VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM&SYLLABUS (DRAFT) OF

BACHELOR OF COMPUTER APPLICATION- BCA (HONOURS)

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

DRAFT FOR REVIEW

Based on

Curriculum & Credit Framework for Undergraduate Programmes (CCFUP), 2023& NEP, 2020

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BACHELOR OF COMPUTER APPLICATION- BCA (Hons./ Hons. with Research)
(under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title		Credit	L-T-P	Marks		
									CA	ESE	TOTAL
BCA (Hons./ Hons. with Research)	4th	VII	**SEMESTER-VII**								
			Major-14	BCAHMJ14	T: Mobile Computing; P: Practical		4	3-0-1	15	60	75
			Major-15	BCAHMJ15	T: Deep Learning; P: Practical		4	3-0-1	15	60	75
			Open Elective	BCAHOE	P: Term Paper	For Honours Students Only	4	0-0-4	15	60	75
			Research	BCAHCRM	T: Research Methodology and Ethics;	*For Honours with Research Students*	4	3-1-0	15	60	75
			Major Elective-03	BCAHDSE 03	T: Big Data Analytics/ Soft Computing/ Computer Vision; P: Practical		4	3-0-1	15	60	75
			Minor-07 (Disc.-I)	BCAMIN07	T: Digital Marketing		4	3-1-0	15	60	75

MJ = Major, MI = Minor Course, DSE = Discipline Specific Elective Course, CRM= Compulsory Research Methodology, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

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SEMESTER-VII

MAJOR (MJ)

BCAHMJ14T: Mobile Computing **Credits 04 (Full Marks:75)**

Course Outcomes:

Students will be able to:

CO1: Understand the fundamentals of wireless networks, mobile computing concepts, and the challenges associated with mobile environments.

CO2: Explain wireless transmission techniques, medium access control protocols, multiple access methods, and the architecture of cellular communication systems.

CO3: Analyze mobile networking technologies, including Mobile IP, transport layer optimization, wireless LANs, Bluetooth, wireless sensor networks, and mobile security mechanisms.

CO4: Evaluate wireless application environments, mobile ad hoc networks (MANETs), and their routing protocols for modern mobile computing applications.

BCAHMJ14T: Mobile Computing (Theory) *Credits 03 (45 hrs.)*

Course Content

Unit 1: Introduction to Mobile Computing [7 L]

Introduction to wireless networks and mobile computing, Characteristics of mobile computing, Applications of mobile computing, Issues and challenges in mobile computing, Mobile computing architecture.

Unit 2: Wireless Transmission and Cellular Communication [10 L]

Fundamentals of wireless transmission, Signal propagation and transmission media, Medium Access Control (MAC) protocols, Multiple access techniques (FDMA, TDMA, CDMA, OFDMA) and their characteristics, Cellular concept, Frequency reuse, Overview of different generations of cellular networks (1G to 5G).

Unit 3: Mobile Networking and Wireless Technologies [10 L]

Mobile IP architecture and operation, Mobile transport layer, TCP performance issues in wireless networks, Mechanisms for improving TCP performance over wireless links, Security issues in mobile environments, IEEE 802.11 Wireless LAN standards, Bluetooth technology, Wireless Sensor Networks (WSNs).

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Unit 4: Wireless Application Environment and Mobile Ad Hoc Networks [10 L]

Wireless Application Protocol (WAP), Wireless Markup Language (WML), Push architecture, Push and Pull services, Mobile Ad Hoc Networks (MANETs), Characteristics of MANETs, Routing protocols for MANETs (Proactive, Reactive, Hybrid).

Unit 5: Emerging Trends in Mobile Computing [8 L]

Internet of Things (IoT) and mobile computing, Mobile cloud computing, Location-based services, Mobile commerce (M-Commerce), Recent trends and future directions in mobile computing.

BCAHMJ14P: Mobile Computing (Lab) *Credits 01 (30 hrs.)*

List of Experiments

1. Study of wireless network architecture and mobile computing environment.
2. Simulation of wireless signal propagation using network simulation tools.
3. Configuration and analysis of different MAC protocols.
4. Performance comparison of multiple access techniques (FDMA, TDMA, CDMA).
5. Simulation of cellular network concepts and frequency reuse.
6. Study of Mobile IP registration and packet routing.
7. Performance analysis of TCP over wireless networks.
8. Configuration and analysis of IEEE 802.11 WLAN.
9. Bluetooth device discovery and communication.
10. Study and simulation of Wireless Sensor Network (WSN) topology.
11. Implementation of simple WAP/WML applications.
12. Development of Push and Pull service demonstrations.
13. Simulation of Mobile Ad Hoc Networks (MANETs).
14. Performance evaluation of MANET routing protocols (AODV, DSR, DSDV).
15. Security analysis of wireless communication using encryption techniques.
16. Mobile network performance analysis using NS-2/NS-3 or OMNeT++.
17. Comparative study of different wireless technologies (Wi-Fi, Bluetooth, ZigBee).
18. Case study on 4G/5G mobile communication systems.
19. Mini project on a mobile computing application.

Reference Books

1. Raj Kamal. Mobile Computing (3rd Edition). Oxford University Press.
2. Hansmann, U., Merk, L., Nicklous, M., & Stober, T. Principles of Mobile Computing (2nd Edition). Springer, 2003.
3. Jochen Schiller. Mobile Communications (2nd Edition). Pearson Education.
4. Stojmenovic, I. (Ed.). Handbook of Wireless Networks and Mobile Computing. Wiley, 2002.

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5. Peter Steenkiste. Introduction to Wireless Networking and Its Impact on Applications. Springer Nature, 2023.
6. K. N. Raja Rao. Advanced Mobile Wireless Communications: A Holistic Coverage from Basic Concepts to 5G Technologies with IoT. Wiley India, 2023.
7. Kumkum Garg. Mobile Computing. Pearson Education India.
8. Andreas F. Molisch. Wireless Communications: From Fundamentals to Beyond 5G (3rd Edition). Wiley, 2023.

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BCAHMJ14: Deep Learning **Credits 04 (Full Marks: 75)**

COURSE OBJECTIVES:

To understand the basic concepts and techniques of Deep Learning and the need of

1. Deep Learning techniques in real-world problems
2. To understand CNN algorithms and the way to evaluate performance of the CNN
3. architectures.
4. To apply RNN and LSTM to learn, predict and classify the real-world problems
5. in the paradigms of DeepLearning.
6. 4. To understand, learn and design GANs for the selected problems.
7. 5. To understand the concept of Auto-encoders and enhancing GANs using auto-encoders.

BCAHMJ15T: Deep Learning (Theory) *Credits 03 (45 hrs.)*

Course Content

UNIT-I: INTRODUCTION TO DEEP LEARNING:

Historical Trends in Deep Learning, Why DL is Growing, Artificial Neural Network, Non-linear classification example using Neural Networks: XOR/XNOR, Single/Multiple Layer Perceptron, Feed Forward Network, Deep Feed- forward networks, Stochastic Gradient –Based learning, Hidden Units, Architecture Design, Back- Propagation.

UNIT-II: CONVOLUTION NEURAL NETWORK (CNN):

Introduction to CNNs and their applications in computer vision, CNN basic architecture, Activation functions-sigmoid, tanh, ReLU, Softmax layer, Types of pooling layers, Training of CNN in TensorFlow, various popular CNN architectures: VGG, Google Net, ResNet etc, Dropout, Normalization, Data augmentation

UNIT-III: RECURRENT NEURAL NETWORK (RNN):

Introduction to RNNs and their applications in sequential data analysis, Back propagation through time (BPTT), Vanishing Gradient Problem, gradient clipping Long Short Term Memory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

UNIT- IV: GENERATIVE ADVERSARIAL NETWORKS (GANS):

Generative models, Concept and principles of GANs, Architecture of GANs (generator and discriminator networks), Comparison between discriminative and generative models, Generative Adversarial Networks (GANs), Applications of GANs.

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UNIT- V: AUTO-ENCODERS:

Auto-encoders, Architecture and components of auto-encoders (encoder and decoder), Training an auto-encoder for data compression and reconstruction, Relationship between Autoencoders and GANs, Hybrid Models: Encoder-Decoder GANs.

BCAHMJ15P: Deep Learning (Lab) *Credits 01 (30 hrs.)*

List of Practical:

Practical 1: Python and Deep Learning Environment

- Installing Anaconda/Python
- Installing PyTorch and TensorFlow
- Working with Jupyter Notebook/Google Colab

Practical 2: NumPy and Tensor Operations

- Matrix operations
- Tensor creation and manipulation
- Linear algebra operations

Practical 3: Data Preprocessing

- Loading datasets
- Data normalization
- Data augmentation
- Train-validation-test split
- Mini-batch creation using DataLoader

Practical 4: Building Neural Networks

- Implementing a simple Artificial Neural Network (ANN)
- Forward propagation
- Loss functions
- Backpropagation
- Optimizers (SGD, Adam)

Practical 5: Image Classification using CNN

- Convolution operation
- Pooling layers
- CNN architecture
- Training on MNIST/Fashion-MNIST

Practical 6: Image Augmentation

- Random crop
- Flip
- Rotation
- Color jitter

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- MixUp/CutMix (Introduction)

Practical 7: Object Detection (Basic)

- Introduction to YOLO
- Running inference on custom images
- Performance evaluation

Practical 8: Sequence Models

- RNN
- LSTM
- GRU
- Sentiment analysis on text dataset

TEXT BOOKS:

1. Deep Learning: An MIT Press Book by Ian Goodfellow and Yoshua Bengio Aaron Courville.
2. Michael Nielson, Neural Networks and Deep Learning, Determination Press,2015.
3. Satish Kumar, Neural networks: A classroom Approach, Tata McGraw-Hill Education, 2004.

REFERENCES:

1. Deep Learning with Python, Francois Chollet, Manning publications, 2018
2. Advanced Deep Learning with Keras, Rowel Atienza, PACKT Publications, 2018

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OPEN ELECTIVE

[for BCA (Hons.) students]

BCAHOEP: TERM PAPER (Practical) **4 credits**

Students to submit a Term Paper in their VIIth Semester. Term Paper is a significant academic assignment requiring in-depth survey and study on a chosen topic on advancement in the related field. It allows students to demonstrate their understanding of core concepts and their ability to apply them to real-world scenarios. The Term Paper serves as a comprehensive evaluation of a student's knowledge and analytical skills in a specific area of AI.

GUIDELINES

- The topic of the Term Paper will be decided by the student in consultation with faculty guide.
- The Term Paper must be based on authoritative sources, and these sources must be given proper credit.
- The word count of the Research Report should be between 3000-4000 words.
- Grading will be based on both research content and presentation.
- Suggested outline of the Research Report
    i. Cover page
    ii. Abstract (not exceeding 200 words + 5 keywords)
    iii. Introduction (including a problem statement, objectives, and overview of the structure of the paper)
    iv. Background and literature review
    v. Data, graphs and pictorial representation on the scope of study
    vi. Observation and discussion
    vii. Conclusion
    viii. References
    ix. Appendices

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COMPULSORY RESEARCH METHODOLOGY (CRM)

[for Hons. with Research students]

CRM: Research Methodology and Ethics

BCAHCRM 3T: Research Methodology and Ethics **3 credits (45 hrs.)**

Course Outcome:

Students able to:

CO1: Learn to formulate research problems and design appropriate methodologies.

CO2: Learn to select and apply suitable data collection and sampling techniques.

CO3: Analyze data using descriptive and inferential statistics, create research instruments, and document them in LaTeX.

CO4: Interpret results ethically and present findings in a structured report in LaTex..

Course Content:

Unit 1: Introduction to Research **[6 L]**

Meaning, objectives, and motivation for research, Types of research (Basic vs. Applied, Qualitative vs. Quantitative), Research approaches and scientific method, Criteria of good research

Unit 2: Research Design & Sampling **[8 L]**

Research problem formulation and hypothesis development, Research design: Need, features, and types (Experimental, Descriptive), Sampling techniques: Probability vs. Non-probability, sample size determination

Unit 3: Data Collection & Measurement **[8 L]**

Primary vs. secondary data, Tools: Questionnaires, interviews, observations, Measurement scales (Nominal, Ordinal, Interval, Ratio), Scaling techniques (Likert, Semantic Differential)

Unit 4: Data Analysis & Hypothesis Testing **[8 L]**

Descriptive statistics (Mean, SD, Skewness), Inferential statistics: t-test, ANOVA, Chi-square, Correlation and regression analysis, Non-parametric tests (Mann-Whitney, Kruskal-Wallis)

Unit 5: Research Ethics & Report Writing **[5 L]**

Ethical issues in research (Plagiarism, Confidentiality), Structure of a research report, Oral presentation techniques, Use of software (SPSS/R) for data analysis

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BCAHCRMP Methodology and Ethics Lab **1 credits [30 Hrs]**

List of Programs:

1. LaTeX Installation and First Document
2. Formatting a Research Problem Statement
3. Creating a Research Proposal Template
4. Designing a Sampling Plan with Lists
5. Building a Questionnaire with Tables
6. Creating a Data Codebook
7. Data Import and Cleaning with R/Python
8. Generating Descriptive Statistics
9. Importing Data into LaTeX with csvsimple
10. Formatting Statistical Tables with booktabs
11. Performing and Reporting a T-Test
12. Creating a Correlation Matrix Table
13. Simple Linear Regression Analysis
14. Non-Parametric Mann-Whitney U Test
15. Managing References with BibTeX
16. Creating a Bar Chart with pgfplots
17. Creating a Scatter Plot with pgfplots
18. Plagiarism Check and Ethical Writing
19. Compiling a Full Research Report
20. Designing a Research Poster with beamerposter

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Reference Books

1. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.). New Age International Publishers.
2. Creswell, J. W., & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (6th ed.). SAGE Publications.
3. Lamport, L. (1994). *LaTeX: A Document Preparation System* (2nd ed.). Addison-Wesley.
4. Mittelbach, F., & Goossens, M. (2004). *The LaTeX Companion* (2nd ed.). Addison-Wesley.

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MAJOR ELECTIVE (DSE)

Major Elective – 03:

(Big Data Analytics/ Soft Computing/ Computer Vision)

BCAHDSE 03: Big Data Analytics **4 credits; Full Marks- 75**

Course Outcome (CO):

Students able to:

CO1: Analyze the fundamental concepts, characteristics, and challenges of Big Data in various application domains.

CO2: Design and implement scalable storage solutions for Big Data using distributed file systems and NoSQL databases.

CO3: Develop and optimize data processing workflows using batch and stream processing frameworks such as Hadoop and Spark.

CO4: Apply advanced analytics techniques, including machine learning and data mining, to extract actionable insights from large datasets.

BCAHDSE03T: Big Data Analytics **3 credits; 45 hrs,**

Course Content:

Unit 1: Introduction to Big Data **[6L]**

Definition and characteristics of Big Data (volume, velocity, variety, veracity, value), Big Data ecosystem: hardware, software, and network considerations, Challenges in Big Data: storage, processing, analytics, security, and privacy, Opportunities and applications in domains such as healthcare, finance, social media, and IoT

Unit 2: Big Data Storage **[7L]**

Distributed file systems: HDFS, Google File System, NoSQL databases: key-value stores (e.g., Redis), document databases (e.g., MongoDB), column-family stores (e.g., Cassandra), graph databases (e.g., Neo4j), Data lakes and cloud storage solutions (e.g., AWS S3, Google Cloud Storage), Data formats and serialization techniques: Avro, Parquet, ORC

Unit 3: Big Data Processing **[8L]**

Batch processing frameworks: Hadoop MapReduce, Apache Hive, Apache Pig, In-memory processing with Apache Spark: RDDs, DataFrames, Spark SQL, Stream processing technologies: Apache Kafka, Apache Storm, Apache Flink, Workflow management tools: Apache Oozie, Apache Airflow

Unit 4: Big Data Analytics Techniques **[8L]**

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Machine learning for Big Data: supervised and unsupervised learning algorithms, Spark MLlib, Data mining techniques for large datasets: association rule mining, clustering, classification, Graph analytics: algorithms for large graphs, Apache GraphX
Visualization tools for Big Data: Tableau, Power BI, Apache Zeppelin

Unit 5: Applications **[6L]**

Big Data applications in healthcare: patient data analysis, disease prediction, Finance: fraud detection, risk management, social media: sentiment analysis, trend detection, Big Data in IoT: sensor data processing, predictive maintenance, Ethical considerations, data governance, and privacy issues in Big Data

BCAHDSE03P: Big Data Analytics Lab **1 credit [30 Hrs]**

Program Details:

Exercise 1: Installation and configuration of Hadoop ecosystem (HDFS, YARN) on a single-node or pseudo-distributed cluster.

Exercise 2: Perform basic HDFS operations: uploading, downloading, listing, and deleting files.

Exercise 3: Implement a simple Hadoop MapReduce program (e.g., Word Count).

Exercise 4: Use Apache Hive to create tables, load data, and run SQL-like queries on large datasets.

Exercise 5: Implement data processing using Apache Pig scripts.

Exercise 6: Introduction to Apache Spark:

- Load data into RDDs and DataFrames.
- Perform basic transformations and actions.

Exercise 7: Use Spark SQL for structured data analysis.

Exercise 8: Implement a real-time data streaming pipeline using Apache Kafka and Spark Streaming.

Exercise 9: Apply Spark MLlib for a supervised learning task (e.g., classification) on a large dataset.

Exercise 10: Perform association rule mining or clustering on Big Data using Spark MLlib.

Exercise 11: Work with NoSQL databases (MongoDB / Cassandra) for storing and querying data.

Exercise 12: Use a Big Data visualization tool (Tableau / Apache Zeppelin) to create dashboards for insights.

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Reference Books:

1. Thomas Erl, Wajid Khattak, Paul Buhler - Big Data Fundamentals: Concepts, Drivers & Techniques, Prentice Hall.
2. Tom White - Hadoop: The Definitive Guide, O'Reilly Media.
3. Bill Chambers, Matei Zaharia - Spark: The Definitive Guide, O'Reilly Media.
4. Foster Provost, Tom Fawcett - Data Science for Business, O'Reilly Media.
5. Jure Leskovec, Anand Rajaraman, Jeffrey Ullman - Mining of Massive Datasets, Cambridge University Press.

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BCAHDSE 03: Soft Computing **Credits 04 (Full Marks: 75)**

BCAHDSE03T: Soft Computing (Theory) *Credits 03 (45 hrs)*

Course Content:

Unit 1: Introduction to Soft Computing **[4 L]**

Soft computing vs. hard computing, evolution of soft computing, features and types of soft computing, applications of soft computing, basics of machine learning.

Unit 2: Neural Networks and Back Propagation networks **[8 L]**

Basic concepts of Neural Networks, Model of Artificial Neuron, Neural Network Architectures, Characteristics of neural networks, Learning Methods, Early neural network architectures, Application domains. Back propagation network (BPN), Back propagation Learning, Applications of BPN, Parameter selection, Variations of Back propagation Algorithms.

Unit 3: Fuzzy Sets and Fuzzy Relations **[5 L]**

Fuzzy versus Crisp, Crisp Sets, Fuzzy sets, Membership functions, fuzzy set operations, properties of Fuzzy sets, Crisp Relations, Fuzzy relations – Fuzzy Cartesian product, Operations of Fuzzy Relations.

Unit 4: Genetic Algorithms **[7 L]**

History of Genetic Algorithm, Basic concepts, Creation of offspring, working principles, encoding, fitness function, reproduction, Genetic modelling: Inheritance operator, crossover, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method, Hybrid systems, evolutionary computing, Genetic

Algorithm based on Back propagation networks- Implementation and comparison on performance of traditional algorithms with Genetic Algorithm.

BCAHDSE03P: Soft Computing (Practical) *Credits 01 (30 hrs)*

1. **Perceptron Implementation** — Design and train a single-layer perceptron for binary classification.
2. **Multi-Layer Perceptron (MLP)** — Implement an MLP with Back Propagation for function approximation.
3. **Fuzzy Set Operations** — Implement fuzzy union, intersection, complement, and Cartesian product.
4. **Defuzzification Methods** — Implement and compare defuzzification techniques (Centroid, Mean of Maxima, etc.).

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5. **Genetic Algorithm Basics** — Implement GA to solve a simple optimization problem (e.g., function maximization).
6. **GA for Combinatorial Problems** — Apply GA to solve the Travelling Salesman Problem (TSP).
7. **Hybrid GA–BPN System** — Train a neural network using GA for weight optimization and compare with standard backpropagation.

Suggested Readings:

1. S, Rajasekaran & G.A. Vijayalakshmi Pai, —Neural Networks, Fuzzy systems and evolutionary algorithms: Synthesis and Applications‖, PHI Publication, 2nd Ed. 2017.
2. Timothy J. Ross, —Fuzzy Logic with Engineering Applications‖, John Wiley and Sons, 3rd ed, 2011.
3. 3. S.N. Sivanandam & S.N. Deepa, —Principles of Soft Computing‖, Wiley Publications, 3rd ed, 2018.
4. Jang, Jyh-Shing Roger, Chuen-Tsai Sun, and Eiji Mizutani. "Neuro-fuzzy and soft computing a computational approach to learning and machine intelligence" Pearson, 1997.

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BCAHDSE 03: Computer Vision **Credits 04 (Full Marks: 75)**

Course Objectives:

Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us. This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc. Knowledge of these concepts is necessary in this field, to explore and contribute to research and further developments in the field of computer vision. Applications range from Biometrics, Medical diagnosis, document processing, mining of visual content, to surveillance, advanced rendering etc.

BCAHDSE03T: Computer Vision (Theory) *Credits 03 (45 hrs)*

Course Content:

Unit I: Digital Image Formation and low-level processing

Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

Unit II: Depth estimation and Multi-camera views

Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.

Unit III: Feature Extraction

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Unit IV: Image Segmentation

Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

Unit V: Pattern Analysis

Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

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Unit VI: Motion Analysis

Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Unit VII: Shape from X

Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

Textbooks

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

References

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.
4. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

BCAHDSE03P: Computer Vision (Lab) *Credits 01 (30 hrs)*

Practical 1: Introduction to Computer Vision Tools

- Installation of Python, OpenCV, and Jupyter/Google Colab
- Reading, displaying, and saving images
- Basic image properties (size, channels, data types)

Practical 2: Image Manipulation

- Image resizing
- Cropping
- Rotation
- Flipping
- Color space conversion (RGB, HSV, Grayscale)

Practical 3: Image Enhancement

- Histogram analysis
- Histogram equalization
- Contrast enhancement

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- Brightness adjustment
- Image smoothing and sharpening

Practical 4: Image Filtering

- Mean filter
- Gaussian filter
- Median filter
- Bilateral filter
- Edge-preserving filtering

Practical 5: Edge and Corner Detection

- Sobel operator
- Prewitt operator
- Laplacian operator
- Canny edge detector
- Harris corner detector

Practical 6: Morphological Operations

- Erosion
- Dilation
- Opening
- Closing
- Contour detection

Practical 7: Feature Detection and Matching

- ORB feature detector
- BRISK feature detector
- Feature matching using BF Matcher
- Homography estimation

Practical 8: Object Detection

- Haar Cascade face detection
- HOG-based pedestrian detection
- YOLO object detection (pre-trained model)

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MINOR (MI)

Minor (MI)-07: Digital Marketing **Credits 04 (Full Marks:75)**

BCAMIN 07T: Digital Marketing (Theory) *Credits 04 (60 hrs)*

Course Outcomes

Students will be able to:

CO1: Understand the fundamentals of digital marketing, its evolution from traditional marketing, and the role of emerging technologies in modern business.

CO2: Apply digital marketing strategies involving online product management, pricing, distribution, and promotional techniques.

CO3: Analyze various digital media channels and formulate effective media plans by selecting appropriate digital communication platforms.

CO4: Evaluate and implement major digital marketing techniques, including SEO, SEM, social media, email, display, video, and mobile marketing.

Course Contents-

Unit 1: Introduction to Digital Marketing [8 L]

Traditional sales and marketing processes, Challenges of traditional marketing, Need for digital transformation, Evolution of digital marketing, Emerging digital technologies, Definition, scope and objectives of digital marketing, Benefits and applications of digital marketing.

Unit 2: Digital Marketing Mix [12 L]

Concept of products in the digital environment, Online product strategies, Online pricing strategies, Digital distribution channels, Online promotional strategies, Customer relationship management (CRM), Consumer behaviour in digital markets.

Unit 3: Digital Media Planning [15 L]

Digital media and communication channels, Digital media planning process, Target audience identification, Media selection strategies, Budget allocation, Strengths and weaknesses of different digital channels, Integrated Digital Marketing Communication (IDMC), Performance measurement of media campaigns.

Unit 4: Digital Marketing Techniques [15 L]

Digital marketing process, Search Engine Optimization (SEO), Search Engine Marketing (SEM), Social Media Marketing (SMM), Email Marketing, Display Advertising, Video Marketing, Mobile Marketing, Introduction to Web Analytics.

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Unit 5: Emerging Trends and Ethics in Digital Marketing [10 L]

Content Marketing, Influencer Marketing, Affiliate Marketing, Artificial Intelligence (AI) in Digital Marketing, Chatbots and Marketing Automation, Google Analytics overview, Digital marketing ethics, Privacy and data protection, Future trends in digital marketing.

Reference Books

1. Philip Kotler, Hermawan Kartajaya, & Iwan Setiawan. Marketing 6.0: The Future is Immersive. Wiley, 2024.
2. Dave Chaffey & Fiona Ellis-Chadwick. Digital Marketing: Strategy, Implementation and Practice (9th Edition). Pearson, 2022.
3. Seema Gupta. Digital Marketing (3rd Edition). McGraw Hill, 2023.
4. Puneet Singh Bhatia. Fundamentals of Digital Marketing (3rd Edition). Pearson India, 2022.
5. Damian Ryan. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation (5th Edition). Kogan Page, 2020.
6. Simon Kingsnorth. Digital Marketing Strategy: An Integrated Approach to Online Marketing (3rd Edition). Kogan Page, 2022.
7. Ian Dodson. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns (2nd Edition). Wiley, 2021.
8. Eric Enge, Stephan Spencer, & Jessie Stricchiola. The Art of SEO: Mastering Search Engine Optimization (4th Edition). O'Reilly Media, 2023.

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