SCHEME & SYLLABUS OF
UNDERGRADUATE DEGREE COURSE
of
B. Tech. (Artificial Intelligence and Data Science)
VII & VIII Semester

[Draft Syllabus Subjected to approval]

Effective for the students admitted in year 2021-22 and onwards
Approved by ……. academic council meeting held on …….

Teaching & Examination Scheme
B. Tech. (Artificial Intelligence and Data Science)
4rd Year – VII Semester
(Effective for the students admitted in year 2021-22 and onward)

S. No.	Category	Course Code	Course Title	Hours			Exam Hours	Marks			Credit
				L	T	P		IA	ETE	Total	
	THEORY										
1	DC	7AD4-01	Computer Vision	3	-	-	3	30	70	100	**3**
2	UE	**University Elective subject** *Course code and title to be selected from the university elective pool of subjects*		3	-	-	3	30	70	100	**3**
3	DE	7AD5-11	Mobile Computing	2	-	-	3	30	70	100	**2**
		7AD5-12	Soft Computing and Evolutionary Algorithms								
		7AD5-13	Generative AI								
Sub Total				**8**	**00**	**00**	**-**	**90**	**210**	**300**	**8**
PRACTICAL & SESSIONAL											
4	DC	7AD4-21	Digital Image Processing Lab	-	-	2	-	60	40	100	**1**
5	UI	7AD7-30	Industrial Training	-	-	1	-	60	40	100	**3**
	UI	7AD7-50	B.Tech. Project - I	-	-	3	-	60	40	100	**2**
6	CCA	7AD8-00	SODECA / Co-Curricular Activity	-	-	-	-	-	100	100	**1**
Sub Total				**00**	**00**	**06**	**-**	**180**	**220**	**400**	**7**
Total				**8**	**00**	**06**	**-**	**270**	**430**	**700**	**15**

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment**, ETE**=End Term Exam,**Cr**=Credits

Teaching & Examination Scheme
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				L	T	P		IA	ETE	Total	
	THEORY										
1	UE		**University Elective subject** *Course code and title to be selected from the university elective pool of subjects*	3	-	-	3	30	70	100	**3**
Sub Total				**3**	**00**	**00**		**30**	**70**	**100**	**3**
	PRACTICAL & SESSIONAL										
10	UI	8AD7-40	Seminar	-	-	2	-	60	40	100	**2**
	UI	8AD7-50	B.Tech. Project - II	-	-	3	-	60	40	100	**4**
12	CCA	8AD8-00	SODECA / Co-Curricular Activity	-	-	-	-	-	100	100	**2**
Sub Total				**00**	**00**	**05**	**-**	**120**	**180**	**300**	**8**
Total				**03**	**00**	**05**	-	**150**	**250**	**400**	**11**

L = Lecture, **T** = Tutorial, = Practical, **IA**=Internal Assessment**, ETE**=End Term Exam,**Cr**=Credits

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD4-01: Computer Vision	
Credit: 3	**Max. Marks: 100 (IA:30, ETE:70)**
3L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives: As a result of successfully completing this course, students will:

- Fundamental Understanding of Computer Vision Principles
- Understanding the concept of Feature Detection and Matching
- Understanding of 3D Vision and Geometry
- Exposure to Advanced Computer Vision Topics and Applications

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

CO-1: Apply Fundamental Computer Vision Concept

CO-2: Implement and Evaluate Image Processing Techniques

CO 3: Design and Develop Feature Detection and Matching Systems

CO-4: Build Object Recognition Systems Using Machine Learning

CO-5: Apply 3D Vision Techniques in Real-World Applications

CO-6: Analyze and Implement Advanced Segmentation and Scene Understanding Techniques

CO-7: Integrate Theoretical Knowledge with Practical Computer Vision Applications

S. No.	Contents	Hours
1	**Introduction to Computer Vision:** Overview, applications, and challenges, Mathematical Foundations - Basics of linear algebra, probability, and statistics Image Formation and Representation - image formation, camera models, pinhole camera, image representation, orthographic and perspective projections, and basic operations on images	**7**
2	**Image Processing for Computer Vision**: Filtering and Enhancement Techniques - Spatial and frequency domain filtering, histogram equalization, edge detection. Image Transformations - Affine transformations, perspective transformations, and homographies. Image Restoration - Denoising, deblurring, and inverse filtering techniques.	**7**
3	**Feature detection & matching**: Edge detection, interest points and corners, blob detection, local image features, Feature Descriptors (SIFT, SURF, ORB, and BRIEF descriptors), feature matching, matching techniques, RANSAC for robust matching, and applications in object recognition.	**8**
4	**Object Recognition and Classification**: Introduction to Object Recognition - Overview of object recognition, challenges, and classic approaches. Machine Learning for Vision - Introduction to machine learning concepts applied to vision, including SVM, k-NN, and decision trees. Deep Learning in Computer Vision - Basics of CNNs, popular architectures (LeNet, AlexNet, VGG), and their applications in object recognition.	**8**
5	**3D Vision and Geometry**: Stereo Vision - Basics of stereo imaging, depth estimation, and epipolar geometry.	**7**

	Structure from Motion (SFM) - Understanding motion, optical flow, and 3D reconstruction from motion. 3D Object Reconstruction -Techniques for 3D reconstruction, point cloud generation, and applications in augmented reality.	
6	**Applications of Computer Vision**: Case studies in autonomous vehicles, medical imaging, surveillance, and augmented reality. Ethical considerations in computer vision.	**5**
Total		**42**

Suggested Books:

1. Gonzalez C. R., Woods E. R., Digital Image Processing, Pearson Education (2008) 3rd ed.
2. Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press;
3. A.K.Jain, " Fundamentals of Digital Image Processing", PHI,1995
4. Sonka M., Hlavac V. and Boyle R., Image Processing, Analysis and Machine Vision, Thomson Learning, (1993)1st ed.
5. Machine Learning for OpenCV: Intelligent image processing with Python, Machine Learning for OpenCV: Intelligent image processing with Python, Packt Publishing
6. McAndrew A., Introduction to Digital Image Processing with Matlab, Thomson Course Technology (2004)
7. Low A., Introductory Computer Vision and Image Processing, McGraw-Hill (1991), 1st ed.
8. Boyle and Thomas: Computer Vision - A First Gurse 2nd Edition, ISBN 0-632-028-67X, Blackwell Science 1995.
9. Pakhera Malay K: Digital Image Processing and Pattern Recogination, PHI.
10. Trucco, E. and Verri, A., "Introductory Techniques for 3-D Computer Vision", Prentice Hall
11. Szeliki, R., "Computer Vision: Algorithms and Applications", Springer
12. Forsyth, D. A. and Ponce, J., "Computer Vision: A Modern Approach",Prentice Hall, 2nd Ed
13. Rajalingappaa Shanmugamani , Deep Learning for Computer Vision: Expert techniques to train advanced neural networks using TensorFlow and Keras, Packt Publishing

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD5-11: Mobile Computing	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

• To make the student understand the concept of the mobile computing paradigm, its novel applications, and limitations.

• To understand the typical mobile networking infrastructure through a popular GSM protocol

• Understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer

• To understand the database issues in mobile environments & data delivery models.

• Understand the ad hoc networks and related concepts.

• To understand the platforms and protocols used in the mobile environment.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Think and develop a new mobile application.

CO-2: Take any new technical issue related to this new paradigm and come up with a solution(s).

CO-3: Develop new ad hoc network applications and/or algorithms/protocols.

CO-4: Understand & develop any existing or new protocol related to the mobile environment

S. No.	Contents	Hours
1	**Introduction:** Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS	**5**
2	**(Wireless) Medium Access Control (MAC):** Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)	**6**
3	**Mobile Network Layer:** IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP	**6**
4	**Mobile Transport Layer:** Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. Database Issues: Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing	**6**
5	**Data Dissemination and Synchronization:** Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.	**5**
	Total	**28**

Suggested Books:

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley, Second Edition, 2009.
2. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007, ISBN: 0195686772
3. ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, “Mobile Computing, Technology Applications and Service Creation” Second Edition, Mc Graw Hill.
4. UWE Hansmann, Lother Merk, Martin S. Nicklaus, Thomas Stober, “Principles of Mobile Computing,” Second Edition, Springer.
5. “GENESIS : Personal Communication Device”. GENESIS 191A321 Document, 1993.
6. “Intelligent Vehicle Highway Systems Projects”. Department of Transportation, Minnesota Document, March 1994.

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD5-12: Soft Computing and Evolutionary Algorithms	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

- Able to understand basics of Fuzzy Set
- Able to understand the concepts of the genetic algorithms.
- Able to understand the idea of the evolutionary algorithms.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.

CO-2: Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic

CO-3: Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self learning situations.

CO-4: Develop some familiarity with current research problems and research methods in Soft Computing Techniques

S. No.	Contents	Hours
1	**Introduction to Soft Computing:** Aims of Soft Computing-Foundations of Fuzzy Sets Theory-Basic Concepts and Properties of Fuzzy Sets- Elements of Fuzzy Mathematics-Fuzzy Relations-Fuzzy Logic	**5**
2	**Application of Fuzzy Sets**: Applications of Fuzzy Sets-Fuzzy Modeling – Fuzzy Decision Making-Pattern Analysis and Classification-Fuzzy Control Systems-Fuzzy Information Processing- Fuzzy Robotics.	**6**
3	**Genetic Algorithms**: Main Operators- Genetic Algorithm Based Optimization-Principle of Genetic Algorithm- Genetic Algorithm with Directed Mutation- Comparison of Conventional and Genetic Search Algorithms Issues of GA in practical implementation. Introduction to Particle swarm optimization-PSO operators-GA and PSO in engineering applications	**6**
4	**Neuro-Fuzzy Technology:** Fuzzy Neural Networks and their learning-Architecture of Neuro-Fuzzy Systems- Generation of Fuzzy Rules and membership functions - Fuzzification and Defuzzyfication in Neuro-Fuzzy Systems- Neuro-Fuzzy Identification - Neuro Fuzzy Control-Combination of Genetic Algorithm with Neural Networks- Combination of Genetic Algorithms and Fuzzy Logic-Neuro-Fuzzy and Genetic Approach in engineering applications.	**6**
5	**Basic Evolutionary Processes, EV:** A Simple Evolutionary System, Evolutionary Systems as Problem Solvers, A Historical Perspective, Canonical Evolutionary Algorithms - Evolutionary Programming, Evolution Strategies, A Unified View of Simple EAs- A Common Framework, Population Size	**5**
	Total	**28**

Suggested Books:

1. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
2. Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)
3. Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
4. Sivanandam, Deepa, " Principles of Soft Computing", Wiley
5. Jang J.S.R, Sun C.T. and Mizutani E, "Neuro-Fuzzy and Soft computing", Prentice Hall
6. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD5-13: Generative AI	
Credit: 2	**Max. Marks: 100 (IA:30, ETE:70)**
2L+0T+ 0P	**End Term Exams: 3 Hours**

Course Objectives:

As a result of successfully completing this course, students will be:

- Understand the fundamentals of generative AI and its applications in computer vision and natural language processing.
- Develop skills in designing and implementing generative models using deep learning frameworks.
- Analyze and evaluate the performance of generative models in various applications.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Design and implement generative models for image and text generation, and other applications.

CO-2: Understand the strengths and limitations of various generative models and be able to select appropriate models for specific tasks.

CO-3: Develop problem-solving skills using generative AI and be able to apply them to real-world problems.

CO-4: Critically evaluate the performance of generative models and develop strategies for improvement.

S. No.	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course	**1**
2	**Overview of Generative AI**: Types of Generative Models (VAE, GAN, RNN, etc.), Applications of Generative AI (Image Generation, Text Generation, etc.)	**6**
3	**Generative Models for Computer Vision** : Convolutional Neural Networks (CNNs) for image processing, Generative Adversarial Networks (GANs) for image generation, Variational Autoencoders (VAEs) for image compression and generation, Case studies: Image generation, Image-to-image translation, etc.	**7**
4	**Generative Models for Natural Language Processing:** Recurrent Neural Networks (RNNs) for text processing, Transformers for text generation and language modeling, Generative models for text summarization, chatbots, and language translation	**7**
5	**Advanced Generative AI Topics:** Generative models for multimodal data (images, text, audio, etc.), Generative models for sequential data (time series, videos, etc.), Advanced techniques: Style transfer, CycleGAN	**7**
	Total	**28**

Suggested Books:

1. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster, O'Reilly Media
2. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
3. Generative Adversarial Networks by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
4. Natural Language Processing (almost) from Scratch" by Collobert et al.
5. Neural Network Methods for Natural Language Processing" by Yoav Goldberg
6. Deep Learning for Computer Vision with Python" by Adrian Rosebrock

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD4-21: Digital Image Processing Lab	
Credit: 1	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+ 2P	**End Term Exams: 2 Hours**

Course Objectives:

As a result of successfully completing this course, students will:

- To introduce the concepts of image processing and basic analytical methods to be used in image processing.
- To familiarize students with image enhancement and restoration techniques
- To explain different image compression techniques. To introduce segmentation and morphological processing techniques.

Course Outcomes:

Upon successful completion of the course, students will be able to

CO-1: Review the fundamental concepts of a digital image processing system.

CO-2: Analyze images in geometric transforms with image rotation, scaling, and translation.

CO-3: Evaluate the techniques for image enhancement and image restoration.

CO-4: Categorize various compression techniques and Interpret Image compression standards

CO-5: Interpret image segmentation and representation techniques.

S. No.	List of Experiments
1	Point-to-point transformation. This laboratory experiment provides for thresholding an image and the evaluation of its histogram. Histogram equalization. This experiment illustrates the relationship among the intensities (gray levels) of an image and its histogram.
2	Geometric transformations. This experiment shows image rotation, scaling, and translation. Two-dimensional Fourier transform
3	Linear filtering using convolution. Highly selective filters.
4	Ideal filters in the frequency domain. Non Linear filtering using convolutional masks. Edge detection. This experiment enables students to understand the concept of edge detectors and their operation in noisy images.
5	Morphological operations: This experiment is intended so students can appreciate the effect of morphological operations using a small structuring element on simple binary images. The operations that can be performed are erosion, dilation, opening, closing, open-close, close-open.

Suggested Books:

1. Digital Image Processing, Rafea l C. Gonzalez, Richard E. Woods, Second Edition, Pearson Education/PHI
2. Image Processing, Analysis, and Machine Vision, Milan Sonka, Vaclav Hlavac and Roger Boyle, Second Edition, Thomson Learning.
3. Digital Image Processing using Matlab, Rafeal C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson Education.

VII Semester B. Tech. (Artificial Intelligence and Data Science)	
7AD7-50 : B.Tech. Project – I	
Credit: 2	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+3P	**Mode of evaluation: Report and presentation**

Assessment or Evaluation

The evaluation criteria for B. Tech. Project - I

S. No.	Category	IA marks bifurcation Max Marks in %	ETE marks bifurcation Max Marks in %
1	Project Motivation, Conceptual Design, Innovativeness, and utility in actual life application	10%	10%
2	Project Ideation, Project Formulation, and Design	10%	10%
3	Project Prototyping & Finalization, Project Planning & Timeline (Project Viability for 2 semesters)	10%	10%
4	Technology Used and Method	10%	10%
5	Project Execution, Development, Deployment, Demonstration and Delivery (Working and completeness) required to justify current semester work and presentation	30%	30%
6	Report writing and project documentation (organization of the report, clarity, use of figure/diagram, writing skills, presentation of result, paper publication, patent application, etc.)	20%	20%
7	Professional ethics (teamwork, punctuality, novelty, etc.)	10%	10%
Total		**100%**	**100%**

VIII Semester B. Tech. (Artificial Intelligence and Data Science)	
8AD7-50 : B.Tech. Project -II	
Credit: 4	**Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+3P	**Mode of evaluation: Report and presentation**

Assessment or Evaluation

The evaluation criteria for B. Tech. Project - II

S. No.	Category	IA marks bifurcation Max Marks in %	ETE marks bifurcation Max Marks in %
1	Project Motivation, Conceptual Design, Innovativeness, and utility in actual life application	10%	10%
2	Project Ideation, Project Formulation, and Design	10%	10%
3	Technology Used and Method	10%	10%
4	Project Execution, Development, Deployment, Demonstration and Delivery (Working and completeness) required to justify current semester work and presentation	30%	30%
5	Report writing and project documentation (organization of the report, clarity, use of figure/diagram, writing skills, presentation of result, paper publication, patent application, etc.)	20%	20%
6	Professional ethics (teamwork, punctuality, novelty, etc.)	10%	10%
7	Paper Published in reputed journals (SCE, SCIE, Scopus, UGC care or any peer-reviewed journal), Paper publications (International or National conferences [IEEE, ACM, Springer, etc]), and presentations at Hackathon (Institute level or SIH) or any institute, state or national level project presentation competitions.	10%	10%
Total		**100%**	**100%**