SPPU B.E./B.Tech IT Sem 7 syllabus

Elective II : Software Defined Networks

414457A : SOFTWARE DEFINED NETWORKS (Elective-II)

Credit: 03

Unit 1 – Introduction to SDN: An Overview

Introduction: The Modern Data Center, Roles and Separation of data, control and management Planes, Advantages and Disadvantages. Need of SDN, Genesis of SDN. Working of SDN: Fundamental characteristics, SDN Devices, SDN controllers, Applications.

Unit 2 – Open flow Protocols

Introduction: Definition, OpenFlow architecture, Flow & Group Tables, types, Hybrid Approaches, The OpenFlow forwarding and pipeline model. OpenFlow Advantages and Limitations, OpenFlow Protocol. Use Case:FloodLight, Mininet,

Unit 3 – Network Visualization (NV)

Definition, Concepts, Benefits of Network Virtualization, Components of a Virtual Network, Applications, Existing Network Virtualization Framework (VMWare and others), Network as a Service (NaaS).

Unit 4 – Control Plane

Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts.

Unit 5 – Data Plane

Data Plane: Software-based and Hardware-based; Programmable Network, Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.

Unit 6 – Network Functions Virtualization (NFV)

Introduction: Concepts, Comparison of NFV and NV, Implementation and Applications. Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.

Text Books

1. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, O'Reilly Media, ISBN:10:1-4493-4230-2, 978- 1-4493-4230-2.

2. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, ISBN: 9780124166752, 9780124166844.

Reference Books

1. Vivek Tiwari, SDN and OpenFlow for Beginners ,Digital Services,10: 1-940686-00-8 13: 978- 1-940686-00-4

2. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design,CRC Press,ISBN:10: 1466572094

3. Open Networking Foundation (ONF)Documents, https://www.opennetworking.org

4. OpenFlow standards, http://www.openflow.or

5. Online Reading, http://www.nec-labs.com/~lume/sdn-reading-list.html,

414455: SOFTWARE DESIGN AND MODELING

Credit: 03

Unit 1 – Object Oriented Methodologies, UML

Views of Software Developments: Traditional System Development

Methodology and Object Oriented Analysis and Design, Importance Object –Orientation Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software Engineering – Ivar Jacobson Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach, Unified Modeling Language: Introduction to Modeling & UML, MDA, UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

Unit 2 – Object Oriented Analysis

Object Oriented Analysis Process, Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations. Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

Unit 3 – Interaction and Behavior Modeling

Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes. Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions. Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram. State Diagram: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States.

Unit 4 – Object Oriented Design

Object Oriented Design Process Designing Business Layer : Object

Oriented Constraints Language (OCL), Designing Business Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes. Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process, Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, and Prototyping the User Interface. Component and Deployment Design using Component and Deployment Diagram.

Unit 5 – Design Principles and Patterns

Introduction to Patterns General Responsibility Assignment Software Patterns (GRASP) : Introduction, Creator , Information Expert, Low coupling, Controller, High Cohesion, Polymorphism , Pure fabrication, Indirection, Protected Variations. Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.

Unit 6 – Architectural Design

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.

Text Books

1. Ali Bahrami, Object Oriented System Development: Using Unified Modeling Language, McGraw-Hill, International Editions 1999,ISBN:0-07-116090-6.

2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978- 0130925695.

3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First Edition,ISBN:9789332555402, 9332555400.

Reference Books

1. Martin Fowler, UML Distilled, Pearson, Third Edition, ISBN:978-81-317-1565-9

2. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub.,ISBN:8184040024, 9788184040029.

3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill, Seventh Edition,ISBN: 9339212088, 9789339212087.

4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8.

5. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition, ISBN: 9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN: 9788126504527.

414453: INFORMATION AND CYBER SECURITY

Credit: 03

Unit 1 – Security Basics

Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

Unit 2 – Symmetric and Asymmetric Key Cryptography

Introduction, Classical Encryption Techniques, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, Chinese Remainder Theorem, Diffie-Hellman, Elgamal Curve Arithmetic, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

Unit 3 – Data Integrity Algorithms and Security Requirements

Cryptographic Hash Functions, requirements and security, SHA-1, SHA-3, Digital Signatures, X.509 Certificate, Kerberos, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

Unit 4 – Legal, Ethical and Professional issues in Information Security, Risk Management

Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.

Unit 5 – Introduction to Cyber laws

Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.

Unit 6 – Tools and methods used in Cybercrime

Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber laws- Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures. Study of any two network security scanners: Nmap, Metasploit, OpenVAS, Aircrack, Snort, Wireshark, Nikito, Samurai, Safe 3 etc.

Text Books:

1. William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0- 13-335469-0

2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1

3. Bernard Menezes, Network Security and Cryptography, Cengage Learning , ISBN-978-81- 315-1349-1

4. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3

Reference Books:

1. Bruice Schneier , Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms, Wiely India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.

2. Nina Godbole , Information Systems Security , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6

3. CK Shyamala et el., Cryptography and Security, Wiley India Pvt. Ltd, ISBN-978-81-265-2285- 9.

4. Berouz Forouzan, Cryptography and Network Security, TMH, 2 edition, ISBN -978-00-70 0208 0.

5. Mark Merkow, Information Security-Principles and Practices, Pearson Ed., ISBN- 978-81-317- 1288-7.

414454: MACHINE LEARNING AND APPLICATIONS

Credit: 04

Unit 1 – Introduction to machine learning

Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation. Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

Unit 2 – Classification

Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Unit 3 – Regression and Generalization

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

Unit 4 – Logic based and Algebraic models

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering. Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters. Tree Based Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Unit 5 – Probabilistic models

Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

Unit 6 – Trends in machine learning

Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons

Text Books

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.

2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.

2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.

3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.

4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.

5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.

6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

414457C: SOFTWARE TESTING AND QUALITY ASSURANCE (Elective – III)

Credit: 03

Unit 1 – Software testing basics

Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.

Unit 2 – Testing techniques and Levels of testing

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.

Unit 2 – Testing techniques and levels of testing

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing,

Configuration Testing, Compatibility Testing.

Unit 3 – Software test automation and quality metrics

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.

Unit 4 – Fundamentals of software quality assurance

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

Unit 5 – Quality assurance models

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM.

Unit 6 – Software quality assurance trends

Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Affect on Software Quality.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson.

2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.

Reference Books

1. Aditya P. Mathur, Foundations of Software Testing, Pearson.

2. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press.

3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications.

4. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition.

5. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill.

6. Stephen Kan, Metrics and Models in Software Quality, Addison – Wesley, Second Edition.

7. S.A.Kelkar, Software quality and Testing, PHI Learing, Pvt, Ltd.

8. Watts S Humphrey, Managing the Software Process ,Pearson Education Inc.

Software Design and Modeling

414455: Software Design and Modeling

CREDITS - 03

Unit I OBJECT ORIENTED METHODOLOGIES, UML 7 Hrs
Views of Software Developments: Traditional System Development Methodology and Object Oriented Analysis and Design, Importance Object –Orientation Some of the object Oriented Methodology:- Object Oriented Design –Booch, Object Modeling Techniques – Rumbaugh, Object – Oriented Analysis - Cood Yourdon, Object – Oriented Software
Engineering – Ivar Jacobson
Unified Approach: Object Oriented Analysis, Object Oriented Design, Iterative Development & Continuous Testing, Modeling Based on UML, Layered Approach,
Unified Modeling Language: Introduction to Modeling & UML, MDA, UML Structure, UML Building Blocks, UML Common Mechanisms, Introduction to all UML Diagram Notational Techniques, 4+1 View.

Unit II OBJECT ORIENTED ANALYSIS 7 Hrs
Object Oriented Analysis Process,
Use Case Modeling: Actor Identification, Actor Classification, Actor Generalization, Use Cases Identification, Communication, Uses/Include and Extend Associations, Writing a Formal Use Cases, Use Case realizations.

Domain / Class Modeling: Approaches For Identifying Classes (Noun-Phase Approach, Common Class Pattern Approach, Class Responsibilities Collaboration Approach, Naming Classes, Class Associations and Identification of Associations, Generalization/Specialization Relationship, Aggregation and Composition Relationships, Attributes and Methods Identification.

Unit III INTERACTION AND BEHAVIOR MODELING 7 Hrs

Activity Diagram : Activity and Actions, Initial and Final Activity, Activity Edge, Decision and Merge Points, Fork and Join, Input and Output Pins, Activity Group, Activity Partitions, Constraints on Action, Swim Lanes.

Sequence Diagram: Context, Objects and Roles, Links, Object Life Line, Message or stimulus, Activation/Focus of Control, Modeling Interactions.

Collaboration Diagram: Objects and Links, Messages and stimuli, Active Objects, Communication Diagram, Iteration Expression, Parallel Execution, Guard Expression, Timing Diagram.

State Diagram: State Machine, Triggers and Ports, Transitions, Initial and Final State, Composite States, Submachine States.

Unit IV OBJECT ORIENTED DESIGN 7 Hrs

Object Oriented Design Process

Designing Business Layer : Object Oriented Constraints Language (OCL), Designing Business

Classes : The Process, Designing Well Defined Class Visibility, Attribute Refinement, Method Design Using UML Activity Diagram, Packaging and Managing Classes.

Designing Access Layer: Object Relational Systems, Object Relation Mapping, Table Class Mapping, Table – Inherited Classes Mapping, Designing the Access Layer Classes: The Process,

Designing View Layer: View Layer Classes Design, Identifying View Classes by Analyzing Use Cases, Macro-Level Design Process, and Prototyping the User Interface. Component and Deployment Design using Component and Deployment Diagram.

Unit V DESIGN PRINCIPLES AND PATTERNS 7 Hrs

Introduction to Patterns

General Responsibility Assignment Software Patterns (GRASP) : Introduction, Creator , Information Expert, Low coupling, Controller,

High Cohesion, Polymorphism , Pure fabrication, Indirection, Protected Variations.
Gang of Four (GoF): Introduction, Categories of Patterns (Creational, Structural and Behavioral Patterns), Singleton, Adapter, State, and Strategy.

Unit VI ARCHITECTURAL DESIGN 7 Hrs

Overview of software Architecture, Designing Client / Server Software Architectures, Designing Service Oriented Software Architectures, Designing Component Based Software Architectures, Designing Concurrent and Real-Time Software Architectures, Designing Product Line Architectures, Related Case Studies.

Text Books

1. Ali Bahrami, Object Oriented System Development: Using Unified Modeling Language,
McGraw-Hill, International Editions 1999,ISBN:0-07-116090-6.
2. Craig Larman, Applying UML and Patterns, Pearson Education, Second Edition,ISBN:978-
0130925695.
3. Erich Gamma et al, Design Patterns: Elements of Reusable Object, Pearson, First
Edition,ISBN:9789332555402, 9332555400.

Reference Books

1. Martin Fowler, UML Distilled, Pearson, Third Edition, ISBN:978-81-317-1565-9
2. Dan Pilone, Neil Pitman, UML in Nutshell, O'reilly Pub.,ISBN:8184040024,
9788184040029.
3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill,
Seventh Edition,ISBN: 9339212088, 9789339212087.
4. Hassan Gomaa, Software Modeling And Design UML, Use Cases, Pattern, & Software
Architectures, Cambridge University Press, ISBN: 978-0-521-76414-8.
5. JIM Arlow, Ila Neustadt, UML 2 and the Unified Process, Pearson, Second Edition,
ISBN: 9788131700549 Tom Pender, UML 2 Bible, Wiley India, ISBN:

9788126504527.

Information and Cyber Security

414453: Information and Cyber Security

CREDITS - 03

Unit I SECURITY BASICS 7 Hrs
Information Security Concepts, Security Threats and Vulnerabilities, Security Architectures and Operational Models, Types of Security attacks, Goals of Security, Malicious code, Intrusion detection system (IDS): Need, Types, Limitations and Challenges, security and privacy.

Unit II SYMMETRIC AND ASYMMETRIC KEY CRYPTOGRAPHY 7Hrs
Introduction, Classical Encryption Techniques, Block Ciphers and Data Encryption standards, Advanced Encryption standard, Public Key Cryptography and RSA, Chinese Remainder Theorem, Diffie-Hellman, Elgamal Curve Arithmetic, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.

Unit III DATA INTEGRITY ALGORITHMS AND SECURITY REQUIREMENTS 7 Hrs
Cryptographic Hash Functions, requirements and security, SHA-1, SHA-3, Digital Signatures, X.509 Certificate, Kerberos, IP Security: Architecture Protocols IPv4, IPv6, AH, EPS, ISAKMP, Web Security: SSL, HTTPS, Mail Security: PGP, S/MIME

Unit IV LEGAL, ETHICAL, AND PROFESSIONAL ISSUES IN INFORMATION SECURITY, RISK MANAGEMENT 7 Hrs

Overview, Risk identification, Risk Assessment, Risk Control Strategies, Quantitative vs. Qualitative Risk Control Practices. Risk Management. Laws and Ethics in Information Security, Codes of Ethics, Protecting programs and data.

Unit V INTRODUCTION TO CYBER LAWS 7 Hrs
Introduction, Definition and origin, Cybercrime and Information security, Classification of Cybercrimes, The legal perspectives- Indian perspective, Global perspective, Categories of Cybercrime, Types of

Attacks, a Social Engineering, Cyber stalking, Cloud Computing and Cybercrime.

Unit VI TOOLS AND METHODS USED IN CYBERCRIME 7 Hrs
Introduction, Proxy servers and Anonymizers, Phishing, Password Cracking, Key-loggers and Spywares, Types of Virus, Worms, Dos and DDoS, SQL injection, Cybercrime and Legal perspectives, Cyber laws-Indian context, The Indian IT Act-Challenges, Amendments, Challenges to Indian Law and cybercrime Scenario in India, Indian IT Act and Digital Signatures. study of any two network security scanners: Nmap, Metasploit, OpenVAS, Aircrack, Snort, Wireshark, Nikito,
Samurai, Safe 3 etc.

Text Books
1. William Stallings, Computer Security : Principles and Practices, Pearson 6th Ed, ISBN: 978-0-13-335469-0
2. Nina Godbole, Sunit Belapure , Cyber Security- Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiely India Pvt.Ltd, ISBN- 978-81-265-2179-1
3. Bernard Menezes, Network Security and Cryptography, Cengage Learning , ISBN-978-81-315-1349-1
4. Dr. V.K. Pachghare, Cryptography and Information security, PHI, Second edition, ISBN- 978- 81-203-5082-3

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1. Bruice Schneier , Applied Cryptography- Protocols, Algorithms and Source code in C, Algorithms, Wiely India Pvt Ltd, 2nd Edition, ISBN 978-81-265-1368-0.
2. Nina Godbole , Information Systems Security , Wiley India Pvt. Ltd, ISBN -978-81-265-1692-6
3. CK Shyamala et el., Cryptography and Security, Wiley India Pvt. Ltd, ISBN-978-81-265-2285-9.
4. Berouz Forouzan, Cryptography and Network Security, TMH, 2 edition, ISBN -978-00-707-0208-0.
5. Mark Merkow, Information Security-Principles and Practices, Pearson Ed., ISBN- 978-81-317-1288-7.

Machine Learning and Application

414454: Machine Learning and Applications

CREDITS - 04

Unit I INTRODUCTION TO MACHINE LEARNING 8 Hrs

Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation.

Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning.

Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

Unit II CLASSIFICATION 8 Hrs

Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Unit III REGRESSION AND GENERALIZATION 8 Hrs

Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso

Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

Unit IV LOGIC BASED AND ALGEBRAIC MODELS 8 Hrs

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering.

Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters.

Tree Based Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy,

Best Split.

Unit V PROBABILISTIC MODELS 8 Hrs
Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

Unit VI TRENDS IN MACHINE LEARNING 8 Hrs
Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties
Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons

Text Books
1. Ethem Alpaydin: Introduction to Machine Learning, PHI 2nd Edition-2013.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data,
Cambridge University Press, Edition 2012.

Reference Books
1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.
3. Parag Kulkarni: Reinforcement Learning and Systemic Machine Learning for Decision Making, IEEE Press, Reprint 2015.
4. Nikhil Buduma: Fundamentals of Deep Learning, O'Reilly Media, June 2017.
5. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition 2012.
6. Kevin P Murphy: Machine Learning – A Probabilistic Perspective, MIT Press, August 2012.

Elective - I - (E) Business Analytics and Intelligence

Business Analytics and Intelligence

Credits: 03

Unit - 1 Decision Making and Decision Support Systems

The role of computerized support for decision making and its importance. Types of decisions managers face, and the process through which they make decisions. Decision making styles, the four stages of Simon's decision making process, and common strategies and approaches of decision makers. The role of Decision Support Systems (DSS), its main components, the various DSS types and classification, and how DSS have changed over time. How DSS supports each phase of decision making and summarize the evolution of DSS applications, and on how they have changed over time.

Unit - 2 Business Intelligence Concepts and Platform Capabilities

Definition of business intelligence (BI), BI architecture, and its components, and relation with DSS. The main components of BI platforms, their capabilities, and the competitive landscape of BI platforms. The building blocks of business reports, the types of business reports, and the components and structure of business reporting systems. Role of Mathematical model in BI, Factors Responsible for successful BI Project, Obstacle to Business Intelligence in an Organization Different types of OLAP and their applications, and the differences between OLAP and OLTP.

Unit - 3 Data Visualization and Dashboard Design

The top job responsibilities of BI analysts by focusing on creating data visualizations and dashboards. The importance of data visualization and different types of data that can be visually represented. The types of basic and composite charts. This will help you to determine which visualization is most effective to display data for a given data set, and to identify best practices for designing data visualizations. Common characteristics of dashboard, the types of dashboards, and the list attributes of metrics usually included in dashboards. The guidelines for designing dashboard and the common pitfalls of dashboard design.

Unit - 4 Business Performance Management Systems

This module focuses on how BI is used for Business Performance Management (BPM). The main components of BPM as well as the four phases of BPM cycle and how organizations typically deploy BPM. The purpose of Performance Measurement System and how

organizations need to define the key performance indicators (KPIs) for their performance management system. Four balanced scorecards perspectives and the differences between dashboards and scorecards. The benefits of using balanced scorecard versus using Six Sigma in a performance measurement system.

Unit - 5 Role of Business Intelligence and Analytics in Business

The role of visual and business analytics (BA) in BI and how various forms of BA are supported in practice. ERP and Business Intelligence, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI Applications in Fraud Detection, BI Applications in Retail Industry.

Unit - 6 BI Maturity, Strategy and Modern Trends in BI

BI maturity and strategy. Different levels of BI maturity, the factors that impact BI maturity within an organization, and the main challenges and the potential solutions for a pervasive BI maturity within an organization. The critical success factors for implementing a BI strategy, BI framework, and BI implementation targets. Open Source BI. Big Data systems. Social BI systems, Geographic BI systems. Customer Experience based BI.