SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE of B. Tech. Information Technology 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. Information Technology
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	7IT4-01	Deep Learning	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	7IT 5-11	Digital Image Processing	2	-	-	3	30	70	100	**2**
		7IT5-12	Soft Computing and Evolutionary Algorithms								
		7IT5-13	Generative AI								
Sub Total				**8**	**00**	**00**	**-**	**90**	**210**	**300**	**8**
PRACTICAL & SESSIONAL											
4	DC	7IT4-21	**Deep Learning Lab**	-	-	2	-	60	40	100	**1**
5	UI	7IT7-30	Industrial Training	-	-	1	-	60	40	100	**3**
	UI	7IT7-50	B.Tech. Project - I	-	-	3	-	60	40	100	**2**
6	CCA	7IT8-00	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 TermExam,**Cr**=Credits

Teaching & Examination Scheme
B. Tech. Computer Science & Engineering
4rd Year – VIII 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	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	8IT7-40	Seminar	-	-	2	-	60	40	100	**2**
	UI	8IT7-50	B.Tech. Project - II	-	-	3	-	60	40	100	**4**
12	CCA	8IT8-00	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. Information Technology	
7IT4-01: Deep Learning	
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 be able :

- To describe the major differences between deep learning and other types of machine learning algorithms.
- To explain the fundamental methods involved in deep learning.
- To understand various aspects of deep learning and its building block.
- To understand and differentiate between the major types of neural network architectures.
- To Select or design neural network architectures for new data problems based on their requirements and problem characteristics and analyze their performance.
- To understand basic working principles and how Deep Learning is used to solve real-world problems

Course Outcomes:

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

CO-1: Able to learn the fundamental concepts of neural networks and deep neural networks.
CO-2: Able to understand the working principle of convolution neural networks.
CO-3: Able to perform hyperparameter tuning.
CO-4: Able to analyze and design neural network for real work problem. CO-5: Able to understand working principle of various types of neural networks.

S. No.	Contents	Hours
1	**Introduction to Neural Networks:** Introduction of artificial neural network and deep learning, characteristics of neural networks terminology, neurons, perceptron, backpropagation, Basic learning laws, Activation and Loss function - Function approximation, applications	7
2	**Introduction to Convolution Neural Networks:** CNN Architecture and Operations, convolutional layer, Pooling layer, Variants of the Convolution Model, Forward and Backward propagation, Building a Deep Neural Network **Improving Deep Neural Networks:** Training a deep neural network, hyper-parameter tuning, Hidden layers, Generalization Gap – Under-fitting Vs Over-fitting – Optimization, Normalization	8
3	**Practical aspects of Deep Learning:** Train/Dev / Test sets, Bias/variance, Overfitting and regularization, Linear models and optimization, Vanishing/exploding gradients, Gradient checking – Logistic Regression, Convolution Neural Networks, RNN and Backpropagation – Convolutions and Pooling	8
4	**Optimization algorithms:** Mini-batch gradient descent, exponentially weighted averages, RMS prop, Learning rate decay, the problem of local optima, Batch norm – Parameter tuning process	8
5	**Neural Network Architectures:** Recurrent Neural Networks, Adversarial NN, Spectral CNN, Self-Organizing Maps, Restricted Boltzmann Machines, Long Short-Term Memory Networks (LSTM) and Deep Reinforcement Learning – Tensor Flow, Keras or MatConvNet for implementation.	9
	Total	**40**

Suggested Books:

1. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2017 (link https://www.deeplearningbook.org/)
2. Deep Learning Step by Step with Python, N D Lewis, 2016
3. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2017
4. Deep Learning, Ian Goodfellow Yoshua Bengio Aaron Courville, MIT Press, 2017
5. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.
6. François Chollet "Deep Learning with Python," First Edition, Manning Publication,2018
7. Neural Networks and Deep Learning, Michael Nielsen, Determination Press (2015) (link: http://neuralnetworksanddeeplearning.com/)

VII Semester B. Tech. Information Technology	
7IT5-11: Digital Image Processing	
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 able:

- To learn the fundamental concepts of Digital Image Processing.
- To understand basic image processing operations.
- To understand image analysis algorithms.
- Expose to current applications in the field of digital image processing

Course Outcomes:

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

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

CO-2: Analyze images in the frequency domain using various transforms.

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

CO-4: Categorize various compression techniques.

CO-5: Interpret image segmentation and representation techniques.

S. No.	Contents	Hours
1	**Introduction to Image Processing:** Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition	**4**
2	**Image Transformation & Filtering**: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models	**6**
3	**Image Restoration:** Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering	**6**
4	**Image Compression:** Coding redundancy, Interpixel redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.	**6**
5	**Image Segmentation & Representation:** Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Region Based Segmentation, Boundary representation, Boundary Descriptors	**6**
	Total	**28**

Suggested Books:

1. Gonzalez C. R., Woods E. R., Digital Image Processing, Pearson Education (2008) 3rd ed.
2. A.K.Jain, " Fundamentals of Digital Image Processing", PHI,1995
3. Sonka M., Hlavac V. and Boyle R., Image Processing, Analysis and Machine Vision, Thomson Learning, (1993)1st ed.
4. McAndrew A., Introduction to Digital Image Processing with Matlab, Thomson Course Technology (2004)
5. Low A., Introductory Computer Vision and Image Processing, McGraw-Hill (1991), 1st ed.
6. Boyle and Thomas: Computer Vision - A First Gurse 2nd Edition, ISBN 0-632-028-67X, Blackwell Science 1995.
7. Pakhera Malay K: Digital Image Processing and Pattern Recogination, PHI.

VII Semester B. Tech. Information Technology	
7IT5-12: 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. Information Technology	
7IT5-13: 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
Deep Learning for Computer Vision with Python" by Adrian Rosebrock

VII Semester B. Tech. Information Technology	
7IT4-21: Deep Learning 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 provide hands-on experience with deep learning frameworks and tools
- To understand the applications and limitations of deep learning in various domains
- To develop skills in designing, training, and evaluating deep neural networks

Course Outcomes:

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

CO-1: Implement and train deep neural networks using popular frameworks like TensorFlow or PyTorch

CO-2: Apply deep learning techniques to real-world problems in computer vision, natural language processing, and time series analysis

CO-3: Understand working principle of various types of neural networks

CO-4: **U**nderstand the working principle of convolution neural networks

S. No.	List of Experiments
1	Demonstration and implementation of Shallow architecture using Python, TensorFlow and Keras i) Google Colaboratory - Cloning GitHub repository, Upload Data, Importing Kaggle's dataset, Basic File operations ii) Implementing Perceptron, iii) Digit Classification: Neural network to classify MNIST dataset
2	Basic implementation of a deep Learning models in PyTorch and Tensor Flow. Tune its performance by adding additional layers provided by the library.
3	Implement custom operations in PyTorch by using deep learning via gradient descent; recursive chain rule (backpropagation); bias-variance tradeoff, regularization; output units: linear, softmax; hidden units: tanh, RELU.
4	Implement a simple CNN starting from filtering, Convolution and pooling operations and arithmetic of these with Visualization in PyTorch and Tensorflow.
5	ConvNet Architectures: Implement a famous convNet architectures - AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet, MobileNet-v1.
6	Convolution Neural Network application using TensorFlow and Keras, i) Classification of MNIST Dataset using CNN ii) Face recognition using CNN
7	Image denoising (Fashion dataset) using Auto Encoders Handling Color Image in Neural Network aka Stacked Auto Encoders (Denoising)
8	Text processing, Language Modeling using RNN
9	Time Series Prediction using RNN
10	Sentiment Analysis using LSTM
11	Image generation using GAN

Suggested Books:

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2. Deep Learning Step by Step with Python, N D Lewis, 2016
3. Deep Learning: A Practitioner's Approach, Josh Patterson, Adam Gibson, O'Reilly Media, 2017
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5. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012.
6. François Chollet "Deep Learning with Python," First Edition, Manning Publication,2018
Neural Networks and Deep Learning, Michael Nielsen, Determination Press (2015) (link: http://neuralnetworksanddeeplearning.com/)

VII Semester B. Tech. Information Technology	
7IT7-50 : 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	Internal Assessment Max Marks in %	End Term Examinations 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. Information Technology	
8IT7-50 : 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	Internal Assessment Max Marks in %	End Term Examinations 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%**