KANNUR UNIVERSITY

(Abstract)

Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College, Kanhangad w.e.f.2020 Admission-Modified Scheme, Syllabus and Model Question papers (9th and 10 th Semesters) Approved - Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 19.09.2024

Read:-1. U.O.s No Acad/C2/16586/NGCI/2021 dated: 30.07.2021,11.08.2021,17.03.2022,19.10.2022,24.05.2023,05/10/2023,20/02/2024

2. E- mail dtd : 28/06/2024 and 11/07/2024 Received from Chairperson BoS in Computer Science (PG)

3. Minutes of the Meeting of the standing committee of the Academic Council held on 12.07.2024

4. E-mail dtd 30/07/2024 received from the Dean Faculty of Technology

5. Minutes of the meeting of the Standing Committee held on 30/08/2024

6. The Orders of the Vice Chancellor in File Number: Acad/C2/16586/NGCI/2021 dtd 18/9/2024

ORDER

1.As per paper read (1) above, the Scheme (1 to 10 Semesters) Syllabus, Pattern of Question Papers and Model Question Papers of Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), offered at Nehru Arts & Science College, Kanhangad, up to VIIIth Semesters were approved and implemented w.e.f 2020 admissions.

2.Subsequently, as per paper read (2) above, the Chairperson BoS in Computer Science(PG) submitted the Modified Scheme (X semester), Syllabus & Model Question Papers of 9th and 10 th Semester Integrated M.Sc. Computer Science with specialization in Artificial Intelligence and Machine Learning Programme, for approval and implementation and the same was forwarded to the Dean, Faculty of Technology for verification.

3.The matter was considered by the Standing Committee of the Academic Council held on 12.07.2024 (paper read 3) and the Standing Committee recommended to place the same before the forthcoming meeting, as the Remarks of Dean was not received at that time.

4. The Dean, Faculty of Technology, after vetting the Syllabus, vide paper read 4 remarked that the Syllabus can be approved.

5. Subsequently, the Syllabi, along with the Remarks of Dean, were placed before the Standing Committee of the Academic Council and the Committee vide paper read (5) above recommended to approve the same.

6.The Vice Chancellor, after considering the recommendation of the Standing Committee of the Academic Council and in exercise of the power of the Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, ***approved the Modified Scheme, Syllabus & Model Question Papers of 9th and 10 th Semesters of Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence and Machine Learning programme***

(CBCSS) and accorded sanction to implement the same w.e.f 2020 admission in affiliated Colleges, subject to reporting to the Academic Council.

7.The Modified Scheme, Syllabus & Model Question Papers of 9th and 10 th Semester Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) in affiliated colleges w.e.f 2020 admission are appended with this U.O.and uploaded in the University website (www.kannuruniversity.ac.in).

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: 1. The Principal, Nehru Arts & Science College, Kanhangad

2. Chairperson BoS in Computer Science (PG)

Copy To: 1.The Examination Branch (Through PA to CE)

2. PS to VC/PA to R/PA to CE

3. AR I/AR II (Acad)

4. EXCI/ EG I/ AR II/ AR I (Exam)

5.The Web Manager, Computer Programmer (for uploading in the website)

6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KV

KANNUR UNIVERSITY * CIVIL STATION P.O. KANNUR Pin-670 002 * THAVAKKARA *

9B40ICSC: Optimization Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B40ICSC	3	3	3

Course Outcome

CO 1: Understand fundamental mathematical optimization techniques.
CO 2: Grasp the principles and applications of convex optimization.
CO 3: Analyze the interplay between learning algorithms and optimization methods.
CO 4: Understand advanced optimization algorithms in machine learning contexts.

Unit I

Mathematical optimization: Solution methods, Least-squares and linear programming: Least-squares problems, Linear programming. Convex optimization: Solution, usage. Nonlinear optimization - local and global. Convex sets - Affine and Convex Sets, hyper planes and half spaces, separating and supporting hyper planes.

(10 Hours)

Unit II

Convex Functions - Basic properties and examples. Operations and preserve convexity, conjugate function, Overview of Convex optimization problems, Lagrange dual function and problem, geometric interpretation, saddle point interpretation, optimality conditions.

(16 Hours)

Unit III

Unconstrained Minimization Problems - Descent Methods, Gradient Descent, Steepest Descent, Newton's Method. Learning Vs Optimization - Empirical risk minimization, surrogate loss functions and early stopping, batch and minibatch algorithms.

(16 Hours)

Unit IV

Challenges in Neural Network Optimization - ill conditioning, local minima, plateaus, saddle points, cliffs and exploding gradients, long term dependencies, indexact gradients, theoretical limits. Algorithms with adaptive learning rates - AdaGrad, RMSProp, Adam, Choosing the right algorithm. Batch Normalization, coordinate descent, supervised pretraining. Designing models to aid optimization.

(12 Hours)

Text Boks

[1] Stephen Boyd and Lieven Vandenberghe, *Convex Optimization*, Cambridge University Press. https://stanford.edu/~boyd/cvxbook/.

[2] Ian Goodfellow, Yoshua Bengio and Aaron Courville. *Deep Learning*, The MIT Press.

References

[1] Marc Peter Deisenroth, A Aldo Faisal and Cheng Soon Ong (2021). *Mathematics for Machine Learning*, Cambridge University Press. https://mml-book.github.io/
[2] Gilbert Strang. *Linear Algebra and Learning from Data* (2019), Wellesley Cambridge Press.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B40ICSC: Optimization Techniques

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define mathematical optimization and describe its importance in real-world applications.
2. Explain the concept of least-squares problems and provide an example.
3. What are convex sets? Provide two examples.
4. Differentiate between affine and convex sets.
5. Discuss the significance of separating and supporting hyperplanes in convex optimization.
6. Describe the supervised pretraining.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Solve a linear programming problem using the simplex method.
8. Explain the operations that preserve convexity with suitable examples.
9. Describe the geometric and saddle point interpretations of the Lagrange dual problem.
10. Discuss the Gradient Descent method and its application in unconstrained minimization problems.
11. Explain the Challenges in Neural Network Optimization.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Compare and contrast local and global optimization techniques in nonlinear optimization. Discuss the challenges associated with global optimization and methods to mitigate these challenges.
13. Discuss optimality conditions in convex optimization problems. Compare and contrast the geometric interpretation and the saddle point interpretation of optimality conditions.
14. Explain how adaptive learning rate algorithms like AdaGrad, RMSProp, and Adam work, and how to choose the right algorithm for a given problem.
15. Explain the significance of batch normalization and coordinate descent in optimizing deep learning models.
16. Illustrate the design of models that aid optimization with specific examples.

(3 x 12 = 36 Marks)

9B41ICSC: Deep Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B41ICSC	4	3	4

Course Outcome

CO 1:

Unit I

Generative Adversarial Networks (GANs): Generative models and their applications -image/text generation, Adversarial training process - generator and discriminator. Deep Convolutional GANs (DCGANs) architecture Loss functions for GANs - adversarial loss, WGAN loss Training stability techniques - gradient penalty, spectral normalization Applications of GANs in specific domains (only in chosen field of interest)

(14 Hours)

Unit II

Attention Mechanisms: Transformer architecture and self-attention mechanism. Applications of attention in a chosen domain (NLP, computer vision), Multi-head attention and its benefits, Encoder-decoder architectures with attention, Masked self-attention for tasks like machine translation, Attention visualization techniques

(12 Hours)

Unit III

Explainable AI (XAI): Importance of explainability in deep learning models, Techniques for interpreting model predictions - LIME, SHAP, Model-agnostic vs. model-specific explainability methods, Evaluating the faithfulness and fairness of explanations, Applications of XAI in a chosen critical domain - healthcare, finance

(16 Hours)

Unit IV

Deep Reinforcement Learning Deep Q-Networks (DQNs) and their limitations, Advanced Deep Q-Learning technique - Double DQN, Exploration vs. exploitation strategies in reinforcement learning, Applications of deep Q-Learning in robotics and game playing

(12 Hours)

References

[1] Ian Goodfellow, Yoshua Bengio and Aaron Courville. *Deep Learning*, The MIT Press.
[2] François Chollet (2017), *Deep Learning with Python,* Manning Publications Company
[3] David Foster (2023), *Generative Deep Learning,* O'Reilly
[4] Maxim Lapan. *Deep Reinforcement Learning Hands-On*, Packt Publishing.
[5] Denis Rothman (2021), *Transformers for Natural Language Processing*. Packt Publishing

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B41ICSC: Deep Learning

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the fundamental components and training process of Generative Adversarial Networks .
2. Discuss the key characteristics of Deep Convolutional GANs
3. Explain how self-attention facilitates capturing relationships between different words in a sequence in NLP
4. Discuss the concept of multi-head attention in Transformer models.
5. Discuss the importance of explainability in deep learning models.
6. Discuss the limitations of Deep Q-Networks (DQNs) in reinforcement learning

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Discuss the evolution of attention mechanisms in deep learning.
8. Write any application of XAI in detail
9. What is the role of self-attention mechanisms in Transformers?.
10. Explain the architecture and training process of Deep Convolutional GANs (DCGANs)
11. What are the Applications of deep Q-Learning in robotics

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. a. Describe the Transformer architecture and the role of self-attention mechanisms .(6 marks)
    b. Discuss encoder-decoder architectures with attention mechanisms (6 marks)
13. a. Compare model-agnostic techniques with model-specific explainability methods in interpreting model predictions. (6 marks)
    b.Explain different attention visualisation techniques in detail
14. Discuss how DCGANs address the limitations of traditional GANs for image generation
15. Discuss challenges and ethical considerations encountered when implementing XAI in healthcare.
16. Draw the architecture of the Deep Q-Network (DQN), discuss its features, and explain how it aids in reinforcement learning.

(3 x 12 = 36 Marks)

9B42ICSC: Information Security and Blockchain Technology

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B42ICSC	3	3	3

Course Outcome

CO 1: Comprehend Information Security Principles
CO 2: Understand Cryptographic Techniques
CO 3: Identify and Mitigate Security Threats
CO 4: Understand basics of Blockchain Technology

Unit I

Introduction to Information Security-The need for Security, Principles of security-Confidentiality, Integrity, Availability, Authentication, Authorization, Non repudiation.
Ciphers and secret messages, security attacks and services, Types of attacks-Passive attacks, Active attacks. Virus and related threats, virus countermeasures. Introduction to Cryptography-Symmetric cipher model, substitution techniques, transposition techniques.

(14 Hours)

Unit II

Mathematics for cryptography: Euclid's algorithm, modular arithmetic, polynomial arithmetic. Block cipher principles- DES: Data Encryption Standard -Introduction, DES Structure-Initial and final permutations, DES function; Round Key Generation; Avalanche and completeness effect. Multiple DES- Double DES, Triple DES, Security of DES- Brute force attack. Advanced encryption standard – AES structure – AES transformation function – key expansion. Application of Block Ciphers.

(12 Hours)

Unit III

Public Key cryptography- Principles of Public Key Cryptosystems; Applications of public Key Crypto systems, Public Key Cryptanalysis. RSA Algorithm. Diffie-Hellman Key exchange, Elgamal Cryptographic systems. Hash functions- examples, application. Secure Hash algorithm. Message authentication functions – requirements of message authentication codes. Digital Signature- signing, verification. Digital signature Services, RSA digital signature scheme.

(16 Hours)

Unit IV

Introduction To BlockChain Technology, History, Features of BlockChain Technology, Terminologies, Benefits. Types of Block Chain- Public, Private, Hybrid, Consortium. Cryptography in BlockChain, BlockChain Structure, BlockChain Transaction Life Cycle. BlockChain Cryptocurrency. BlockChain Security. BlockChain Applications.

(12 Hours)

Textbook

[1] Forouzan and Mukhopadhyay, *Cryptography And Network Security,* 3rd Ed, McGraw Hill. https://udlbook.github.io/udlbook/

[2] William Stallings, *Cryptography and Network Security - Principles and Practice*, 7th Ed, Pearson.

[3] Sonali Vyas, Vinod Kumar Shukla, Shaurya Gupta, Ajay Prasad. *Blockchain Technology: Exploring Opportunities, Challenges, and Applications*.

References

[1] Bishop Matt, *Introduction to Computer Securit*y, Addison-Wesley,2004.

[2] Buce Schneier., *Applied cryptography – protocols and algorithms*, Springer Verlag 2003.

[3] Zibin Zheng, Shaoan Xie, Hongning Dai, Xiangping Chen, and Huaimin Wang. *An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends*-IEEE 2017.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B42ICSC: Information Security and Blockchain Technology

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define confidentiality and authentication.
2. Explain Euclid's algorithm in cryptography.
3. Explain Block chain cryptography.
4. Discuss El-Gamal cryptosystem.
5. Explain RSA algorithm.
6. Describe Digital signature and its services.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explain Diffie-Hellman key exchange with example.
8. Discuss the various encryption techniques with example.
9. Explain in detail the key generation technique in AES algorithm.
10. Discuss the various types of Block chain.
11. Explain the types of attacks in information security.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain substitution and transposition techniques with examples.
13. Explain DES structure and multiple DES techniques.
14. Explain the working of AES algorithm with example.
15. Discuss the importance of Digital signature in cryptography.
16. Explain in detail about Block chain? Explain Block chain security.

(3 x 12 = 36 Marks)

9B43ICSC: Natural Language Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B43ICSC	3	3	3

Course Outcome

CO 1: Understand the Fundamentals and Historical Context of NLP
CO 2: Master Morphological Analysis and Parsing Techniques
CO 3: Develop Proficiency in Part-of-Speech Tagging and Sequence Labelling
CO 4: Explore Advanced NLP Applications and Techniques

Unit I

History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP.
Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, the relation to language, Cross entropy.

(14 Hours)

Unit II

Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams: N-gram language model, N-gram for spelling correction.

(12 Hours)

Unit III

Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).

(16 Hours)

Unit IV

Discourse –reference resolution, reference phenomenon, syntactic & semantic constraints on co reference. Applications of NLP: Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition, Natural language generation.

(12 Hours)

Textbook

[1] Christopher D. Manning and Hinrich Schutze, *Foundations of Natural Language Processing* , 6 th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003

[2] Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, 3rd edition, Prentice Hall, 2009.

References

[1] Nitin Indurkhya, Fred J. Damerau, *Handbook of Natural Language Processing* second edition, Published February 23, 2010 by Chapman & Hall.
[2] Jacob Eisenstein, *Introduction to Natural Language Processing* ,The MIT Press.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B43ICSC: Natural Language Processing

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the challenges in NLP.
2. What is entropy in NLP?
3. Explain Regular expression.
4. Explain Conditional Random Field.
5. Explain semantic constraints on co reference.
6. Briefly explain Natural language generation.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Differentiate between Inflectional morphology & Derivational morphology.
8. Explain Information retrieval in NLP.
9. Explain Rule based POS tagging with examples.
10. Explain Hidden Markov Model.
11. Explain Discourse-reference resolution.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain the applications of NLP.
13. Explain Part-Of-Speech tagging in NLP.
14. Explain Morphological parsing with FST.
15. Explain N-grams in detail.
16. Explain stages in NLP.

(3 x 12 = 36 Marks)

9B44ICSC: Lab-13: Natural Language Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B44ICSC	6	3	4

Course Outcome

CO 1: Implementing fundamental NLP tasks such as tokenization, part-of-speech tagging, and named entity recognition.
CO 2: Developing a basic search engine and sentiment analysis classifier using these NLP techniques.
CO 3: Implementing and evaluating machine learning approaches like SVM for sentiment analysis on labelled datasets.
CO 4: Leveraging pre-trained models for named entity recognition to extract entities from text effectively.
CO 5: Visualizing NLP outputs using tools like spaCy's displacy to enhance interpretation and validation of results.

List of Programs

1. Write a program to calculate the entropy and perplexity of a given text corpus.
2. Implement a basic morphological parser using regular expressions in Python that can distinguish between different morphological forms of a given set of words.
3. Build a bigram and trigram language model from a sample text corpus and use it to generate probable word sequences.
4. Implement a simple POS tagger using the Penn Treebank tag set and evaluate its performance on a test corpus.
5. Implement a POS tagger using the HMM approach and evaluate it against a standard dataset.
6. Use a CRF library to train a POS tagger and evaluate its performance.
7. Implement a simple reference resolution algorithm to resolve pronouns in a given text.
8. Use a pre-trained translation model to translate a paragraph from English to another language and analyse the output for accuracy and fluency.
9. Build a basic search engine using Python that indexes a set of documents and retrieves relevant documents based on a user query.
10. Implement a sentiment analysis classifier using a machine learning approach and evaluate its accuracy on a labelled dataset.
11. Create a simple NLP program using Python that performs basic text processing tasks such as tokenization, part-of-speech (POS) tagging, and named entity recognition (NER) using spaCy.
12. Use a pre-trained NER model to extract named entities from a given text and visualize the results using a tool like spaCy.

9B45ICSC: Lab-14: Mini Project

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B45ICSC	6	3	4

List of Elective Courses for Elective I

Sl. No.	Course Code	Course title	Hours per week	Credits
1	10B46ICSCE01	Human Computer Interaction	3	3
2	10B46ICSCE02	Grid and Cloud Computing	3	3

*Elective I should be chosen from this list

List of Elective Courses for Elective II

Sl. No.		Course title	Hours per week	Credits
1	10B47ICSCE01	Computer Vision	3	3
2	10B47ICSCE02	Internet of Things	3	3

*Elective II should be chosen from this list

Syllabi for Elective Courses

10B46ICSCE01: Human Computer Interaction

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B46ICSCE01	3	-	3

Course Outcome

CO 1: Understand the principles of human memory, thinking, and the interaction between humans and computers
CO 2: Understand the design process with a focus on users, scenarios, and navigation.
CO 3: Understand usability principles, HCI patterns, and techniques for software evaluation through user participation.
CO 4: Grasp the principles of human-AI interaction, interactive machine learning, and guidelines.

Unit I

The Human: Human Memory, Thinking. Computer - Text entry devices, positioning, pointing and drawing, display devices, VR and 3D interaction, understanding computer memory speed and capacity, storage format and standards

Unit II

Interaction: Models of interaction, Frameworks and HCI, Ergonomics, Interaction Styles. Interaction Design: What is design?, Process of design, user focus, scenarios, navigation design.

Unit III

Principles to support usability, HCI Patterns, Evaluating a software through user participation, Web usability, usability testing. Universal Design: Multimodal interaction, Designing for diversity.

Unit IV

Human-AI interaction: Interactive machine learning, IML applications, Human-Ai interaction guidelines. Explainable AI, AI Ethics and Fairness.

Text Books

[1] Alan Dix (2004). *Human-Computer Interaction.* 3rd edition.

[2] Steve Krug, *Don't Make Me Think, Revisited*: A *Common Sense Approach* to *Web Usability* (Voices That Matter). 3rd Edition.

References

[1] *A Review of User Interface Design for Interactive Machine Learning* (TIIS 2018) by Dudley and Kristensson

[2] *Guidelines for Human-AI Interaction (*CHI 2019*)* by Amershi et al

[3] *Biases in AI Systems (*Communications of ACM, 2021*)*, Srinivasan and Chander.

[4] *Effects of Explanations in AI-Assisted Decision Making: Principles and Comparisons* (ACM Transactions on Interactive Intelligent Systems, 2022), Wang and Yin.

10B46ICSCE02: Grid and Cloud Computing

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B46ICSCE02	3	-	3

Course Outcome

CO 1: To understand the fundamental concepts of Distributed Computing, Grid Computing and its large scale scientific applications

CO 2: To acquire knowledge on the concept of virtualization

CO 3: To gain knowledge about different cloud deployment models and cloud computing categories

CO 4: To learn implementations of open source grid middleware packages and Hadoop Framework

CO 5: To understand the security issues in the grid and the cloud environment

Unit I

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers – Grid computing Infrastructures – cloud computing – service oriented architecture – Introduction to Grid Architecture and standards –

Elements of Grid – Overview of Grid Architecture.Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

Unit II

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software, Security as a Service – Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices, Desktop Virtualization – virtual clusters and Resource Management – Virtualization for data center automation. Tools and Products available for Virtualization.

Unit III

Open source grid middleware packages – Globus Toolkit (GT4) Architecture, Configuration – Usage of Globus – Main components and Programming model – Introduction to Hadoop Framework – Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

Unit IV

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

Text Books

[1] Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, *Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet, First Edition*, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012

References

[1] Jason Venner, *Pro Hadoop - Build Scalable, Distributed Applications in the Cloud,* A Press, 2009

[2] Tom White, *Hadoop The Definitive Guide, First Edition.* O Reilly, 2009

[3] Bart Jacob (Editor), *Introduction to Grid Computing,* IBM Red Books, Vervante, 2005

[4] Ian Foster, Carl Kesselman, *The Grid: Blueprint for a New Computing Infrastructure, 2nd Edition,* Morgan Kaufmann

[5] Frederic Magoules and Jie Pan, *Introduction to Grid Computing,* CRC Press, 2009

[6] Daniel Minoli, *A Networking Approach to Grid Computing,* John Wiley Publication, 2005

[7] Barry Wilkinson, *Grid Computing: Techniques and Applications, Chapman and Hall,* CRC, Taylor and Francis Group, 2010

[8] Kris Jamsa, *Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more*, Jones & Bartlett Learning Company, 2013

[9] R. Buyya, C. Vecchiola, S. T. Selvi, *Mastering Cloud Computing,* McGraw Hill (India) Pvt Ltd., 2013

10B47ICSCE01: Computer Vision

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B47ICSCE01	3	-	3

Course Outcome

CO 1: To introduce and discuss the basic concepts of computer vision techniques
CO 2: Understandings on the applications of machine vision
CO 3: To accomplish knowledge about motion analysis

Unit I

Introduction: Motivation, Difficulty, Image analysis tasks, Image representations, Image digitization, Image properties, Color images, Cameras. Data Structures: Levels of image data representation - Traditional image data structures - Hierarchical data structures. Texture: Statistical texture description, Syntactic texture description methods, Hybrid texture description methods, Texture recognition method applications.

Unit II

Object Recognition: Knowledge representation, Statistical pattern recognition, Neural nets, Syntactic pattern recognition, Recognition as graph matching, Optimization techniques in recognition, Fuzzy systems.

Unit III

Introduction to Bag of Features, Classifying images with Bag of features, Common Issues in Image classification, Recent object detection algorithms-YOLO, Fully Convolutional Networks, RetinaNet, EfficientDet

Unit IV

Motion Analysis: Differential motion analysis methods, Optical flow, Analysis based on interest points, Detection of specific motion patterns, Video Tracking, Motion models to aid tracking.

Text Books

[1] Szeliski, Richard, *Computer Vision: Algorithms and Applications* - 2nd Edition, Springer Verlag, 2022.

[2] Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing, Analysis and Machine Vision*, Cengage Learning, New Delhi, 2014.
[3] Wesley E. Synder and Hairong Qi, *Machine Vision*, Cambridge University Press, USA, 2010.
[4] *Geron* Aurelien, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition*, O'Reilly

References

[1] Rafael C Gonzalez, Richard E Woods, Steven L Eddins, *"Digital Image Processing",* Pearson Education, New Delhi, 2009.
[2] Shapiro L and Stockman G, *Computer Vision*, Prentice-Hall, 2001.

10B47ICSCE02: Internet of Things

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B47ICSCE02	3	-	3

Course Outcome

CO 1: Understand the fundamental concepts and principles of the Internet of Things (IoT) and its applications.
CO 2: Gain knowledge of the different technologies, protocols, and architectures used in IoT systems.
CO 3: Develop skills to design and implement IoT solutions using sensor technologies, data analytics, and cloud computing.
CO 4: Recognize the challenges and security considerations associated with IoT deployments and learn strategies to mitigate them.
CO 5: Explore the potential impact of IoT in various industries and understand its role in transforming business processes and enabling smart environments.

Unit I

Introduction to IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

Unit II

IoT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture. IoT Protocols: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards.

Unit III

Protocols – IEEE 802.15.4 – BACnet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP–Security. Building IoT with RASPBERRY PI &ARDUINO: Building IOT with

RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces.

Unit IV

Programming Raspberry Pi with Python - Other IoT Platforms - Arduino. Case Studies and Real World Applications :Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

Text Books

[1] ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015

[2] Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

[3] Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.

References

[1] Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

[2] Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012

10B48ICSC: Project

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B48ICSC	16	-	8

Guidelines given in the regulation (Acad/C2/16586/NGCI/2021 dated 31.05.2021)

10B49ICSC: General Viva Voce

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B49ICSC	-	-	2

Guidelines given in the regulation (Acad/C2/16586/NGCI/2021 dated 31.05.2021)