Simulation Methodology:Definition and steps of simulation, random number, random number generator, Discrete EventSystem Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

LABORATORY (OPERATIONS RESEARCH)

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
    i. Multiple constraints
    ii. Unbounded solution
    iii. Infeasible solution
    iv. Alternative or multiple solution
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method.
16. Performance measures for M/M/1 queuing model.
17. ABC analysis.
18. Inventory model.

Text Books:
1. Operations Research: An Introduction. H.A. Taha.

Reference Books:
1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Hand Book: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest& Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

Course Outcomes-
On successful completion of the course, the students will be able to:

B.TECH
COMPUTER SCIENCE AND BUSINESS SYSTEM
SEMESTER V SYLLABUS

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SYLLABUS

B.Tech(Computer Science and Business System) V Semester

CB-501 SOFTWARE DESIGN WITH UML

UNIT – I

INTRODUCTION TO SOFTWARE ENGINEERING AND UML: Introduction- Software

Engineering Concepts- Development activities- Managing software development- UML introduction-modeling concepts- Project organization and communication.

UNIT – II

REQUIREMENTS ELICITATION AND ANALYSIS: Introduction-Requirement Elicitation Concepts-Requirements Elicitation Activities- Managing Requirements Elicitation- Case Study: ARENA-Analysis concepts- Analysis activities: From Use cases to Objects- Managing Analysis.

UNIT – III

STATIC UML DIAGRAMS: Class Diagram- Elaboration - Domain Model- Finding conceptual classes and description classes- Associations- Attributes- Domain model refinement- Finding conceptual class Hierarchies- Aggregation and Composition- Relationship between sequence diagrams and use cases - When to use Class Diagrams

UNIT – IV

DYNAMIC UML DIAGRAMS: Dynamic Diagrams- UML interaction diagrams - System sequence diagram - Collaboration diagram- When to use Communication Diagrams- State machine diagram and Modelling - When to use State Diagrams-Activity diagram- When to use activity diagrams Implementation Diagrams- UML package diagram-When to use package diagrams- Component and Deployment Diagrams-When to use Component and Deployment diagrams

UNIT – V

DESIGN PATTERNS: Design Pattern- Describing Design Patterns- How design patterns solve design problems- Selecting a design Pattern- Using a design pattern- Case Study: Designing a Document Editor

List of Experiments

Students should design a mini project and should apply the following experiments.

1. Requirement Engineering
   1. Writing Problem Statement
   2. Writing Requirement Specification
      - SRS
      - Use Case
   3. Planning Project with PERT Diagram
2. **Designing Project**.
   1. Use Case Diagrams
   2. Interaction Diagrams
   3. State chart Diagrams
   4. Activity Diagrams

5. Class Diagrams
6. Package Diagrams
7. Component Diagrams
8. Deployment Diagrams.
9. Mapping Design to code.

Text Book

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: using UML, Patterns, and Java", Third Edition, Prentice Hall, 2010.

Reference Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software" Addison-Wesley Professional, 1994.
2. Ali Bahrami, "Object Oriented Systems Development", McGraw Hill Edition, 2017.

Online Resources

3. https://www.umsl.edu/~sauterv/analysis/488_f01_papers/quillin.htm
4. https://medium.com/omarelgabrys-blog/object-oriented-analysisand-design-introduction-part-1-a93b0ca69d36

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CB-502 COMPILER DESIGN

UNIT – I

Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator, lex, flex.

UNIT – II

Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(0), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator, yacc, bison

UNIT – III

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.

UNIT – IV

Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT – V

Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

List of Experiments
 1. Implement a lexical analyzer to recognize tokens in C. (identifiers, constants, operators, keywords etc.).
 2. Design a Calculator using LEX.
 3. Identify an arithmetic expression using LEX and YACC.
 4. Evaluate expression that takes digits, *, + using YACC.
 5. Generate Three address codes for a given expression (arithmetic expression, flow of control).
 6. Implement Code Optimization Techniques like copy propagation, dead code elimination, common sub expression elimination.
 7. Generate Target Code (Assembly language) for the given set of Three Address Code.

Books:

 1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman. Pearson Education
 2. Lex &Yacc, Levine R. John, Tony Mason and Doug Brown, O'Reilly

Reference Books:

 1. The Design and Evolution of C++, Bjarne Stroustrup.
 2. Compiler Design, Raghavan, TMH Pub.
 3. Compiler Construction: Principles and Practice, Louden, Cengage Learning
 4. Compiler Design in C, A. C. Holub. Prentice-Hall Inc., 1993.
 5. Writing compiler & Interpreters, Mak, Willey Pub.

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CB-503 FUNDAMENTALS OF MANAGEMENT

UNIT – I

Management Theories: Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-on word). Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

UNIT – II

Functions of Management- Planning, Organizing, Staffing, Directing, Controlling

UNIT – III

Organization Behavior: Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity

UNIT – IV

Organizational Design: Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

UNIT – V

Managerial Ethics: Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility

Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid.

Home Assignment:

The topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

1. Topic: Corporate social responsibility (CSR) and HRM implications: What does it mean to be socially responsible within an increasingly financially driven market economy?
2. Topic: Leaders are Born, Not Made! The debate

Text Books:

1. Understanding the Theory and Design of Organizations by Richard L. Daft, 11e, Cengage, 2020
2. Management by James Arthur, Finch Stoner, R. Edward Freeman, and Daniel R Gilbert 6th Ed; Publisher: Pearson Education/Prentice Hall
3. Organizational Behaviour by Stephen P. Robbins, Prentice Hall, 2013

Reference Books:

1. Organizational Behaviour by Fred Luthans, Mc Graw-Hill, 2013
2. Organizational Behavior by Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, 16e, Pearson Education, 2016
3. Business Ethics: Ethical Decision Making & Cases, by O. C. Ferrell, John Fraedrich, Linda Ferrell, 12th edition, Cengage,2017

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CB-504 Business Strategy

UNIT – I

Introduction to Strategic Management, Importance of Strategic Management, Vision and Objectives, Schools of thought in Strategic Management, Strategy Content, Process, and Practice, Fit Concept and Configuration Perspective in Strategic Management

UNIT – II

Internal Environment of Firm- Recognizing a Firm's Intellectual Assets, Core Competence as the Root of Competitive Advantage, Sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy.

UNIT – III

External Environments of Firm- Competitive Strategy, Five Forces of Industry Attractiveness that Shape Strategy, The concept of Strategic Groups, and Industry Life Cycle, Generic Strategies, Generic Strategies and the Value Chain.

UNIT – IV

Corporate Strategy, and Growth Strategies, The Motive for Diversification, Related and Unrelated Diversification, Business Portfolio Analysis, Expansion, Integration and Diversification, Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT – V

Strategy Implementation: Structure and Systems, The 7S Framework, Strategic Control and Corporate Governance

Home Assignment:

- Latest business events would be discussed in class and students should be ready to discuss these events (in groups). The topic will be mentioned beforehand. Students are required to meet in groups before coming to class and prepare on the topic.
- There will be periodic homework assignments relating to the course concepts or mini-cases. Specific instructions will be given separately.

Final Project:

Students (in groups) are required to work on a project and submit the project report and deliver presentation. The topic of the project will be given later.

Text Books:

1. Contemporary Strategic Management by Robert M. Grant, 7th Edition, Blackwell, 2012
2. Competitive Strategy by Michael E. Porter, The Free Press, 1980
3. Competitive Advantage by Michael E. Porter, The Free Press, 1985

Reference Books:

1. Competitive Strategy, 1980.M.E. Porter,
2. Competitive Advantage, 1985 Richard Rumelt (2011).
3. Good Strategy Bad Strategy: The Difference and Why It Matters by Richard Rumelt, Profile Books Ltd, 2013
4. Strategic Management by Francis Cherunilam, 4th Edition, HPH, 2016
5. Strategic Management and Business Policy by Azhar Kazmi, McGraw Hill Education, 2018

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CB-505 Business Communication & Value Science-III

Unit I

SWOT and Motivation in Real Life Scenarios, SWOT and Life Positions; Create your SWOT; SWOT Vs. TOWS – The Balancing Act; Presentation on the strengths identified to survive in the VUCA World; Motivation; Scenario based activity on identifying and leveraging motivation; Present findings and approaches as groups.

Unit II

Pluralism in Cultural Spaces Rivers of India; Awareness and respect for pluralism in cultural spaces; Rhythms of India (Cultures in India; Global, Glocal, Translocational, Debate on Global, Glocal, tanslocational impacts; Cross-cultural communication; Culture shock; Gender awareness - Gender awareness campaign

Unit III

Role of science in nation building, Role of science post- independence, Introduction to technical writing, Basic rules of technical writing through examples. Practice activity on technical writing. Application of technical writing in real-life scenarios. Maslow's theory - Recognize how motivation helps real life - Leverage motivation in real-life scenarios.

Unit IV

Introduction to Artificial Intelligence, Importance of AI, AI in Everyday Life

Text Book(s)

1. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers, Oxford University Press.

Reference Books

2. Pringle, A. S., & O'Keefe, S. S. (2009). Technical Writing 101: A Real-World Guide to Planning and Writing Technical Content (3rd ed.). Scriptorium Publishing Services, Inc.
4. Alred, G. J., Brusaw, C. T., &Oliu, W. E. (2011). Handbook of Technical Writing, Tenth Edition (10th ed.). St. Martin's Press.
5. Reynolds, S., Valentine, D., &Munter, M. M. (2019). Guide to Cross-Cultural Communications (2nd Edition) (Guide to Series in Business Communication) (2nd ed.).Pearson
6. Hurn, B., & Tomalin, B. (2016). Cross-Cultural Communication: Theory and Practice (1st ed. 2013 ed.). Palgrave Macmillan.

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CB-506 (A) Conversational Systems

Unit I

Fundamentals of Conversational Systems:

Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI.

Underlying Technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc.

Introduction to Top players in Market – Google, MS, Amazon &Market trends.

Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview

Unit II

Foundational Blocks for Programming: Basic Python programming concepts, Node Basics.

Natural Language Processing: Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chatbots etc. General chatbot architecture,

Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis), Affective NLG

Unit III

Building a chatbot/Conversational AI system: Fundamentals of Conversational Systems (NLU, DM and NLG), Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools.

Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai. Security & Compliance – Data Management, Storage, GDPR, PCI.

Unit IV

Role of ML/AI in Conversational Technologies –Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc. to effectively converse

Unit V

Contact Centers: Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

Overview on Conversational Analytics: Conversation Analytics: The need of it, Introduction to Conversational Metrics.

Future– Where are we headed? Summary, Robots and Sensory Applications overview, XR Technologies in Conversational Systems, XR-Commerce, What to expect next? – Future technologies and market innovations overview.

List of Experiments
1. A python program to identify morphological features of a word by analysing it.
2. A python program to generate word forms from root and suffix information.
3. A python program to perform morphological analysis of a word by the use of Add-Delete table.
4. A python program to calculate the bigrams from a given corpus and calculate probability of a

sentence.

5. A python program to do sentiment analysis for the given dataset and to classify sentences based on their categories.
6. A python program to find Parts – Of - Speech tags of words in a sentence.
7. A python program to know the importance of context and size of training corpus in learning Parts of Speech and understand the concept of chunking and get familiar with the basic chunk tagset.
8. A python program to detect the entities from the dataset and tag them based on their categories.
9. A python program to build a Neural Network to recognize handwritten digits using MNIST dataset.
10. A python program to build a Recurrent Neural Model with Keras.
11. Formulate a problem statement for mini-project to build a chatbot for an application that proves its importance from a social perspective.

Text Books:

1. Designing Voice User Interfaces: Principles of Conversational Experiences 1st Edition by Cathy Pearl, O'Reilly
2. Conversational Interfaces: Principles of Successful Bots, Chatbots & Messaging Apps By Mariya Yao

References:

1. Bot Business 101: How to start, run & grow your Bot / AI business By Ekim Kaya
2. Designing Bots: Creating Conversational Experiences By Amir Shevat O'Reilly
3. Designing Conversational Interfaces By Alper Çuğun

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CB-506 (B) Cloud, Microservices & Application

Unit I

Cloud Fundamentals; Cloud Service Components, Cloud service/Deployment Models. Cloud components Guiding Principle with respect to utilization/Security/Pricing. and the applications of Cloud.. Public Cloud Platforms overview and their usage.

Unit II

Application architectures-Monolithic & Distributed, Microservice fundamental and design approach, Cloud Native applications-12 Factors App.

Unit III

Application integration process/Apification Process, API Fundamental. Microservice /API management, Spring boot Fundamental and design of microservice, API tools. Developer Portal. Applications of Microservice and APIFICATION.

Unit IV

Devops fundamentals: Tools and Applications Containerization Process and application. Python-Refresher, Use cases for cloud application development.

Unit V

Design and developing solution steps using containers & containerization of application and deployment using Kubernetes, Cloud Security and Monitoring Tools

List of Experiments

1. Find procedure to run the virtual machine of different configuration using virtual-manager.

2. Virtualize a machine and check how many virtual machines can be utilized at a particular time.

3. Create a VM Clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.

4. Create a Snapshot of a VM at a given point in time and test the snapshot by restoring the VM to that time. (Note: Testing can be done by installing an application and then restore it.)

5. Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix and launch it.

6. Test how a SaaS applications scales in response to demand.

7. Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.

8. Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.

9. Find the procedure to develop a DevSecOps – Cloud (AWS, GCP, Azure).

10. Find the procedure to develop a DevSecOps – Cluster (Kubernetes).

11. Find the procedure to develop a Container (Docker).

To Build and Test Your Docker Images in the Cloud with Docker commands.

Text Books:

1. Cloud Computing: Principles and Paradigms by RajkumarBuyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
2. Cloud Computing Virtualization Specialist Complete Certification Kit - Study Guide Book, Ivanka Menken Gerard Blokdijk, 2009
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing By Ronald L. Krutz, Russell Dean Vines

Reference Books:

1. Cloud Computing: A Practical Aprroach, Anthony T.Velte, TobeJ.Velte, Robert Elsenpeter, Publication Person Education, 2009
2. Storage Virtualization: Technologies for Simplifying Data Storage and Management, Tom Clark, Addison-Wesley, 2005
3. Cloud Computing Technologies and Strategies of the Ubiquitous Data Center, Curtis Franklin Jr.Brian J.S. Chee, 2010
4. Introduction to Cloud Computing: Business & Technology, TimothyChou,2009

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CB-506 (C) Machine Learning

UNIT – I

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML.

UNIT – II

Classification: Supervised Learning; The problem of classification; Feature Engineering; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-mesure, accuracy, area under curve); Statistical decision theory including discriminant function and decision surfaces; Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines; Artificial neural networks including backpropagation; Applications of classifications; Ensembles of classifiers including bagging and boosting.

UNIT – III

Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

UNIT – IV

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression

UNIT – V

Association rule mining algorithms including apriori, Expectation-Maximization (EM) algorithm for unsupervised learning. Clustering: Average linkage; Ward's algorithm; Minimum spanning tree clustering; K- nearest neighbours clustering; BIRCH; CURE; DBSCAN, Anomaly and outlier detection methods.

List of Experiments

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. A python program to implement decision tree

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML libraries.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the support vector Classifier model to perform this task. Python can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML libraries can be used for this problem.

8. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points.

Select appropriate data set for your experiment and draw graphs.

10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML API in the program.

11. Implementation of a mini project – Stock prices predictor/ Sports predictor/ Sentiment analyzer/ Healthcare predictor.

Text Books:

1. Machine Learning, Tom M. Mitchell, vMcGraw-Hill
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

References:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Machine Learning: The art and science of algorithms that make sense of data, Peter Flash, Cambridge. University press
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009
4. Pattern Classification, 2/e, R.O. Duda, P.E. Hart, D.G. Stork, Wiley, 2001
5. Pattern Recognition and Machine Learning, C. Bishop, Springer, 2007
6. Introduction to Machine Learning, 3/e, E. Alpaydin, Prentice-Hall, 2014
7. Foundations of Machine Learning, A.Rostamizadeh, A. Talwalkar, M. Mohri, MIT Press
8. Statistical Pattern Recognition, 3/e, A. Webb, Wiley, 2011