DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

UNIVERSITY OF LUCKNOW

Course Structure and Syllabus

For

BACHELOR OF COMPUTER APPLICATION (BCA)

3rd Year

as per

NEP-2020

(To be effective from the session 2025-2026)

BACHELOR OF COMPUTER APPLICATION (BCA)

YEAR: THIRD, SEMESTER-V

(To be effective from the session 2025-2026)

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-501	Computer Network	3	1	0	20	10	30	70	100	4
2.	NBCA-502	Data Analytics	3	1	0	20	10	30	70	100	4
3.	NBCA-503	Artificial Intelligence	3	0	0	20	10	30	70	100	3
4.	NBCA-504	Cyber Law and Internet Security	3	0	0	20	10	30	70	100	3
5.	NBCA-505X	Departmental Elective-I	3	0	0	20	10	30	70	100	3
Practical											
6.	NBCA-506P	Data Analytics Lab	0	0	3		20	20	30	50	2
7.	NBCA-507P	Industrial Training viva-voce	0	0	2		20	20	30	50	1
8.	NBCA-508P	Project Phase-I	0	0	6		20	20	30	50	4
9.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	**12**	**2**	**15**					**650**	**24**

Departmental Elective-I

NBCA-5051	Graph Theory
NBCA-5052	Software Testing and Audit
NBCA-5053	UNIX Operating System
NBCA-5054	Data Mining and Data Warehousing

BACHELOR OF COMPUTER APPLICATION (BCA)

YEAR: THIRD, SEMESTER-VI

(To be effective from the session 2025-2026)

S. No.	Paper Code	Subject	Periods			Evaluation Scheme				Sub Total	Credit
						Sessional Exam			Exam		
			L	T	P	CT	TA	Total	ESE		
1.	NBCA-601	Machine Learning	3	1	0	20	10	30	70	100	4
2.	NBCA-602	Multimedia System	3	1	0	20	10	30	70	100	4
3.	NBCA-603	Software Project Management	3	0	0	20	10	30	70	100	3
4.	NBCA-604X	Departmental Elective-II	3	0	0	20	10	30	70	100	3
Practical											
5.	NBCA-605P	Machine Learning Lab	0	0	3		20	20	30	50	2
6.	NBCA-606P	Seminar	0	0	3		20	20	30	50	2
7.	NBCA-607P	Project Phase-II	0	0	9		50	50	100	150	6
8.	NBCA-GP	General Proficiency	-	-	-		-	--	-	50	
		Total	12	2	15					650	24

Departmental Elective-II

NBCA-6041	Open Source Software
NBCA-6042	Mobile Computing
NBCA-6043	Cryptography
NBCA-6044	Cyber Forensic Analytics

Note: If the student leaves the Programme after completing Semester-VI successfully, student will be awarded a **Bachelor Degree in Computer Application.**

NBCA-501

COMPUTER NETWORK

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand basic computer network technology.
- Identify the different types of network topologies and protocols.
- Enumerate the layers of the OSI model and TCP/IP.
- Understand the concept of IP addressing, subnetting and routing mechanisms.

Unit –I **08**

Introduction: Goals and applications of networks, network structure and architecture, the OSI reference model, services, Network Topology Design: Delay analysis, back bone design, local access network design, physical layer transmission media, switching methods, ISDN, and terminal handling.

Unit-II **08**

Medium Access Sub Layer: Channel allocations, LAN protocols - ALOHA protocols - overview of IEEE standards - FDDI. Data Link Layer - Elementary data link protocols, sliding window protocols, and error handling.

Unit - III **08**

Network Layer: Point to point networks, routing, and congestion control. Internet Working -TCP / IP, IP packet, IP address, IPv6.

Unit - IV **08**

Transport Layer: Transport layer design issues, connection management, session layer design issues, and remote procedure call. Presentation layer design issues, data compression techniques, cryptography - TCP - window management.

Unit-V **08**

Application Layer: File transfer, access and management, electronic mail, virtual terminals. Internet and public networks.

Text Book:

1. Forouzen, "Data Communication and Networking", TMH

2. A.S. Tanenbaum, Computer Networks, Pearson Education

Reference Books:

1. W. Stallings, Data and Computer Communication, Macmillan Press

2. Anuranjan Misra, "Computer Networks", Acme Learning

3. G. Shanmugarathinam,"Essential of TCP/ IP", Firewall Media

NBCA-502

DATA ANALYTICS

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of the course, students are expected to have the ability to:

- Understand Data and its analytics in the real world
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Handle large scale analytics projects from various domains.
- Develop intelligent decision support systems.

Unit-I **08**

Introduction: Sources and nature of data, classification of data, characteristics of data; Introduction to data analytics: need, types, analytic process, tools and techniques, and applications of data analytics. Data Analytics Lifecycle: various phases of data analytics lifecycle-discovery, data preparation, model planning, model building, communicating results and operationalization.

Unit-II **08**

Data Exploration: Data profiling, analysing target data, Statistics and Probability: basic probability, conditional probability, Bayes' theorem, Distribution: continuous vs discrete Distributions, Normal Distribution: sample mean, and population mean, bias and variance and Maximum Likelihood Estimation.

Unit-III **08**

Data Analysis: Basic analysis technique: Hypothesis testing, Types of hypothesis: null hypothesis and alternate hypothesis, types of error, P-value and level of significance, types of hypothesis testing: Z-test, t-test, Chi square, ANOVA Test, analysis of variance and regression analysis.

Unit-IV **08**

Mining Data and Data Cleaning: Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream and filtering streams. Data cleaning: Causes and impact of missing values, types of missing values, imputing missing values, Outliers: deleting and capping, various function of data cleaning.

Unit-V **08**

Data Visualization: Introduction data visualization, benefits of good data visualization, types of data visualization: Box plots, Histograms, Heat maps, Charts and Charts Types, Tree maps and Word Cloud/Network diagram.

Text Books:

1. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley.
2. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier.
3. Learn Data Analysis with Python Lessons In Coding by Henley, Apress.

Reference Books:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press.
3. John Garrett, Data Analytics for IT Networks: Developing Innovative Use Cases, Pearson Education.
4. Michael Berthold, David J. Hand," Intelligent Data Analysis", Springer.

NBCA-503

ARTIFICIAL INTELLIGENCE

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand how to apply knowledge representation techniques to common AI applications.
- Analyse a problem in hand and do the inference to identify the computing requirements that are essential to solve the problem.
- Understand the concepts related to searching, reasoning and handling uncertainty.
- Understand the concept and type of learning.
- Understand the need and various component of expert system.
- Understand soft computing technologies like fuzzy logic, neural network etc.

Unit-I **08**

Introduction: Introduction to AI, Scope and applications of AI: Natural language processing, computer vision, speech recognition, robotics, and expert system. Intelligent agents: Structure and working of intelligent agents.

Unit-II **08**

Intelligent Searching Methods: Searching for solutions, solving state space search, uninformed search strategies, informed search strategies: DFS, BFS. Heuristic search: Hill climbing, best first search, branch and bound.

Unit-III **08**

Knowledge Representation: Predicate logic: Unification, modus pones, resolution, dependency directed backtracking. Rule based systems: forward reasoning: conflict resolution, backward reasoning: uses of no backtrack.

Unit-IV **08**

Structured knowledge representation: Semantic nets- slots, exceptions and default frames, conceptual dependency, and scripts. Expert Systems: Need and justification for expert systems, and knowledge acquisition, and component of an expert system.

Unit-V **08**

Handling Uncertainty: Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, and fuzzy logic. Learning: Concept of learning, learning automation, learning by inductions, and neural nets.

Text Book:

1. E. Rich and K. Knight, "Artificial intelligence", TMH.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House.
3. Peter Jackson, "Introduction to Expert Systems", AWP, M.A.

Reference Books:

1. D.W. Patterson, "Introduction to AI and Expert Systems", PHI.
2. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int Ed.
3. Charnick, "Introduction to A.I.", Addison Wesley.
4. Marcellous, "Expert System Programming", PHI.
5. Elamie, "Artificial Intelligence", Academic Press.
6. Lioyed, "Foundation of Logic Processing", Springer Verlag.

NBCA-504

CYBER LAW AND INTERNET SECURITY

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the need of information security and threats to information system.
- Identify and analyse statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
- Locate and apply case law and common law to current legal dilemmas in the technology field.
- Understand about internet security threats.

Unit-I **08**

Fundamentals of Cyber Law: Jurisprudence of cyber law, object and scope of the IT Act 2000, introduction to Indian cyber law, uncitral model law, ISP guideline. Intellectual property issues and cyber space, Indian perspective, overview of intellectual property related legislation in India, patent, copyright, trademark law, law related to semiconductor layout and design.

Unit-II **08**

E-commerce Security: Security threats to e-commerce, virtual organization, business transactions on web, e-governance and EDI, concepts in electronic payment systems, e-cash, credit/debit cards, e-agreement, legal recognition of electronic and digital records, e-commerce issues of privacy, wireless computing-security challenges in mobile devices.

Unit-III **08**

Security Policies: Development of policies, www policies, email security policies, policy review process-corporate policies-sample security policies, publishing and notification requirement of the policies, Evolving technology security: mobile, cloud, outsourcing and SCM.

Unit-IV **08**

Internet Security Threats: Role of security in internet and web services, classification of threats and attacks, security challenges, security implication for organizations, security services-authentication, confidentiality, integrity, and availability in information security, basic concepts of network security, perimeters of network protection & network attack, hacking, cracking, sneaking, viruses, Trojan horse, malicious code and logic bombs.

Unit-V **08**

Investigation and Ethics: cyber-crime and evidence, act, treatment of different countries of cyber-crime, ethical issues in data and software privacy, plagiarism, pornography, tampering computer documents, data privacy and protection, domain name system, software piracy, issues in ethical hacking.

Text Book:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analyzing Computer Security", Pearson Education India.
2. Harish Chander, "Cyber Law and IT Protection", PHI Publication, New Delhi.
3. Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House.

Reference Books:

1. Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
2. Anshul Kaushik, "Cyber Security", Khanna Publishing House.
3. V.K. Jain, "Cryptography and Network Security", Khanna Publishing House, Delhi.

NBCA-5051

GRAPH THEORY

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Solve problems using graph theory and apply some basic algorithms for graphs.
- Determine whether a graph is a Hamiltonian and/or an Euler graph.
- Demonstrate different traversal methods for trees and graphs.
- Solve problems involving vertex and edge connectivity, planarity and crossing numbers.
- Represent graphs in Vector space and using Matrix.
- Model real world problems using graph theory like four color problem.

Unit-I **08**

Introduction: Graphs, sub graphs, some basic properties, various example of graphs & their sub graphs, walks, path & circuits, connected graphs, disconnected graphs and component, Euler graphs, various operation on graphs, Hamiltonian paths and circuits, and the traveling sales man problem.

Unit- II **08**

Trees: Distance diameters, radius and pendent vertices, rooted and binary trees, spanning trees, fundamental circuits, finding all spanning trees of a graph and a weighted graph, Prim's and Kruskal's algorithm.

Unit -III **08**

Cut Set and Planarity: Cuts sets and cut vertices, some properties, all cut sets in a graph, fundamental circuits and cut sets, connectivity and separability, network flows planer graphs, Combinatorial and Geometric dual: Kuratowski's graphs, detection of planarity, geometric dual, discussion on criterion of planarity, thickness and crossings.

Unit -IV **08**

Vector Space: Vector space of a graph and vectors, basis vector, cut set vector, circuit vector, circuit and cut set subspaces, matrix representation of graph – basic concepts; incidence matrix, circuit matrix, path matrix, cut-set matrix, and adjacency matrix.

Unit -V **08**

Graph Colouring: Colouring, covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic polynomials, matching, covering, and four colour problem.

Text Book:

1. Deo, N, Graph theory with applications to Engineering and Computer Science, PHI.

Reference Books:

1. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, TMH.

2. Robin J. Wilson, Introduction to Graph Theory, Pearson Education.

3. Harary, F, Graph Theory, Narosa.

NBCA-5052

SOFTWARE TESTING AND AUDIT

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- Learn how to planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, and generate a testing report.
- Expose the advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.

Unit-I **08**

Introduction: Software development life cycle, testing process, terminologies in testing: error, fault, failure, test cases, testing suite, test oracles, impracticality of testing all data, and impracticality of testing all paths. Audit: Verification, verification methods, validation, validation methods, evolutionary nature of verification and validation, difference between verification and validation. SRS verification, source code reviews, user documentation verification, and software project audit.

Unit-II **08**

Functional Testing: Boundary value analysis, equivalence class testing, decision table based testing, and cause effect graphing technique. Structural Testing: Control flow testing, path testing, independent paths, generation of graph from program, identification of independent paths, cyclomatic complexity.

Unit-III **08**

Regression Testing: Concept, regression test cases selection, reducing the number of test cases, and code coverage prioritization technique. Reducing the number of test cases: Prioritization guidelines, priority category, scheme, and risk analysis.

Unit-IV **08**

Software Testing Activities: Levels of testing, debugging, testing techniques and their applicability, and exploratory testing. Automated Test Data Generation: Test data, approaches to test data generation, test data generation using genetic algorithm, test data generation tools, software testing tools, and software test plan.

Unit-V **08**

Object Oriented Testing: Definition, issues, class testing, object oriented integration and system testing. Testing Web Applications: user interface testing, usability testing, security testing, performance testing, database testing, and post deployment testing.

Text Book:

1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012
2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003.

Reference Books:

1. Roger S. Pressman, "Software Engineering -A Practitioner"s Approach", Fifth Edition, McGraw Hill International Edition, New Delhi, 2001.

2. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994.

NBCA-5053

UNIX OPERATING SYSTEM

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Describe UNIX operating system commands.
- Understand the UNIX Architecture, File systems and use of basic Commands.
- Understand and analyze UNIX System calls, Process Creation, Control & Relationship.
- Understand Shell Programming and to write shell scripts.

Unit-I **08 Brief**

Introduction: History of UNIX and LINUX, strengths and weaknesses of UNIX-like operating systems Basic concepts in UNIX-like systems: the kernel, shells, multiuser multitasking operation, remote access, file system, processes, environment and environment variables, the command line, online manual Using the vi editor – modes of operation and switching between them, text navigation, editing text, saving and quitting, using buffers (cut-copy-paste), pattern searching and replacement.

Unit-II **08**

UNIX Architecture: The UNIX operating system, LINUX and gnu. The UNIX architecture, features of UNIX, POSIX and single UNIX specification, internal and external commands, command structure, man browsing and manual pages on-line. The file system: The parent – child relationship, the home variable, pwd, cd, mkdir, absolute pathname, and relative pathname.

Unit-III **08**

Basic File Attributes: Listing directory contents, the UNIX file system, ls –l, -d option, file ownership, file permissions, chmod, directory permissions, changing file ownership, file attributes. The Process: Process basics, process status, system processes (-e or –a), mechanism of process creation, process states and zombies, and running jobs in background.

Unit-IV **08**

Simple Filters: pr, head, tail, cut, paste, sort, uniq, tr. Filters using regular expressions – grep and sed: grep, Basic Regular Expressions (BRE), Extended Regular Expressions (ERE) and egrep, the stream editor, and line addressing using multiple instructions (-E and -F) context addressing.

Unit-V **08**

The Shell: The shell's interpretive cycle, shell offerings, pattern matching, escaping and quoting, redirection, pipes, tee, command substitution, shell variables, and essential shell programming.

Text Book:

1. Sumitabha Das, "UNIX – Concepts and Applications", Tata McGraw Hill.
2. Behrouz A. Forouzan, Richard F. Gilberg, "Unix and shell Programming", Thomson Learning.
3. Neil Matthew and Richard Stones, "Beginning Linux Programming", Wrox.

Reference Books:

1. Kernighan and Pike, "Unix programming environment", Pearson Education.
2. Rosen, Host, Klee, Farber, Rosinski, "The Complete Reference Unix", TMH.
3. Yashavant P. Kanetkar, "Unix Shell Programming", BPB Publications.

NBCA-5054

DATA MINING AND DATA WAREHOUSING

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications. Gain insight into the challenges and limitations of different data mining technology.
- Provide an overview of the methodologies and approaches to data mining
- Describe the various tasks of mining such as classification, clustering, association rule mining.
- Explore data warehouse and multi-dimensional data models.

Unit-I **08**

Introduction: Overview, definition, functionalities, data processing, form of data preprocessing, data cleaning: missing values, noisy data (binning, clustering, regression, computer and human inspection), inconsistent data, data integration and transformation. Data Reduction: Data cube aggregation, dimensionality reduction, data compression, numerosity reduction, and clustering, and discretization.

Unit-II **08**

Concept Description: Definition, data generalization, analytical characterization, analysis of attribute relevance, mining class comparisons, statistical measures in large databases, measuring central tendency, measuring dispersion of data, graph displays of basic statistical class description, mining association rules in large databases, association rule mining, mining single dimensional Boolean association rules from transactional databases.

Unit-III **08**

Classification and Predictions: Issues regarding classification and prediction, decision tree, Bayesian classification, classification by back propagation, multilayer feed-forward neural network, back propagation algorithm, classification methods k nearest neighbour classifiers, and genetic algorithm.

Unit-IV **08**

Cluster Analysis: Data types in cluster analysis, categories of clustering methods, partitioning methods. Hierarchical clustering- CURE and Chameleon. Density based methods-DBSCAN, OPTICS. Grid based methods- STING, CLIQUE. Model based methods.

UNIT-V **08**

Data Warehousing: Overview, definition, delivery process, difference between database system and data warehouse, multi-dimensional data model, data cubes, stars, snowflakes, fact constellations, concept hierarchy, process architecture, 3 tier architecture, and data marting.

Text books:

1. Jiawei Han, MichelineKamber, "Data Mining Concepts and Techniques",Morgan Kaufman Publications.
2. Alex Berson, Stephen Smith, "Data Warehousing, Data Mining& OLAP", McGraw Hill.
3. Charu C. Aggarwal, "Data Mining -The Textbook", Springer.

Reference Books:

1. Margaret H Dunhan,"Data Mining Introductory and Advanced Topics", Pearson Education.
2. Ian H. Witten Eibe Frank, "Data Mining", Morgan Kaufman Publications.
3. Pang-Ning Tan Michael Steinbach, Vipin Kumar, Data Mining, Pearson Education.

NBCA-506P

DATA ANALYTICS LAB

L	T	P
0	0	3

Course Outcomes (COs):
At the end of this course students will be able to:

- Understand the working of NumPy array.
- Understand the concept of Python Pandas.
- Perform various operations such as detecting outliers, identifying missing values, and removal of duplicate record etc.
- Implement reading of CSV files.
- Perform data visualization.

LIST OF PRACTICALS

1. Write a program to create a NumPy array and Access and manipulate elements in the array.
2. Write a Program to create a 5x5 2D array for random numbers between 0 and 1 using NumPy.
3. Write a Program to calculate the mean, median, standard deviation, and variance using NumPy.
4. Write a Program to generate a random array of 50 numbers having mean 110 and standard deviation 15.
5. Write a Program to read the data and perform normalization.
6. Write a Program to create a data frame using Python Pandas.
7. Write a program to sort the data frame based on the first column.
8. Write a program to detect the outliers and remove the rows having outliers.
9. Write a Program to checking for missing values using is null () and not null ().
10. Create a program to identify and count missing values in a data frame.
11. Write a program to remove all duplicates from the first column.
12. Write a Program to Reading a CSV File and reading with Specific Columns and rows.
13. Create a Program we use various functions in NumPy library to carry out the chi-square test.
14. Create a Program we use various functions in NumPy library to carry out the ANOVA test.
15. Write a program to create a data visualization like using matplotlib with taking any datasets: Do the following

    - Create a Box plots,
    - Create a Histograms,
    - Create a Heat maps,
    - Create various Charts

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

NBCA-601

MACHINE LEARNING

L	T	P
3	1	0

Course Outcomes (COs):

After the completion of this course, students will be able to

- Explain the fundamental usage of the concept Machine Learning system
- Demonstrate on various regression Technique
- Analyse the Ensemble Learning Methods
- Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning.
- Discuss the Neural Network Models and Fundamentals concepts of Deep Learning

Unit-I **8**

Introduction: Artificial Intelligence, Machine Learning, Types of Machine Learning Systems, Challenges of Machine Learning. Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator.

Unit-II **8**

Supervised Learning: Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes, Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Binary Classification.

Unit-III **8**

Ensemble Learning: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking. Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, and Naïve Bayes Classifiers.

Unit-IV **8**

Unsupervised Learning: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures. Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, and PCA.

Unit-V **8**

Neural Networks: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, TensorFlow, Loading and Preprocessing Data with TensorFlow.

Text Books:

1. Alpaydin, E. 'Introduction to machine learning', MIT press.
2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Publications, 2019
3. Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese, ZdravkoI. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020

Reference Books:

1. Mitchell, T.M. 'Machine Learning', McGraw-Hill
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, 'Deep Learning', MIT Press.
3. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani 'An Introduction to Statistical Learning', Springer.
4. Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012.

NBCA-602

MULTIMEDIA SYSTEM

L	T	P
3	1	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Describe the types of media and define multimedia system.
- Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
- Use and apply tools for image processing, video, sound and animation.
- Apply methodology to develop a multimedia system.
- Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.

Unit-I **09**

Introduction: Multimedia, multimedia information, multimedia objects, multimedia in business and work, convergence of computer, communication and entertainment products, stages of multimedia projects, multimedia hardware, memory & storage devices, communication devices, multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools.

Unit-II **06**

Multimedia Building Blocks: Text, sound MIDI, digital audio, audio file formats, MIDI under windows environment, audio & video capture.

Unit-III **09**

Data Compression: Huffman coding, Shannon Fano algorithm, Huffman algorithms, adaptive coding, arithmetic coding, higher order modelling, finite context modelling, dictionary based compression, sliding window compression, LZ77, LZW compression, compression ratio, lossless & lossy compression.

Unit-IV **06**

Speech Compression & Synthesis: Digital audio concepts, sampling variables, lossless compression of sound, lossy compression & silence compression.

Unit-V **10**

Images: Multiple monitors, bitmaps, vector drawing, lossy graphic compression, image file format animations, images standards, JPEG compression, Zig-Zag coding, multimedia database, content based retrieval for text and images. Video: Video representation, colors, video compression, MPEG standards, and MHEG standard video streaming on net.

Text Books:

1. Tay Vaughan "Multimedia, Making IT Work" Osborne McGraw Hill.
2. Buford "Multimedia Systems" Addison Wesley.
3. Agrawal & Tiwari "Multimedia Systems" Excel.

Reference Books:

1. Mark Nelson "Data Compression Book" BPB.
2. David Hillman "Multimedia technology and Applications" Galgotia Publications.
3. Rosch "Multimedia Bible" Sams Publishing.
4. Sleinreitz "Multimedia System" Addison Wesley.

NBCA-603

SOFTWARE PROJECT MANAGEMENT

L	T	P
3	0	0

Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Successful development of the project's procedures of initiation, planning, execution, regulation and closure.
- Guidance of the project team's operations towards achieving all the agreed upon goals within the set scope, time, quality and budget standards.
- Project plans that address real-world management challenges.
- Develop the skills for tracking and controlling software deliverables.

Unit-I **08**

Introduction: Fundamentals of software project management, need identification, vision and scope document, project management cycle, SPM objectives, management spectrum, SPM framework, software project planning, planning objectives, project plan, types of project plan, structure of a software project management plan, software project estimation, estimation methods, estimation models, and decision process.

Unit-II **08**

Project Organization and Scheduling: Project elements, work breakdown structure, Types of WBS, functions, activities and tasks, project life cycle and product life cycle, ways to organize personnel, project schedule, scheduling objectives, building the project schedule, scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar charts, Milestone charts, and Gantt charts.

Unit-III **08**

Project Monitoring and Control: Dimensions of project monitoring & control, earned value analysis, earned value indicators: budgeted cost for work schedule, cost variance, schedule variance, cost performance index, schedule performance index, interpretation of earned value indicators, error tracking, software reviews, types of review.

Unit-IV **08**

Software Quality Assurance and Testing: Testing objectives, testing principles, test plans, test cases, types of testing, levels of testing, test strategies, program correctness, program verification & validation, testing automation & testing tools, concept of software quality, software quality attributes, software quality metrics and indicators, the SEI capability maturity model, SQA activities, formal SQA approaches.

Unit-V **08**

Project Management: Software configuration management: software configuration items and tasks, baselines, plan for change, change control, change requests management, version control, risk management: risks and risk types, risk breakdown structure, risk management process: risk identification, risk analysis, risk planning, risk monitoring, cost benefit analysis, software project management tools.

Text Books:

1. M. Cotterell, Software Project Management, Tata McGraw Hill Publication.
2. S. A. Kelkar, Software Project Management, PHI Publication.

Reference Books:

1. Royce, Software Project Management, Pearson Education
2. Kieron Conway, Software Project Management, Dreamtech Press

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OPEN SOURCE SOFTWARE

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Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Understand the concepts, strategies, and methodologies related to open source software development.
- Be familiar with open source software products and development tools currently available on the market.
- To utilize open source software for developing a variety of software applications, particularly Web applications.
- Understand the open source operating system and implement the open source database and programming languages.

Unit-I **08**

Introduction- Introduction to open sources, need of open sources, advantages of open sources and application of open sources.

Unit-II **08**

Open Source Operating Systems: LINUX- Introduction, general overview, kernel mode and user mode, process, advanced concepts, scheduling, personalities, cloning and signals.

Unit-III **08**

Open Source Database: MySQL- Introduction - setting up account-starting, terminating and writing your own SQI programs, record selection technology, working with strings - date and time, sorting query results.

Unit-IV **08**

Open Source Programming Languages: PHP- Introduction - programming in web environment, variables, constants, datatypes, operators, statements, functions, arrays and OOP - string manipulation and regular expression.

Unit-V **08**

Perl: Introduction, background, Perl overview, Perl parsing rules, variables and data -statements and control structures, subroutines, packages, and modules- working with files and data manipulation.

Text Book:

1. Martin C. Brown, "Perl: The Complete Reference", Tata McGraw-Hill Publishing Company Limited, Indian Reprint
2. Vikram Vaswani, "MYSQL: The Complete Reference", Tata McGraw -Hill Publishing Company Limited, Indian Reprint.
3. Paul Kavanagh, "Open Source Software: Implementation and Management", Elsevier.

Reference Books:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly.
2. Wesley J. Chun, "Core Phython Programming", Prentice Hall.
3. Steven Holzner, "PHP: The Complete Reference", Tata McGraw-Hill Publishing Company Limited, Indian Reprint.

NBCA-6042

MOBILE COMPUTING

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Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- Learn the concept of cellular network and GSM.
- List out the data management issues in mobile computing.
- Understand the concept of Ad-hoc Network and Routing Protocols.

Unit-I **08**

Introduction: Issues in mobile computing, characteristics of mobile computing, structure of mobile computing and overview of wireless telephony: cellular concept.

Unit-II **08**

Evaluation of Mobile System and Wireless Network: GSM, CDMA, FDMA, TDMA; Wireless networking: Wireless LAN overview, Bluetooth, wireless multiple access protocols, TCP over wireless, wireless applications, data broadcasting, mobile IP and WAP.

Unit-III **08**

Data Management Issues: Management issues, hoarding techniques, data replication for mobile computers, adaptive clustering for mobile wireless networks and file system.

Unit-IV **08**

Mobile Agents: Introduction, type, need, mobile agent, features of mobile agents, life cycle of mobile agents, security and fault tolerance, and transaction processing in mobile computing environment.

Unit-V **08**

Mobile Adhoc Networks (MANETs): Introductions, features, and applications of MANETs, Routing protocols, Global State Routing (GSR), Destination Sequenced Distance Vector routing (DSDV) and Dynamic Source Routing (DSR) and Ad Hoc On-demand Distance Vector routing (AODV).

Text Book:

1. Jochen Schiller, "Mobile Communications", Addison-Wesley.
2. Raj Kamal, "Mobile Computing", Oxford University Press.
3. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing, Technology Applications and Service Creation", Mc Graw Hill.

Reference Books:

1. Charles Perkins, "Mobile IP", Addison Wesley.
2. Charles Perkins, "Ad hoc Networks", Addison Wesley.
3. Upadhyaya, "Mobile Computing", Springer.

NBCA-6043

CRYPTOGRAPHY

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Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Learn the basic concepts of security threats, mechanisms and symmetric cryptography.
- Understand the conventional encryption algorithms.
- Understand modern block cipher and public key encryption techniques analysis.
- Understand the concept of Hash functions and message authentication.

Unit-I **08**

Introduction: Security attacks and cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers.

Unit-II **08**

Modern Block Ciphers: Block ciphers principals, Shannon's theory of confusion and diffusion, Fiestal structure, DES, strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, and random number generation.

Unit-III **08**

Finite Fields: Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primality testing, Euclid's algorithm, Chinese remainder theorem, discrete logarithms. principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm.

Unit-IV **08**

Message Authentication and Hash Function: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions and MACS, MD5 message digest algorithm, secure hash algorithm(SHA).

Unit-V **08**

Digital Signatures: Digital signatures, authentication protocols, digital signature standards (DSS), and proof of digital signature algorithm. Authentication Application: Kerberos, directory authentication service, electronic mail security-pretty good privacy (PGP), and S/MIME.

Text Book:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson.
2. Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag.
3. Bruce Schiener, "Applied Cryptography", Wiley.

Reference Books:

1. Oded Goldreich ,"Foundations of Cryptography" , Cambridge University Press.
2. Alfred J. Menezes, Paul C. Van Oorschot, Scott A. Vanstone "A Handbook of Applied Cryptography", CRC Press.
3. Wembo Mao, "Modern Cryptography: Theory and Practice", Pearson Education.

NBCA-6044

CYBER FORENSIC ANALYTICS

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Course Outcomes (COs):

After the successful completion of the course student will be able to:

- Outline the Cyber crime and its types.
- Explore the Cyber Forensics Techniques.
- Use the Cyber Investigation Techniques.
- Explore the Cyber Evidence Management Techniques.
- Outline the Cyber Laws in India.

Unit-I **08**

Cyber Crime: Cyber Space, Cyber Crime, Criminal Behaviour, Jurisdictional Concerns, Jurisprudential Inconsistency, eCash Security, Prepaid Cards, Stored Values Cards, Mobile Payments, Internet Payment Services, Cyber stalking, Cyber extortion, Cyber terrorism, Cyber warfare, Cyber weapons, ATM frauds.

Unit-II **08**

Cyber Forensics: Digital device, Hard disk, Disk characteristics, Disk imaging, Data Carving, Techniques, commercial piracy, soft lifting, Steganography, Network components, Port scans, Wireshark, PCAP analysis, Trojans and Backdoors, Botnets, DoS, DDoS Attacks, Honey Pots, Malware, Virus and Worms.

Unit-III **08**

Cyber Investigation: Concepts of Investigation, cyber investigation, Network Investigation, Investigating audit logs, Investigating Web attacks, Investigating Computer Intrusions, Profiling, Cyber Criminal profiling, Stylometric Techniques, Warranted searches, Warrantless searches, and Undercover Techniques.

Unit-IV **08**

Evidence Management: Evidence, Digital Evidence, Types, physical evidence, Real evidence, Circumstantial evidence, network evidence, Evidence collection, Evidence Analysis, Contextual Information, Evidence Management, pre search activities, On Scene activities, and Report Preparations.

Unit-V **08**

Cyber Laws and Authorities: Information Technology Act 2000, Digital signature, Electronic Governance, Secure electronic records, Regulation of certifying authorities, CERNTin, Electronic signature certificates, Penalties compensation.

Text Book:

1. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson, 2013.
2. Garima Tiwari, "Understanding Laws– Cyber Laws And Cyber Crimes", Lexis Nexis, 2014.

Reference Books:

1. Chuck Easttom, Jeff Taylor, "Computer Crime, Investigation, and the Law", Course Technology, 2018.
2. Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Eoghan Casey, 2018.

NBCA-605P

MACHINE LEARNING LAB

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Course Outcomes (COs):

At the end of this course students will be able to:

- Implement procedures for the machine learning algorithms
- Design and develop python programs for various learning algorithms
- Apply appropriate data sets to the machine learning algorithms
- Develop machine learning algorithms to solve real world problems

LIST OF PRACTICALS

1. 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.
2. 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.
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. Exercises to solve the real-world problems using the following machine learning methods: a) Linear Regression b) Logistic Regression c) Binary Classifier
5. Develop a program for Bias, Variance, Remove duplicates , Cross Validation
6. Write a program to implement Categorical Encoding, One-hot Encoding
7. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.
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. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
11. Apply EM algorithm to cluster a Heart Disease Data Set. 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 Java/Python ML library classes/API in the program.
12. Exploratory Data Analysis for Classification using Pandas or Matplotlib.

13. Write a Python 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
14. Write a program to Implement Support Vector Machines and Principle Component Analysis
15. Write a program to Implement Principle Component Analysis

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.