning 82 Comparison between Virtual and Traditional Storage Provisioning Use Cases for Thin and Traditional LUNs LUN Masking Types of Intelligent Storage Systems High-End Storage Systems Midrange Storage Systems **Fiber Channel Storage Area Networks** Fiber Channel: Overview The SAN and Its Evolution Components of FC SAN Node Ports Cables and Connectors Contents Interconnect Devices SAN Management Software FC Connectivity Point-to-Point Fiber Channel Arbitrated Loop Fiber Channel Switched Fabric FC-SW Transmission Switched Fabric Ports Fiber Channel Architecture Fiber Channel Protocol Stack	**12**	**CO2**

	FC-4 Layer FC-2 Layer FC-1 Layer FC-0 Layer Fiber Channel Addressing World Wide Names FC Frame 110. Structure and Organization of FC Data Flow Control BB_Credit EE_Credit Classes of Service Fabric Services Switched Fabric Login Types Zoning Types of Zoning FC SAN Topologies Mesh Topology Core-Edge Fabric Benefits and Limitations of Core-Edge Fabric Virtualization in SAN Block-level Storage Virtualization Virtual SAN (VSAN) **IP SAN and FCoE** iSCSI Components of iSCSI iSCSI Host Connectivity iSCSI Topologies Native iSCSI Connectivity Bridged iSCSI Connectivity Combining FC and Native iSCSI Connectivity iSCSI Protocol Stack iSCSI PDU 6 iSCSI Discovery iSCSI Names iSCSI Session iSCSI Command Sequencing FCIP FCIP Protocol Stack FCIP Topology FCIP Performance and Security FCoE I/O Consolidation Using FCoE Components of an FCoE Network Converged Network Adapter Cables FCoE Switches FCoE Frame Structure FCoE Frame Mapping FCoE Enabling Technologies Priority-Based Flow Control (PFC) Enhanced Transmission Selection (ETS Congestion Notification (CN) Data Center Bridging Exchange Protocol (DCBX) 1		
III	**Network-Attached Storage** General-Purpose Servers versus NAS Devices Benefits of NAS File Systems and Network File Sharing Accessing a File System Network File Sharing Components of NAS NAS I/O Operation NAS Implementations Unifi ed NAS Unifi ed NAS Connectivity 164 Gateway NAS Gateway NAS Connectivity Scale-Out NAS Scale-Out NAS Connectivity NAS File-Sharing Protocols NFS CIFS Factors Affecting NAS Performance File-Level Virtualization Object-Based and Unified Storage Object-Based Storage Devices Object-Based Storage Architecture Components of OSD Object Storage and Retrieval in OSD Benefits of Object-Based Storage Common Use Cases for Object-Based Storage Content-Addressed Storage CAS Use Cases Healthcare Solution: Storing Patient Studies Finance Solution: Storing Financial Records Unified Storage Components of Unifi ed Storage Data Access from Unified Storage	**12**	**CO3**

	Introduction to Business Continuity Information Availability Causes of Information Unavailability Consequences of Downtime Measuring Information Availability BC Terminology BC Planning Life Cycle Failure Analysis Single Point of Failure Resolving Single Points of Failure Multipathing Software Business Impact Analysis BC Technology Solutions I/O Operation without PowerPath I/O Operation with PowerPath Automatic Path Failover Path Failure without PowerPath Path Failover with PowerPath: Active-Active Array Path Failover with PowerPath: Active-Passive Array Backup and Archive Backup Purpose Disaster Recovery Operational Recovery Archival Backup Considerations Backup Granularity Recovery Considerations Backup Methods 6 Backup Architecture Backup and Restore Operations Backup Topologies Backup in NAS Environments Server-Based and Serverless Backup NDMP-Based Backup Backup Targets Backup to Tape Physical Tape Library Limitations of Tape 2 Backup to Disk Backup to Virtual Tape Virtual Tape Library Data Deduplication for Backup Data Deduplication Methods DataDeduplication Implementation Source-Based Data Deduplication Target-Based Data DeduplicationBackup in Virtualized Environments Data Archive Archiving Solution Architecture Use Case: E-mail Archiving Use Case: File Archiving		
IV	Local Replication Replication Terminology Uses of Local Replicas Replica Consistency Consistency of a Replicated File System Consistency of a Replicated Database Local Replication Technologies Host-Based Local Replication LVM-Based Replication Advantages of LVM-Based Replication Limitations of LVM-Based Replication File System Snapshot Storage Array-Based Local Replication Full-Volume Mirroring Pointer-Based, Full-Volume Replication Pointer-Based Virtual Replication Network-Based Local Replication Continuous Data Protection CDP Local Replication Operation Tracking Changes to Source and Replica Restore and Restart Considerations Creating Multiple Replicas Local Replication in a Virtualized Environment Remote	**12**	**CO4**

	Replication Modes of Remote Replication Remote Replication Technologies Host-Based Remote Replication LVM-Based Remote Replication Host-Based Log Shipping Storage Array-Based Remote Replication Synchronous Replication Mode Asynchronous Replication Mode Disk-Buffered Replication Mode Network-Based Remote Replication CDP Remote Replication Three-Site Replication Three-Site Replication — Cascade/Multihop Synchronous + Asynchronous Synchronous + Disk Buffered Three-Site Replication — Triangle/Multitarget Data Migration Solutions Remote Replication and Migration in aVirtualized Environment Cloud Computing Cloud Enabling Technologies Characteristics of Cloud Computing Benefits of Cloud Computing Cloud Service Models Infrastructure-as-a-Service Platform-as-a-Service Software-as-a-Service Cloud Deployment Models Public Cloud Private Cloud Community Cloud Hybrid Cloud Cloud Computing Infrastructure Physical Infrastructure Virtual Infrastructure Applications and Platform Software Cloud Management and Service Creation Tools Cloud Challenges Challenges for Consumers Challenges for Providers Cloud Adoption Considerations		
V	Securing the Storage Infrastructure Information Security Framework Risk Triad Assets Threats Vulnerability Storage Security Domains Securing the Application Access Domain Controlling User Access to Data Protecting the Storage Infrastructure 341 Data Encryption Securing the Management Access Domain Controlling Administrative Access Protecting the Management Infrastructure Securing Backup, Replication, and Archive Security Implementations in Storage Networking FC SAN FC SAN Security Architecture Basic SAN Security Mechanisms LUN Masking and Zoning Securing Switch Ports Switch-Wide and Fabric-Wide Access Control Logical Partitioning of a Fabric: Virtual SAN NAS NAS File Sharing: Windows ACLs NAS File Sharing: UNIX Permissions NAS File Sharing: Authentication and Authorization Kerberos Network-Layer Firewalls IP SAN Securing Storage Infrastructure in Virtualized and Cloud Environments Security Concerns Security Measures Security at the Compute Level	**12**	**CO5**

	Security at the Network Level Security at the Storage Level Concepts in Practice: RSA and VMware Security Products RSA Secure ID RSA Identity and Access Management RSA Data Protection Manager VMware vShield Managing the Storage Infrastructure Monitoring the Storage Infrastructure Monitoring Parameters Components Monitored Hosts Storage Network Storage Monitoring Examples Accessibility Monitoring Capacity Monitoring Performance Monitoring Security Monitoring Alerts Storage Infrastructure Management Activities Availability Management Capacity Management Performance Management Security Management Reporting Storage Infrastructure Management in a Virtualized Environment Storage Management Examples Storage Allocation to a New Server/Host File System Space Management Chargeback Report Storage Infrastructure Management Challenges Developing an Ideal Solution 384Storage Management Initiative Enterprise Management Platform Information Lifecycle Management Storage Tiering Intra-Array Storage Tiering Inter-Array Storage Tiering		

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments	EMC	John Wiley & Sons	2nd	2012

Course Outcomes:

After completion of the course, a student should be able to:

CO1: Understand different techniques of storage and RAID Technologies
CO2: Understand different intelligent storage technologies. Also, understand the benefits of Fibre Channel Storage Networks along with iSCSI.
CO3: Understand the architecture of NAS and deployment along with Object based and unified storage technologies. Also, the learner will be able to configure the storage devices to maintain highest level of availability
CO4: Understand Replication and Migration techniques and implement them.
CO5: Understand Different techniques for managing and securing storage infrastructure

PSIT402d: Cyber Forensics

M. Sc (Information Technology)		Semester – IV	
Course Name: Cyber Forensics		Course Code: PSIT402d	
Periods per week (1 Period is 60 minutes)		4	
Credits		4	
		Hours	Marks
Evaluation System	Theory Examination	2½	60
	Internal	--	40

Course Objectives:

- Explain laws relevant to computer forensics
- Seize digital evidence from pc systems
- Recover data to be used as evidence
- Analyse data and reconstruct events
- Explain how data may be concealed or hidden

Unit	Details	Lectures	Outcome
I	Computer Forensics: The present Scenario, The Investigation Process, Computers – Searching and Seizing, Electronic Evidence, Procedures to be followed by the first responder.	12	CO1
II	Setting up a lab for Computer Forensics, Hard Disks and File Systems, Forensics on Windows Machine, Acquire and Duplicate Data	12	CO2
III	Recovery of deleted files and partitions, Using Access Data FTK and Encase for forensics Investigation, Forensic analysis of Steganography and Image files, Cracking Application passwords.	12	CO3
IV	Capturing logs and correlating to the events, Network Forensics – Investigating logs and Network traffic, Investigating Wireless and Web Attacks.	12	CO4
V	Email Tracking and Email Crime investigation. Mobile Forensics, Reports of Investigation, Become an expert witness.	12	CO5

Books and References:					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	EC-Council CHFIv10 Study Guide	--	EC-Council	--	2018
2.	The official CHFI Exam 312-49 study Guide	Dave Kleiman	SYNGRESS	--	2007
3.	Digital Forensics and Incident Response	Gerard Johansen	Packt Publishing	--	2020
4.	Practical Cyber Forensics	Niranjan Reddy	Apress	--	2019

M. Sc (Information Technology)		**Semester – IV**	
Course Name: Cyber Forensics Practical		**Course Code: PSIT4P2d**	
Periods per week (1 Period is 60 minutes)		4	
Credits		2	
		Hours	**Marks**
Evaluation System	**Practical Examination**	2	50
	Internal	--	-

List of Practical:
10 practicals covering the entire syllabus must be performed. The detailed list of practical will be circulated later in the official workshop.

Course Outcomes:

After completion of the course, a student should be able to:

CO1: Investigate the cyber forensics with standard operating procedures.

CO2: Recover the data from the hard disk with legal procedure.

CO3: To recover and analyse the data using forensics tool