

<b>University of Engineering &amp; Management, Kolkata</b> <b>Department of Computer Science &amp; Engineering</b> <b>B.Tech(CSE) 2021 - 2025 Batch</b> <b>7th Semester Structured Syllabus</b>			
<b>Sl. No.</b>	<b>Paper Code</b>	<b>Paper Name</b>	<b>Credit Point</b>
1	PCC-CSE701	Cloud Computing & IOT	<b>3.0</b>
2	PCC-CSE702	Network Security & Cryptography	<b>3.0</b>
3	PEC-CSE701A	Professional Elective - IV : Neural Networks and Deep Learning	<b>3.0</b>
4	PEC-CSE702A	Professional Elective - V : Speech & Natural Language Processing	<b>3.0</b>
5	OEC-CSE701A	Open Elective-II : Blockchain Technology	<b>3.0</b>
6	HSMC-CSE702	Essential Studies for Professionals - VII	<b>0.5</b>
7	HSMC-CSE782	Skill Development for Professionals - VII	<b>0.5</b>
8	PROJ-CSE701	Project – II	<b>6.0</b>
9	MC-CSE781	Mandatory Additional Requirements (MAR)	<b>0.0</b>
10	MOOC 7	Massive Open Online Courses (Mandatory for B.Tech(Honours))	<b>5.0</b>
<b>Total Credit Points of Semester [for B.Tech]</b>			<b>22.0</b>
<b>Total Credit Points of Semester [for B.Tech(Hons.)]</b>			<b>27.0</b>

**Paper Name: Cloud Computing & IOT**

**Paper Code: PCC-CSE701**

**Credit: 3**

**Module I Definition of Cloud Computing:**

Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public, Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm, Benefits, and advantages of Cloud Computing

**Module II A brief introduction on Composability:**

Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients

**Module III**

**IaaS** – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos

**PaaS** – Basic concept, tools and development environment with examples

**SaaS** - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS), Compliance as a Service (CaaS)

**Module IV Concepts of Abstraction and Virtualization:**

Virtualization technologies: Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D)

**Module V Load Balancing and Virtualization:**

Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere, Machine Imaging (including mention of Open Virtualization Format – OVF)

**Module VI Porting of applications in the Cloud:**

The simple Cloud API and AppZero Virtual Application appliance

**Module VII** Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development, Use of PaaS Application frameworks.

**Module VIII Use of Google Web Services:**

Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google

Translate, a brief discussion on Google Toolkit (including the introduction of Google APIs in brief), major features of Google App Engine service. 4 Use of Amazon Web Services  
Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Use of Microsoft Cloud Services Windows Azure platform: Microsoft's approach, architecture, and main elements, an overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

### **Module IX Cloud Management:**

An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle), Concepts of Cloud Security, Cloud security concerns, Security boundary, Security service boundary, Overview of security mapping, Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance, Identity management (awareness of Identity protocol standards)

### **Module X Service Oriented Architecture:**

Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogues, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs, Cloud-based Storage: Cloud storage definition – Manned and Unmanned, Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

### **Text Books:**

1. Mastering Cloud Computing, 1st Edition, Foundations and Applications Programming, RajkumarBuyya, Christian Vecchiola, S.Thamarai Selvi, McGraw Hill.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley.

### **Paper Name: Network Security & Cryptography**

### **Paper Code: PCC-CSE702**

### **Credit: 3**

### **Module I INTRODUCTION**

Introduction to the Concepts of Cryptography & Security: The need for security, Security Approaches,

Principles of Security, Types of Attacks. Cryptographic Techniques: Plain Text and Cipher Text, Classical Encryption Techniques, Substitution Techniques, Transposition Techniques, Encryption and Decryption,

Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

## **Module II SYMMETRIC KEY CRYPTOGRAPHY**

Diffie-Hellman key Exchange – Algorithm, Key Exchange Protocols and Man-in-the-Middle protocol. Computer-based Symmetric Key Cryptographic Algorithms: Algorithm Types and Modes, An overview of Symmetric Key Cryptography, DES, International Data Encryption Algorithm (IDEA), RC5, Blowfish, AES, Differential and Linear Cryptanalysis.

## **Module III ASYMMETRIC KEY ALGORITHM & AUTHENTICATION AND HASH FUNCTION**

Asymmetric Key Algorithm, Digital Signature and RSA Introduction: Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required), Secure Hash Algorithm – SHA-512 Logic and Round Function.

## **Module IV**

Internet Security Protocols: User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication

Electronic Mail Security : Basics of mail security, Pretty Good Privacy, S/MIME.

Firewall: Introduction, Types of firewall, Firewall Configurations, DMZ Network

## **TEXT BOOK**

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Third Edition, 2003.
2. Behrouz A. Foruzan, “Cryptography and Network Security”, Tata McGraw-Hill, 2007.

## **REFERENCES**

3. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc, 2001.
4. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education, 2003.
5. Wade Trappe and Lawrence C. Washington, “Introduction to Cryptography with coding theory”, Pearson Education, 2007.
6. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education, 2007.

7. Thomas Calabrese, “Information Security Intelligence : Cryptographic Principles and Applications”, Thomson Delmar Learning, 2006.

Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill, 2003.

#### **Professional Elective - IV**

**Paper Name: Neural Networks and Deep Learning**

**Paper Code: PEC-CSE701A**

**Credit: 3**

#### **Module:1 MACHINE LEARNING BASICS**

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants  
Stochastic gradient decent, Curse of Dimensionality.

#### **Module:2 DEEP LEARNING ARCHITECTURES**

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

#### **Module:3 CONVOLUTIONAL NEURAL NETWORKS**

Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet – Applications.

#### **Module:4 TRANSFER LEARNING**

Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

#### **Module:5 SEQUENCE MODELLING – RECURRENT AND RECURSIVE NETS**

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

#### **Module:6 AUTO ENCODERS**

Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders.

#### **Module:7 DEEP GENERATIVE MODELS**

Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversarial Networks.

#### **Text Books / Reference Books:**

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “ Deep Learning”, MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
4. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow:
5. Explore neural networks with Python", Packt Publisher, 2017.
6. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.
7. Francois Chollet "Deep Learning with Python", Manning Publications, 2017

## **Professional Elective - V**

### **Paper Name: Speech & Natural Language Processing**

### **Paper Code: PEC-CSE702A**

### **Credit: 3**

#### **Module I Introduction: Origins and challenges of NLP – Language Modelling:**

Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

#### **Word Level Analysis:**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

#### **Module II Syntactic Analysis:**

Finite state automata, Regular expression & Regular Grammar, Context-Free Grammar, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

#### **Semantics and Pragmatics:**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

#### **Module IV Discourse Analysis and Lexical Resources:**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Information retrieval, different ways, similarity checking, methods to check efficiency of a classifier.

**Text / Reference Books:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.

**Open Elective - II**

**Paper Name: Blockchain Technology**

**Paper Code: OEC-CSE701A**

**Credit: 3**

**Module I: Introduction to Distributed database**

Distributed DBMS, Limitations of distributed DBMS, Byzantine general problem and fault tolerance, Distributed file systems, Distributed hash function / hash table.

**Module II: Introduction of Cryptography and Blockchain**

What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain. Blockchain network, mining mechanism, chain policy, life of blockchain application.

**Module III: Distributed consensus**

Nakamoto consensus, Proof of work , Proof of stake, Proof of burn, difficulty level, Sybil attack, energy utilization and alternate. Consensus model I - Permissionless models and Consensus model II - Permissioned models.

**Module IV: Bitcoin & Cryptocurrency**

What is Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact Of Blockchain Technology On Cryptocurrency.

**Module V: Ethereum**

What is Ethereum, Introduction to Ethereum, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Receiving Ether's What's a Transaction?, Smart Contracts. Merkle patricia tree.

### **Module VI: Hyperledger**

What is Hyperledger? Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer.

### **Module VII: Solidity Programming**

Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Enum, address)

### **Module VIII: Blockchain Applications**

Application brief on Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain.

### **Text / Reference Books:**

1. Blockchain Technology – Concepts and Applications by Kumar Saurabh, Ashutosh Saxena. Wiley.
2. Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications (Grayscale Indian Edition) by Lorne Lantz and Daniel Cawrey. (O'Reilly)

### **Paper Name: Essential Studies for Professionals - VII**

**Paper Code: HSMC-CSE702**

**Credit: 2**

**\*\*GATE Exam Syllabus**

### **Paper Name: Skill Development for Professionals - VII**

**Paper Code: HSMC-CSE782**

**Credit: 1**

**\*\*Quantitative aptitude.**