Walchand Institute of Technology, Solapur
(An Autonomous Institute)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Choice Based Credit System (CBCS)

Structure and Syllabus
for
B.Tech. Computer Science and Engineering
Hons. Artificial Intelligence and Machine Learning
W.E.F. 2025-26

HEAD
Computer Science and Engineering
Walchand Institute of Technology
Solapur 413006.

Dr. Mrs. M. A Nirgude
Dean Academics

Computer Science and Engineering

Vision

To develop professional engineers in Computer Science & Engineering having ethical values, research aptitude and ability to address challenges of modernization in the IT industry aiming at overall sustainable development of the society.

Mission

- M1 - To impart quality education in the field of Computer Science & Engineering in accordance with the needs of the Modernization & Globalization through technology enabled education.
- M2 - To inculcate lifelong learning in students to face challenges posed by ever-changing IT career landscape as a disciplined professional with a sense of professional ethics.
- M3 - To inculcate critical thinking and creativity for identifying various societal issues and to provide solutions.
- M4 - To enhance career opportunities for students through academia-industry interaction and research.

Computer Science and Engineering

Program Educational Objectives (PEOs)

1. Graduate will exhibit strong fundamental knowledge and technical skills in the field of Computer Science & Engineering to pursue successful professional career, higher studies and research.
2. Graduate will exhibit capabilities to understand and resolve various societal issues through their problem solving skills.
3. Graduate will be sensitive to ethical, societal and environmental issues as a software engineering professional and be committed to life-long learning.

Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)	
PO 1	**Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO 9	**Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning difference
PO 10	**Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life-long Learning**: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of

	technological change. (WK8)

Program Specific Outcomes (PSOs)

1. Apply the principles of computational mathematics, computer systems and programming paradigms to solve computational problems.
2. Design and develop application software with functionalities applicable for desktop, web and mobile applications with due consideration of system software constraints.
3. Apply software engineering methods, cutting edge technologies and ICT, using appropriate tools and FOSS alternatives for designing, developing & testing application software.

Computer Science and Engineering Department

Legends Used	
L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B. Tech.	Bachelor of Technology

Computer Science and Engineering

Course Code Format

2	**1**	**I**	**T**	**U/P**	**2**	**C**	**C**	**1**	**T/L**
Year of Syllabus revision		Program Code		U-Under Graduate P-Post Graduate	Semester No./ Year1/2/3/…8	CourseType		Course Serial No 1-9	T-Theory, L-Lab session P- Programming

Program Code	
CS	Computer Science and Engineering
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Core Compulsory Course
SN*	Self-Learning **N*** *indicates the serial number of electives offered in the respective category*
EN*	Core Elective **N*** *indicates the serial number of electives offered in the respective category*
ON*	Open Elective **N*** *indicates the serial number of electives offered in the respective category*
SK	Skill Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship

Sample Course Code	
23CSU3CC1T	Discrete Mathematics Structures

Computer Science & Engineering and Information Technology

Semester	Course Code	Name of Course	Engagement Hours			Credits	FA	SA		Total
			L	T	P		ESE	ISE	ICA	
IV	22CSU4HA1T	Machine Learning	3	1		4	60	40	25	125
V	22CSU5HA1T	Reinforcement Learning	3		2	4	60	40	25	125
V	22CSU5HA1T	Seminar			2*	1			25	25
VI	22CSU6HA1T	Natural Language Processing	3		2	4	60	40	25	125
VII	22CSU7HA1P	Mini Project			4*	2	50		50	100
VII	22CSU7HA1T	Deep Learning	3		--	3	60	40	--	100
VII	22CSU7HA1L	Deep Learning	--	--	2	1			25	25
		Grand Total	12	1	12	19	290	160	175	625

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
B.Tech. (Computer Science and Engineering), Hons. AI & ML, Semester-VII

22CSU7HA1P – MINI PROJECT

Teaching Scheme		**Examination Scheme**	
Practical	4 Hours/week	**ESE**	50 Marks
Credits	2	**ICA**	50 Marks

Introduction

Project based learning is a paradigm which is becoming time-honored now a days. To keep abreast with this, Project course is included in the curriculum which is spread over both semesters of final year. For this course, students carry out a project as a team that allows them to demonstrate their abilities and to develop skills within their chosen area of interest. Hardware realization as well software projects with focus on design and research aspects are accepted. Also communicating effectively, both in oral and written form are an important skill for engineering graduates in many different contexts. This course also aims to foster these skills.

Course Prerequisite:

Student shall have technical competency as well as behavioral facet to carry project as a part of a team. Student shall have an adept knowledge of hardware and software architecture and associated programming skills. Student shall also possess necessary technical report writing skills, presentation skills.

Course Objectives:

1. Explore project identification process and carryout literature survey for real world problem.
2. Evaluate alternative approaches, and justify the use of selected tools and methods.
3. Consider relevant social, ethical and legal issues.
4. Give an exposure to planning and designing a project.
5. Enhance team working and leadership skills.
6. Enhance presentation and technical documentation skills.

Course Outcomes:

Student will be able to-
1. Study and select problem of societal relevance.
2. Select an appropriate solution design with due consideration for society.
3. Carry out impact analysis for environment and sustainability consideration(s).
4. Design a system using software engineering techniques and modern tools.
5. Engage in teamwork and communicate effectively, while observing professional ethics.

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22CSU7HA1T– DEEP LEARNING

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Course Objectives:

1. To understand the basics of neural networks and its need.
2. Comparing different deep learning models.
3. To understand the Convolutional and Recurrent nets in Deep Learning
4. To analyze Types of Networks

Course Outcomes:

Student will be able to-

1. Understand the basics of Deep Learning and apply the tools to implement deep learning applications
2. Evaluate the performance of deep learning models
3. To apply the technique of Convolution (CNN) and Recurrent Neural Network (RNN) a Auto encoders for implementing Deep Learning models
4. To apply deep generative models for real-time application development.

Unit – I	**Foundations of Deep learning**	**7 Hours**

What is machine learning and deep learning? Supervised and Unsupervised Learning, Limitations of machine learning, History of deep learning, Advantages and challenges of deep learning. Understanding how deep learning works, Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning, Introduction, and use of popular industry tools such as Tensorflow, Keras, PyTorch.

Unit – II	**Deep Neural Networks (DNNs)**	**8 Hours**

Introduction to Neural Networks: The Biological Neuron, The Perceptron, Multilayer Feed-Forward Networks, Training Neural Networks: Backpropagation and Forward propagation Activation Functions: Linear, Sigmoid, Tannh, Softmax, Rectified Linear, Loss Functions: Loss Function Notation, Loss Functions for Regression, Loss Functions for Classification, Hyperparameters: Learning Rate, Regularization, Momentum, Sparsity, Deep Feedforward Networks – Example of Ex OR, Hidden Units, cost functions, error backpropagation, Gradient-Based Learning, Implementing Gradient Descent, vanishing and exploding gradient descent, Deep Learning with Pytorch, Jupyter, colab.

Unit – III	**Convolution Neural Network (CNN)**	**8 Hours**

Introduction, CNN architecture overview, The Basic Structure of a Convolution Network-Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolution Network

Unit – IV	**Recurrent Neural Networks**	**8 Hours**

Recurrent and Recursive Nets: Recurrent Neural Networks, Bidirectional RNN, Encoder Decoder Architectures, Introduction to Long Short-Term Memory (LSTM) and Temporal Dependencies, Gated Recurrent Units (GRUs), Applications of RNN in Real World- Image Captioning and Time Series Forecasting and Prediction		
Unit – V	**Autoencoders**	**6 Hours**
Under complete Auto encoders, Regularized Autoencoders-Sparse Autoencoders, Stochastic Encoders and Decoders, Applications of Autoencoders, Introduction to transfer learning		
Unit – VI	**Applications of Deep Learning**	**8 Hours**
Computer vision, Object Detection using YOLO model, Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), Discriminator network, Generator network, types of GAN, Applications of GAN networks.		

Internal Continuous Assessment (ICA):

ICA shall include at least eight of the following:

1. Implementation of a deep learning model with MNIST data using Caffe2
2. Implementation of sentiment analysis using LSTM using Amazon Alexa reviews Dataset.
3. Implementation of Airline sentiment analysis using LSTM using Tweeter reviews Dataset.
4. Implementation of CNN for flower Image classification
5. Build a MLP model to demonstrate the effect of Batch Normalization using Keras.
6. Implementation of CNN for Image classification using MNIST dataset
7. Implementation of CNN for Hand written digit recognition using MNIST dataset
8. Transfer learning using ResNet50 for image recognition
9. Build a Keras classification Model on the Diabetes Dataset
10. Implementation of CNN model for animal image classification using Fashion MNIST
11. Implementation of Autoencoder techniques
12. Application of Generative models

Text Books

1. Goodfellow, I., Bengio, Y. Courville, A, "Deep Learning", MIT Press, 2016.
2. Josh Patterson & Adam Gibson, "Deep Learning"
3. Charu Agarwal, "Neural Networks and deep learning", A textbook
4. Deep Learning - A Practical Approach by Rajiv Chopra, Khana Publications, ISBN: 9789386173416

Reference Books

1. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017

e-Books:

1. http://csis.pace.edu/ctappert/cs855-18fall/DeepLearningPractitionersApproach.pdf
2. https://www.dkriesel.com/_media/science/neuronalenetze-en-zeta2-1col- dkrieselcom.pdf
3. MOOC Courses Links: https://www.my-mooc.com/en/categorie/deep-learning
4. Michael Nielsen, "Neural Networks and Deep Learning", Online book, 2016 (http://neuralnetworksanddeeplearning.com/)
5. Deep Learning for Visual Computing https://onlinecourses.nptel.ac.in/noc22_ee54
6. Deep Learning - IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_cs22
7. Deep Learning - IIT Ropar https://onlinecourses.nptel.ac.in/noc22_cs35/
8. Introduction to Deep Learning: https://www.coursera.org/learn/introduction-to-deeplearning-boulder
9. Deep Learning Specialization : https://www.coursera.org/specializations/deep-learning