

SEVENTH SEMESTER

**IK Gujral Punjab Technical University,
Kapurthala**

Seventh Semester / Eighth Semester

| Course Code | Type of Course | Course Title | Hours per Week | | | Marks Distribution | | Total Marks | Credits |
|--------------------|-------------------------------|-----------------------------------|----------------|----------|-----------|--------------------|------------|-------------|-----------|
| | | | L | T | P | Internal | External | | |
| BTCS 701-18 | Professional Core Courses | Network Security and Cryptography | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BTCS 702-18 | Professional Core Courses | Data Mining and Data Warehousing | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BTOE *** | Open Elective Courses | Open Elective-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BTCS ZZZ-18 | Professional Elective | Elective- IV | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BTCS TTT-18 | Professional Elective Courses | Elective-V | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BTCS 703-18 | Project | Project-II | 0 | 0 | 12 | 120 | 80 | 200 | 6 |
| BTCS ZZZ-18 | Professional Elective | Elective- IV lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| BTCS TTT-18 | Professional Elective | Elective- V lab | 0 | 0 | 2 | 30 | 20 | 50 | 1 |
| Total | | | 15 | 0 | 14 | 380 | 420 | 800 | 23 |

Seventh Semester / Eighth Semester

| Course Code | Course Title | Marks Distribution | | Total Marks | Credits |
|--------------------|-------------------|--------------------|----------|-------------|---------|
| | | Internal | External | | |
| BTCS 801-18 | Semester Training | 300 | 200 | 500 | 16 |

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|---------------------------------|---------------------------------------------------------|-----------------|-----------------|
| Course Code: BTCS 701-18 | Course Title : Network Security and Cryptography | 3L:0T:0P | 3Credits |
|---------------------------------|---------------------------------------------------------|-----------------|-----------------|

Detailed Contents:

UNIT 1: Introduction (3 Hours)

Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model

[5hrs] (CO 1)

UNIT 2: Math Background

Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem

[5hrs]

(CO 1)

UNIT 3: Cryptography

Dimensions of Cryptography, Classical Cryptographic Techniques Block Ciphers (DES, AES) : Feistel Cipher Structure, Simplified DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations Public-Key Cryptography : Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography

[12hrs] (CO 2)

UNIT 4 Hash and MAC Algorithms

Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Key Management : Key Distribution Techniques, Kerberos

[6hrs] (CO 3)

UNIT 5 Security in Networks

Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME

[7hrs] (CO 4)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Understand the fundamental principles of access control models and techniques, authentication and secure system design

CO2: Have a strong understanding of different cryptographic protocols and techniques and be able to use them.

CO3: Apply methods for authentication, access control, intrusion detection and prevention.

CO4: Identify and mitigate software security vulnerabilities in existing systems.

Suggested Readings/ Books:

1. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

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|--------------------------------------|-----------------------------------------------------------|-------------------|-------------------|
| Course Code: BTCS -702-18 | Course Title: Data Warehousing and Data Mining | 3L: 0T: 0P | Credits: 3 |
|--------------------------------------|-----------------------------------------------------------|-------------------|-------------------|

Detailed Contents:

UNIT 1:

Data Warehousing Introduction: design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP and data cube, Data cube operations, data cube computation.

Data mining: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity

[10hrs]

UNIT 2:

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method

[10 hrs]

UNIT 3:

Cluster analysis: Introduction, partition methods, hierarchical methods, density based methods, dealing with large databases, cluster software

Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

[10 hrs]

UNIT 4:

Web data mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.**[8 hrs]**

Suggested Readings / Books:

1. Carlo Vercellis, Business Intelligence: Data mining and Optimization for Decision Making, WILEY.
2. Han J., Kamber M. and Pei J. , b Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearsoneducation press (1996), 1st ed.
5. Pooniah P. , Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

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|---------------------------------|-------------------------------------|-----------------|-----------------|
| Course Code: BTCS 704-18 | Course Title : Deep Learning | 3L:0T:0P | 3Credits |
|---------------------------------|-------------------------------------|-----------------|-----------------|

Detailed Contents:

UNIT 1: Machine Learning Basics: Learning, Under-fitting, Overfitting, Estimators, Bias, Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning, Unsupervised Learning and Stochastic Gradient Decent.

[4hrs] (CO 1)

UNIT 2: Deep Feedforward Network: Feed-forward Networks, Gradient-based Learning, Hidden Units, Architecture Design, Computational Graphs, Back-Propagation, Regularization, Parameter Penalties, Data Augmentation, Multi-task Learning, Bagging, Dropout and Adversarial Training and Optimization.

[4hrs] (CO 2)

UNIT 3: Convolution Networks: Convolution Operation, Pooling, Basic Convolution Function, Convolution Algorithm, Unsupervised Features and Neuroscientific for convolution Network. **[6hrs] (CO 3)**

UNIT 4: Sequence Modelling: Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder- Decoder Sequence-to-Sequence Architectures, Deep Recurrent Network, Recursive Neural Networks and Echo State networks.

[12hrs] (CO 4)

UNIT 5: Deep Generative Models: Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Sigmoid Belief Networks, Directed Generative Net, Drawing Samples from Auto –encoders.

[14hrs] (CO 5)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Comprehend the advancements in learning techniques

CO2: Compare and explain various deep learning architectures and algorithms.

CO3: Demonstrate the applications of Convolution Networks

CO4: Apply Recurrent Network for Sequence Modelling

CO5: Deploy the Deep Generative Models

Suggested Readings/ Books:

Text Books:

1. Goodfellow L., Bengio Y. and Courville A., *Deep Learning*, MIT Press (2016).
2. Patterson J. and Gibson A., *Deep Learning: A Practitioner's Approach*, O'Reilly (2017), 1st ed.

Reference Books:

1. Haykin S., *Neural Network and Machine Learning*, Prentice Hall Pearson (2009), 3rd ed.
2. Geron A., *Hands-on Machine Learning with Sci-kit and TensorFlow*, O'Reilly Media (2017)

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|--------------------------|---------------------------------|-------------|-----------|
| Course Code: BTCS 705-18 | Course Title: Deep Learning Lab | L:0;T:0;2P: | Credits;1 |
|--------------------------|---------------------------------|-------------|-----------|

Detailed List of Tasks:

- Creating a basic network and analyze its performance
- Deploy the Confusion matrix and simulate for Overfitting
- Visualizing a neural network
- Demo: Object Detection with pre-trained RetinaNet with Keras
- Neural Recommender Systems with Explicit Feedback
- Backpropagation in Neural Networks using Numpy
- Neural Recommender Systems with Implicit Feedback and the Triplet Loss
- Fully Convolutional Neural Networks
- ConvNets for Classification and Localization
- Text Classification and Word Vectors
- Character Level Language Model (GPU required)

Suggested Tools Python/R/MATLAB

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|------------------------------------------|---------------------------------------------|-------------------|-------------------|
| Course Code: BTCS721-18 | Course Title: Block Chain Technology | 3L:0 T: 0P | Credits: 3 |
|------------------------------------------|---------------------------------------------|-------------------|-------------------|

Detailed Contents:

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments- Consensus in a Bitcoin network

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos

DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance

HYPER LEDGER FABRIC & ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining, DApps, DAO

BLOCKCHAIN APPLICATIONS

Internet of Things-Medical Record Management System-Block chain in Government and Block chain Security-Block chain Use Cases –Finance

COURSE OUTCOMES

CO1: Understand emerging abstract models for Block chain Technology.

CO2: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: It provides 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.

CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

REFERENCES

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

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|----------------------------|-------------------------------------------------|-----------------|------------------|
| Course Code: 713-18 | Course Title: Block chain Technology lab | L: T: 2P | Credits:1 |
|----------------------------|-------------------------------------------------|-----------------|------------------|

1. To Develop Naive Block chain construction.
2. Design Memory Hard algorithm and its Implementation
3. Design Toy application using Blockchain
5. Program to Solve a Mining puzzles using Block chain
6. The ability to formulate mathematical models and problem-solving skills through programming techniques for addressing real-time problems using appropriate data structures and algorithms.
7. The ability to provide design, build, and deploy a distributed application and provide solutions using block chain applications to enhance business measures by sharing information safely and effectively.
8. The ability to create crypto currencies and give a strong technical understanding of Block chain technologies with an in-depth understanding of applications, open research challenges, and future directions.

| Seventh/Eight Semester | | | | | | | |
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| S. No. | Category | Code | Course Title | Hours per | | | Credits |
| | | | | L | T | P | |
| 3 | Open Elective | OECE-703-18 | Road Safety | 3 | 0 | 0 | 3 |
| <p>UNIT 1. Road Accidents Causes of road accidents: Vehicle design factors & Driver characteristics influencing road safety, Road condition, Parking and its influence on traffic safety</p> <p>UNIT 2. Road safety measures Accident data collection methods; Representation of accident data: Collision and condition diagram; Methods to Identify and Prioritize Blackspots; Road safety measures</p> <p>UNIT 3. Road safety audits Key elements in Road safety audit; Road safety audit procedure and investigations; Role of ITS in Road safety</p> <p>UNIT 4. Ensuring Traffic Safety in Road Operation: -Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guardrails & Barriers and Road Lighting.</p> <p>REFERENCE BOOKS: 1. BABKOV, V.F. 'Road conditions and Traffic Safety', MIR, publications, Moscow - 1975. 2. K.W. Ogden, 'Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996. 3. Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009. 4. C. Jotin Kishty & B. Kent Lall, "Transportation Engineering-An Introduction", Third Edition, Prentice Hall of India Private Limited, New Delhi, 2006 5. Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety. 6. Khanna and Justo, 'Text book of Highway Engineering', Nemchand Brothers, Roorkee, 2001</p> | | | | | | | |