D. Y. Patil College of Engineering and Technology

Kasaba Bawada, Kolhapur

(An Autonomous Institute)

NBA Accredited

Accredited by NAAC with 'A' Grade

Structure and Syllabus of Final Year B. Tech in Computer Science and Engineering (Artificial Intelligence–Machine Learning)

Department of

Computer Science and Engineering (AI-ML)

Effective from Academic year 2023-24

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR

Teaching and Evaluation Scheme from Year 2023-24

Final Year B. Tech - Computer Science & Engineering (AI-ML)

SEMESTER-VII

Sr. No.	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
1	201AIMLL401	PCC	Deep Learning	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
2	201AIMLL402	PCC	Internet of Things	2	-	-	2	100	ISE MSE ESE	20 30 50	20 20	40
3	201AIMLL403 - 405	PEC	Professional Elective-II	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
4	201AIMLL406	OEC	Open Elective-II	3	1	-	4	100	ISE MSE ESE	20 30 50	20 20	40
5	201AIMLP407	PCC-LC	Application Development Laboratory	1	-	2	2	50	ISE ESE POE	25 25	10 10	20
6	201AIMLP408	PCC-LC	Deep Learning Laboratory	-	-	2	1	50	ISE ESE POE	25 25	10 10	20
7	201AIMLP409	PEC-LC	Internet of Things Laboratory	-	-	2	1	25	ISE	25	10	10
8	201AIMLP410	PROJ	Internship	-	1$	-	4	100	ISE	100	40	40
9	201AIMLP411	PROJ	Project-III	-	-	4*	2	100	ISE ESE-POE	50 50	20 20	40
Total				12	2	10*	22	725				290

Professional Elective-II:			Open Elective-II:		
Sr. no.	Course Code	Name of the Course	Sr. no.	Course Code	Name of the Course
1.	201AIMLL403	Embedded Deep Learning	1.	201AIMLL406	AI For Everyone
2.	201AIMLL404	Digital Image Processing			
3.	201AIMLL405	Pattern Recognition	Other Department List Attached		

Note –

- The practical batch size should be considered as 20 students per batch.
- * - For Project – III, consider the workload of 2 hours per week for each project group consisting of 4/5 students.
- **$** - A faculty workload of 1 hour for a batch of 10 students per week will be considered for the Internship to evaluate the work done during the Internship after ESE of Sem.-IV/ Sem.-VI.
- The elective should be offered by the department, if the minimum number of students opting for a particular elective must be 30 students and it should be taught by the concerned teacher.

D.Y. PATIL COLLEGE OF ENGINEERING TECHNOLOGY
KASABABAWADA, KOLHAPUR -416006

An Autonomous Institute

Final Year B. Tech. Open Elective –II List

Open elective courses are offered to gain knowledge of multidisciplinary areas. Students must choose one open elective course from the list of courses offered by other departments (excluding open elective courses offered by their department). Following is the list of Open Elective-II courses. The detailed syllabus is available on the college website under an academic tab.

Sr. No.	Department	Course Code	Subject Name
1	Computer Science & Engineering	201CSL409	Security and Privacy in Social Networks
		201CSL410	Web Applications Development
2	Electronics and Telecommunication	201ETL409	Biomedical Instrumentation
		201ETL410	Electronic Automation
3	Civil	201CEL415	Smart Cities
		201CEL416	GPS & Remote Sensing
4	Mechanical	201MEL406	Industrial Management (IM)
		201MEL407	Computer Integrated Manufacturing System (CIMS)
5	Chemical	201CHL45.1	Fuel Cell Technology
		201CHL45.2	Industrial Behavior and Practices
6	Computer Science & Engineering (Data Science)	201DSL406	Business Intelligence & Analytics.
		201DSL407	Data Visualization and Storytelling.
7	Architecture	201AR408-A	Affordable Housing
		201AR408-B	Sustainable Community Living

Semester-VIII

Students can choose any one track for the **Semester VIII** from the following –

1. Regular Academic Track –

- This is the regular academic track where lectures, practicals, and project – IV work will be conducted regularly as per the time table in the department and college campus.

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR
Teaching and Evaluation Scheme from Year 2023-24
Final Year B. Tech- Computer Science & Engineering (AI-ML)
SEMESTER-VIII – Regular Track

Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
1	201AIMLL412	PCC	Applications of AI-ML	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
2	201AIMLL413	PCC	Augmented and Virtual Reality	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
3	201AIMLL414-416	PEC	Professional Elective-III	3	-	-	3	100	ISE MSE ESE	20 30 50	20 20	40
4	201AIMLL417-419	PCC	Professional Elective-IV	3	1	-	4	100	ISE MSE ESE	20 30 50	20 20	40
5	201AIMLP420	PCC-LC	Applications of AI-ML Laboratory	-	-	2	1	50	ISE ESE-POE	25 25	10 10	20
6	201AIMLP421	PCC	Augmented and Virtual Reality Laboratory	-	-	2	1	50	ISE ESE-POE	25 25	10 10	20
7	201AIMLP422-424	PEC	Professional Elective-III Laboratory	-	-	2	1	25	ISE	25	10	10
8	201AIMLP425	PROJ	Project-IV	-	-	4*	2	100	ISE ESE-POE	50 50	20 20	40
Total				12	1	10*	18	625				250

Professional Elective-III		
Sr. no.	**Course Code**	**Name of the Course**
1.	201AIMLL414	High Performance Computing with AI
2.	201AIMLL415	Natural Language Processing
3.	201AIMLL416	Data Mining and Business Intelligence

Professional Elective–IV		
Sr. no.	**Course Code**	**Name of the Course**
1.	201AIMLL417	Nature Inspired Algorithms
2.	201AIMLL418	Computer Vision
3.	201AIMLL419	Optimization Techniques in Machine Learning

Note:

- The practical batch size should be considered as 20 students per batch
- * - For Project – IV, consider the workload of 2 hours per week for each project group consisting of 4/5 students.
- The elective should be offered by the department, if the minimum number of students opting for a particular elective must be 30 students and it should be taught by the concerned teacher.
- ISE: In Semester Evaluation
- MSE: Mid Semester Examination
- ESE: End Semester Examination

2. Professional track –

D. Y. PATIL COLLEGE OF ENGINEERING & TECHNOLOGY, KOLHAPUR Teaching and Evaluation Scheme from Year 2023-24 Final Year B. Tech- Computer Science & Engineering (AI-ML) SEMESTER-VIII – Professional Track												
Sr. No	Course Code	Course Type	Name of the Course	Teaching Scheme per Week				Total Marks	Evaluation Scheme			
				Lecture	Tutorial	Practical	Credits		Type	Max. Marks	Min. for Passing	
1	201AIMLP427	PROJ	Project-IV	-	-	4*	2	100	ISE	50	20	40
									ESE-POE	50	20	
2	201AIMLP428	PROJ	Professional Skills Development **	-	1	36**	4	125	ISE-I	125	130	210
							6	200	ISE-II	200		
							6	200	ESE-OE	200	80	
Total				-	1	40	18	625				250

Guidelines for Professional Track:

1. Students must submit his/her willingness for this track before the term end of the semester – VII.
2. The head of the department will appoint one faculty coordinator to coordinate PTC work and manage all activities concerned with this track like assigning mentors to the students, organizing Professional Track Committee (PTC) meetings, monitoring the entire process concerned with Professional Track, etc.
3. Students can apply for the Professional Track in the following scenarios provided he/she obtain a letter accordingly from the concerned authority while applying for this track –
   a. If a student is selected in the company with a PPO (Pre-Placement Offer) program through the college TPO.
   b. If a student has an opportunity to work on sponsored projects in an industry/Research Int for 3-5 months.
   c. If a student is getting an onsite Internship offer for 3-5 months.
   d. If a student is getting a Company Training program of 3-5 months.
   e. If a student wants to do Innovation/Entrepreneurial activities for 3-5 months.
4. Students should submit the application along with all communication details to the Professional Track faculty coordinator before the term end of the semester – VII.
5. The work concerned with this track should be worth 400-500 hours and completed during semester VIII.
6. All formalities of getting an offer letter/permission to work in the concerned organization (a-e) are to be completed from the concerned authority (a-e) in writing before starting of ESE of Semester – VII.
7. The student should submit his/her application to the Professional Track Committee (PTC) along with details of communication done with the concerned authorities for its approval.
8. Professional Track Committee (PTC) comprises of HoD, Department T & P coordinator, T & P officer, faculty coordinator, and two, third-party experts from Industry / Research

Institute / Entrepreneur. The role of PTC is confined to the assessment and approval of applications only.

9. Professional Track Committee (PTC) will assess the applications based on the communications, the kind of work that is expected to be done by the student in concerned organization (a-e), and allocation of concerned organization (a-e) supervisor, depth of the technical exposure, student's development and feasibility of work. Committee will accordingly approve application satisfying the guidelines for professional track and the decision of the committee will be final.
10. There should be proper written communication between the concerned organization, TPO, department T & P Coordinator, and faculty coordinator mentioning the details clearly as per the syllabus structure.
11. Professional Track faculty coordinator should declare the list of students approved for, undertaking Professional Track before the end of ESE of semester-VII.
12. It is mandatory for a student and his/her parent to submit an undertaking, mentioning completion of the Professional Track as per concerned organization requirements and guidelines as per syllabus structure.
13. If the student fails to complete the above Professional Track as per the guidelines within the stipulated period of semester VIII, he/she will be declared as FAIL. Such a candidate has to complete the said work in subsequent 3-5 months, and then the ESE-OE examination will be conducted during the regular examination schedule of the college.

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Following are the evaluation guidelines for the Professional Skills Development Course -

i. The evaluation of the **Professional Skills Development** will be based on the work done by the student in a concerned organization.
ii. The faculty mentor assigned will be responsible for monitoring and assessment of the student on a continuous basis.
iii. Every faculty mentor will be assigned a workload of 1 hour per week for every student.
iv. The ISE marks are to be given based on the continuous assessment done by the concerned organization (a-e) supervisor and faculty mentor.
v. Students must present their work to the faculty mentor every month in an online mode or onsite (Minimum 3 presentations) in coordination with the concerned organization (a-e) supervisor for 100 marks taken together for all presentations and demonstrations under ISE-I with 4 credits.
vi. Concerned organization (a-e) should provide a certificate of completion of the assigned task alongwith marks under ISE-II head for 200 marks with 8 credits, in coordination with the faculty mentor before the conduct of the ESE-OE exam.
vii. ESE-OE is to be conducted for 200 marks with 6 credits in the concerned organization (a-e) where the student is doing his/her work. The ESE-OE will be conducted by both, the faculty mentor and concerned organization (a-e) supervisor.
viii. Students may complete **Professional Global Certification** either assigned by the concerned organization (a-e) supervisor based on his/her assigned work or on his/her own, like Palo Alto, AWS, Blue Prism, Java Certifications, etc.
ix. All credits will be earned by the student on completion of ISE and ESE-OE.

Course Plan

Course Title : Deep Learning	
Course Code : 201AIMLL401	**Semester : VII**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE : 20 + MSE : 30	**ESE Marks : 50**

Course Description:

Deep learning is a sub-field of machine learning that focuses on learning complex, hierarchical feature representations from raw data. The dominant method for achieving this, artificial neural networks, has revolutionized the processing of data (e.g. images, videos, text, and audio) as well as decision-making tasks (e.g. game-playing). Its success has enabled a tremendous amount of practical commercial applications and has had a significant impact on society.

In this course, students will learn the fundamental principles, underlying mathematics, and implementation details of deep learning. This includes the concepts and methods used to optimize Applications ranging from computer vision to natural language processing and decision-making (reinforcement learning) will be demonstrated.

Course Objectives:

1. To introduce the fundamentals of deep learning.
2. To introduce different models of deep learning to work with various types of inputs with respect to various applications.
3. To learn architectures and optimization methods for deep neural network training.

Course Outcomes (COs):

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

C401.1	Understand the fundamentals of neural networks.
C401.2	Remember architectures and optimization methods for deep neural network training.
C401.3	Apply attention mechanisms to the neural network.
C401.4	Critically evaluate the method's applicability in new contexts and construct new applications.

Prerequisite:	Machine learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C401.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
C401.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	1
C401.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
C401.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3

Content	Hours
Unit 1: Introduction to Neural Network and Deep Learning Biological Neuron, Idea of computational units, McCulloch–Pitts unit, McCulloch Pitts Neuron, Introduction to neural network, Single layer and multilayer perceptrons (MLPs), representation power of MLPs, History of Deep Learning, Deep learning workflow, Learning types	07
Unit 2: Activation functions and hyperparameters Activation Functions: sigmoid neurons, RELU, gradient descent, feed forward neural network representation, Back propagation, Hyperparameters: Learning rate, Epoch, Dense.	07
Unit 3: Convolutional Neural Networks Deep learning techniques, The convolutional operation, The max pooling operation, Training a convnet from scratch on a small dataset, Using pre-trained convnet, Visualizing what convnet learn.	07
Unit 4: Recurrent Neural Networks Introduction to RCNN, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, Long Short Term Memory, Gated Recurrent Units,	08

Bidirectional LSTMs, Bidirectional RNNs, Encoder-Decoder Models, and Attention Mechanism.	
Unit 5: Optimization and Generalization Optimization in Deep Learning –Non–convex optimization for deep networks-stochastic optimization Generalization in neural networks -spatial transformer networks-recurrent networks, LSTM-recurrent neural network language models-world-level RNNs & deep Reinforcement learning-computational & artificial neuroscience.	09
Unit 6: Case Study Emotion recognition using human face and body language, Deep learning for Natural Language Processing, Speech recognition, Transformers, and Sequence to sequence learning.	07

Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, the MIT press, 2016.
2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009
3. Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi 2020.

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106184/
2. https://www.coursera.org/specializations/deep-learning

Course Plan

Course Title : Internet of Things	
Course Code : 201AIMLL402	**Semester : VII**
Teaching Scheme : L-T-P : 2-0-0	**Credits :2**
Evaluation Scheme : ISE : 20 + MSE : 30	**ESE Marks : 50**

Course Description:

Internet of Things known as IoT is the study that describes the network of objects that are different things which are embedded with sensors, software, and also other technologies to connect and exchange data with other systems and devices over the Internet.

Course Objectives:

1. To explore the interconnection and integration of the physical world and the cyber space.
2. To design & develop IOT devices and applications.

Course Outcomes (COs):

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

C402.1	Understand core technology, applications, sensors used, and IOT architecture, along with the industry perspective.
C402.2	Understand Raspberry's workings and implementation
C402.3	Understand the various communication protocols used in the IoT.
C402.4	Apply various IOT technologies in real-life applications

Prerequisite:	Machine learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C402.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
C402.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	1
C402.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
C402.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3

Content	Hours
Unit 1: Introduction to IoT: What is IoT, how does it work? Differences between Embedded device and IoT device, Properties of IoT device, IoT Ecosystem, IoT Decision Framework, IoT Solution Architecture Models, and major IoT Boards in Market	05
Unit 2: Sensors Applications of various sensors: Google Maps, Waze, WhatsApp, Ola Positioning sensors: encoders and accelerometers, Image sensors: cameras, Global positioning sensors: GPS, GLONASS, IRNSS, Galileo and indoor localization systems, Motion & Orientation Sensors: Accelerometer, Magnetometer, Proximity Sensor, Gyroscope Calibration, noise modeling and characterization and noise filtering and sensor data processing. Privacy & Security	5
Unit 3: Setting Up Raspberry/Arduino to Create Solutions Explore Raspberry Pi, setting up Raspberry Pi, showing the workings of Raspberry Pi using SSH Client and Team Viewer, Understand Sensing actions, Understand Actuators and MEMS	05

Unit 4: Communication Protocols used in IoT Types of wireless communication, Major wireless Shortrange communication devices, properties, comparison of these devices (Bluetooth, WIFI, ZigBee, 6LoWPAN), Major wireless Long-range communication devices, properties, comparison of these devices (Cellular IoT, LPWAN)	05
Unit 5: IoT and Cloud Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Cloud computing in IoT, IoT in cloud architecture, Logging on to cloud, Cloud based IoT platforms, IBM Watson, Google cloud	05
Unit 6: IoT Applications Industrial Internet 4.0, Applications such as: Smart home, wearables, smart city, smart grid, connected car, connected health (digital health, telehealth, telemedicine), smart retail	05

Textbooks:

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014

Reference Books

1. Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1stEdition, Apress Publications, 2014

2. CunoPfister, Getting Started with the Internet of Things, O Reilly Media, 2011

3. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing, 2015

Online Material

1. Introduction to Internet of Things Prof. Sudip Misra IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_cs96/preview

Professional Elective-II
Course Plan

Course Title: Professional Elective-II Embedded Deep Learning	
Course Code: 201AIMLL403	**Semester :VII**
Teaching Scheme: L-T-P: 3-0-0	**Credits : 3**
Evaluation Scheme: ISE : 20 + MSE : 30	**ESE Marks: 50**

Course Description:
This course covers algorithmic and hardware implementation techniques to enable embedded deep learning. It describes synergetic design approaches at the application, algorithmic, computer architecture, and circuit-level that will help in achieving the goal of reducing the computational cost of deep learning algorithms.

Course Objectives:
1. To give a wide overview of a series of effective solutions for energy-efficient neural networks on battery constrained wearable devices
2. To optimize the neural networks for embedded deployment on all levels of the design hierarchy
3. To elaborate on how to design efficient Convolutional Neural Network processors, exploiting parallelism and data-reuse, sparse operations, and low-precision computations

Course Outcomes (COs):
Upon successful completion of this course, the students will be able to:

C403.1	Understand the basic training and inference techniques of a neural network.
C403.2	Be able to implement neural networks using machine learning tools
C403.3	Be able to implement neural networks on customized hardware, such as FPGA
C403.4	Be able to design and develop Embedded system automation based on machine learning computation and control capacity.

Prerequisite:	Deep Learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C403.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	2
C403.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
C403.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	2
C403.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3

Content	Hrs
Unit 1: Embedded Deep Neural Networks Introduction, Machine Learning, Deep Learning, and Challenges for Deep Neural Networks	07
Unit 2: Optimized Hierarchical Cascaded Processing Introduction, **Hierarchical Cascaded Systems –** Two –Stage Wake-up Systems, Cost-precision, model of Hierarchical Classifiers**, General Proof of Concept-** System Description, Input Statistics	09
Unit 3: Hardware Algorithm Co-Optimizations Introduction, Energy Gain in Low Precision Neural Networks, Test- Time Fixed – Point Neural Networks	06
Unit 4: Circuit Techniques for Approximate Computing Introduction, Techniques- Resilience Identification and Quality Management, Approximate Circuits , Architectures	07
Unit 5: ENVISION: Energy – Scalable Sparse Convolutional Network Processing Neural Network Acceleration, Processor Data path, On-Chip Memory Architecture, Hardware Support for Exploiting Network Sparsity	08
Unit 6: BINAREYE: Digital and Mixed Signal Always –On Binary Neural Network Processing Introduction, Binary Neural Networks, Binary Neural Networks applications, A Programmable Input-to-Label Accelerator Architecture, BinarEYE : A digital SX implementation.	08

Text Books:

1. Embedded Deep Learning, Algorithms, Architectures And Circuits for Always –On Neural Network Processing, Springer

Reference Books:

1. Fundamentals of Deep Learning , Chapter 6. Embedding and Representational Learning, by Nikhil Buduma

Online Resources:

1. Embedded Deep Learning, Bert Moons, Daniel Bankman.

Course Plan

Course Title: Professional Elective-II : Digital Image Processing	
Course Code:201AIMLL404	Semester :VII
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks: 20+30	ESE Marks: 50

Course Description:

This course is intended for students to learn digital image processing techniques, including representation, sampling and quantization, image acquisition, imaging geometry, image transforms, image enhancement, image smoothing and sharpening, and image restoration. More advanced topics, including degradation models, image filtering, color image processing, and image segmentation, are also to be learned to gain accuracy in machine learning models.

Course Objectives:

1. To learn and understand various image transformations used in digital image processing
2. To learn and understand various image enhancement technique used in digital image processing
3. To learn and understand various image restoration technique and methods used in digital image processing
4. To learn and understand various image compression and segmentation techniques used in digital image processing

Course Outcomes (COs):

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

C404.1	Describe the basic issues and the scope of image processing, and the roles of image processing and systems in a variety of applications.
C404.2	Explore different techniques in image acquisition and color transformation
C404.3	Understand how digital images are represented
C404.4	Explore and apply the concepts of Edge detection, segmentation and object recognition

Prerequisite:	Computer image analysis

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C404.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	2
C404.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
C404.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	2
C404.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3

Content	Hours
Unit 1: What Is Digital Image Processing Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System	07
Unit 2: Digital Image Fundamentals Elements of Visual Perception, Image Sensing and Acquisition , Image Sampling and Quantization, An Introduction to the Mathematical Tools Used in Digital Image Processing	08
Unit 3: Image Enhancement in Spatial Domain Necessity of Image enhancement, Basic gray Level Transformation, Histogram processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	07
Unit 4: Image Restoration Introduction to image restoration techniques, A Model of the Image Degradation/Restoration Process, Inverse Filtering, Geometric Mean Filter, Noise Estimation, Restoration in the Presence of Noise Only.	08
Unit 5: Image Segmentation Fundamentals and role of segmentation, Point, Line, and Edge Detection, Edge linking, Thresholding, Effect of illumination, Region-Based Segmentation, Boundary Descriptors.	08
Unit 6: Object Recognition Regional Descriptors,Object Patterns and Pattern Classes, Recognition Techniques, Case Study: Handwritten text Recognition	07

Text Books:

1. Digital Image. Processing. Third Edition. Rafael C. Gonzalez. University of Tennessee. Richard E. Woods. NledData Interactive. Pearson International Edition.

Reference Books:

1. Digital Image Processing Using MATLAB
2. Principles of Digital Image Processing, Core Algorithms Wilhelm
3. Fundamentals of Digital Image Processing by Sanjay Sharma

Online Resources:

1. https://www.coursera.org/courses?query=image%20processing
2. https://onlinecourses.nptel.ac.in/noc19_ee55/preview

Course Plan

Course Title: Professional Elective – II : Pattern Recognition	
Course Code: 201AIMLL405	**Semester: VII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

To help students understand basic mathematical and statistical techniques commonly used in pattern recognition. To introduce students to a variety of pattern recognition algorithms.

Course Objectives:

1. To know the basics of different mathematical and statistical techniques commonly used in pattern recognition.
2. To understand different pattern recognition algorithms.
3. To learn various preprocessing algorithms.
4. To introduce various algorithms for image classification.

Course Outcomes (COs):

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

C405.1	Understand the basic mathematical and statistical techniques commonly used in pattern recognition.
C405.2	Apply a variety of pattern recognition algorithms.
C405.3	Understand and apply various preprocessing algorithms.
C405.4	Apply various algorithms for image classification.

Prerequisite:	Probability & Statistics.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C405.1	2	2	-	1		-	-	-	-	-	-	-	-	-	2
C405.2	2	2	1	-	2	-	-	-	-	-	-	2	2	-	3
C405.3	-	2	1	2	1	-	-	-	-	-	-	2	1	-	2
C405.4	2	3	2	-	2	-	-	-	-	-	-	2	-	2	3

Content	Hours
Unit 1: Introduction and mathematical Preliminaries Principles of pattern recognition: Uses, mathematics, Classification and Bayesian rules, Clustering vs classification, Basics of linear algebra and vector spaces, Eigen values and eigen vectors, Rank of matrix and SVD.	7
Unit 2: Pattern Recognition basics Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Parameter estimation methods, Hidden Markov models, dimension reduction methods, Fisher discriminant analysis, Principal component analysis, non-parametric techniques for density estimation, nonmetric methods for pattern classification, unsupervised learning, algorithms for clustering: K -Means, Hierarchical and other methods	8
Unit 3: Feature Selection and extraction Problem statement and uses, Branch and bound algorithm, Sequential forward and backward selection, Cauchy Schwartz inequality.	7
Unit 4: Feature Selection and extraction-II Feature selection criteria function: Probabilistic separability based and Interclass distance based, Feature Extraction: principles	7
Unit 5: Visual Recognition Sources Human visual recognition system, Recognition methods: Low-level modelling (e.g., features), Midlevel abstraction (e.g., segmentation), High-level reasoning (e.g., scene	8

understanding); Detection/Segmentation methods; Context and scenes, Importance and saliency, Large-scale search and recognition, Egocentric vision, systems, Human-in-the-loop interactive systems, 3D scene understanding.	
Unit 6: Recent advancements in Pattern Recognition Comparison between performance of classifiers, Basics of statistics, covariance and their properties, Data condensation, feature clustering, Data visualization, Probability density estimation, Visualization and Aggregation, FCM and soft-computing techniques, Examples of real-life datasets.	8

Text Books:

1. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer, 2006.
2. O. Duda, P. E. Hart and D . G. Stork, Pattern Classification, John Wiley, 2001.
3. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009

Reference Books:

1. Pattern Classification by Richard O. Duda , Peter E. Hart, David G. Stork, Wiley, 1973.
2. P.A Devijver and J. Kittler, Pattern Recognition: A Statistical Approach, Prentice-Hall International, Englewood Cliffs, NJ, 1980.
3. K. Fukunaga, Introduction to Statistical Pattern Recognition, 2nd Ed. Academic Press, New York, 1990.

Online Resources:

https://nptel.ac.in/courses/106/106/106106046/

Open Elective - II
Course Plan

Course Title : Open Elective - II : AI For Everyone	
Course Code : 201AIMLL406	**Semester : VII**
Teaching Scheme : L-T-P : 3-1-0	**Credits :4**
Evaluation Scheme : ISE+MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

AI is a part of computer science based on the theoretical and applied principles of that field. These principles include the data structures used in knowledge representation, the algorithms needed to apply that knowledge, and the languages and programming techniques used in their implementation.

Course Objectives:

1. Familiarize students with artificial intelligence principles and techniques.
2. Introduce the facts of computational models and their applications.
3. Explore problem-solving paradigms, search methodologies, and learning algorithms.

Course Outcomes (COs):

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

COs	
C406.1	Characterize different types of AI environments, transform a given real world problem to state space problem, and understand and identify the stages and issues in the development of an expert system.
C406.2	Apply different searching algorithms and heuristic methodologies to reach the goal in state-space problems.
C406.3	Formulate a given real world problem formally using different knowledge representation methods and draw inferences from it.
C406.4	Implement enappropriate searching strategies for few real-world

Prerequisite:	Knowledge of basic Computer Algorithms

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C406.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
C406.2	2	3	3	-	-	-	-	-	-	-	-	-	2	-	3
C406.3	2	1	2	-	-	-	-	-	-	-	-	-	2	-	3
C406.4	3	2	3-	-	-	-	-	-	-	-	-	-	3	-	3

Content	Hours
Unit1: Introduction Importance of AI, Evolution of AI, Application of AI, Classification of AI with respect to environment, Intelligent agents, Different type of agents, Expert Systems, Stages in the development of Expert Systems, Difficulties in Developing Expert Systems, Applications of Expert Systems.	6
Unit 2: Representation and Search The proportional calculus, the predicate calculus, Using inference rules to produce predicate calculus expression, Graph theory, Strategies for state space search, Introduction to heuristic search, Hill climbing and dynamic programming, Best first search algorithm, Using heuristics in games	8
Unit3: Adversarial Search Problem solving by Search, Problem space State space, Blind Search-Types, Performance measurement-In formed search strategies, Heuristic functions, Local search strategies-Hill climbing, and simulated annealing.	7
Unit 4: Rule based expert system Introduction, K rules as knowledge, representation, schemes, Expert system development teams, Structure, Characteristics, Forward chaining and backward chaining inference techniques., Media Advisor: A Demonstration, Conflict resolution, Advantages and disadvantages.	8
Unit 5: Uncertainty management in rule based expert system: Introduction, Basic probability theory, Bayesian reasoning, Forecast, Certainty factors theory and evidential reasoning, Comparison of Bayesian reasoning and certainty	8

factors.	
Unit 6: Machine Learning: Machine learning and deep learning concepts, Tensor Flow-general overview, Installing Tensor Flow, first working session, Data Flow graph, Tensor Flow Programming model, how to use Tensor Board. Case Study: ChatGPT	8

Text Books:

1. Gorge F Luger, "Artificial Intelligence; structures and strategies for complex problem solving", Pearson Education, 5th Edition. [Units 1, 2, 3 &6]
2. Michael Negnevistsky, "Artificial Intelligence: A guide to intelligent systems", Person Education, 2nd edition. [Units 4, 5]
3. Giancarlo Zaccone, "Getting started with Tensor Flow", Packt Publishing, 2016. [Unit6].

Reference Books:

1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson Education India, 6 January2015

Online Resources:

1. https://nptel.ac.in/courses/106/102/106102220/
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview

Course Plan

Course Title : Application Development Laboratory	
Course Code : 201AIMLP407	Semester : VII
Teaching Scheme : L-T-P : 1-0-2	Credits : 2
Evaluation Scheme : ISE Marks : 25	ESE-POE Marks : 25

Course Description:

In this course, students will learn about the markup languages HTML, XHTML and the CSS and XSLT standards for formatting and transforming web content, interactive graphics and multimedia content on the web, and client-side programming using Javascript, Angular and Node.js. Also contain newer tools like Flask and Postman.

Course Objectives:

1.To introduce students to front end web design and emerging web technology concepts and tools.
2.To learn database access technologies and state management techniques.

3.To expose students to XAMPP web services, Flask, and Postman tools.

4.To describe Android architecture and the tools for developing Android applications.

Course Outcomes (COs):

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

C407.1	Design web application using MVC and Angular JS
C407.2	Demonstrate use of server side technologies and Explore newer tools for web development
C407.3	Design and develop user Interfaces for the Android platform
C407.4	Design and develop database based android application
Prerequisite:	Object oriented Programming, Basics of HTML and CSS

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C407.1	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-6
C407.2	2	-	-	-	2	-	-	-	-	-	-	-	-	-	L-3
C407.3	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-6
C407.4	-	-	3	-	2	-	-	-	-	-	-	-	2	-	L-6

Content	Hours
Unit 1: Front End Web Designing HTML and CSS: HTML Design Patterns: HTML Structure, XHTML, DOCTYPE, Header Elements, Conditional Style Sheet, Structural Block Elements, Terminal Block Elements, Multipurpose Block Elements, Inline Elements, Class and ID Attributes, HTML Whitespaces CSS Selector and Inheritance: Type, Class and ID Selector, Position and Group Selectors, Attribute Selectors, Pseudo-element Selectors, Pseudo-class Selectors, Subclass Selector, Inheritance, Visual Inheritance, and Bootstrap	3
Unit 2: Javascript Basics: Introduction to JavaScript, basic program of JavaScript, variables, functions, conditions, loops and repetition, Function, Arrays (DOM), Built-in Objects, Regular Expression, Exceptions, Event handling In Javascript, Validating HTML form data using javascript, Validation- AJAX – Jquery	2

Unit 3: Basics of Angular and Node JS: Angular - Web Application architecture, MVC and MVVM design Patterns, Angular architecture, Angular building blocks, Forms implementation. NodeJs architecture, web based applications	2
Unit 4: Embedding a Machine Learning Model into a Web Application Serializing fitted scikit-learn estimator, Setting up an SQLite database for data storage, Developing a web applications with Flask, Deploying the web application to a public server API Endpoint Testing with Postman: Installation, create request, import request, exporting request as code, API Endpoint Testing, Create, Modify and delete the contents, Inspecting and using header information.	3
Unit 5: Android Overview: Overview of Android, History, Android Versions, Android OS stack: Linux kernel, Native Libraries/DVM, Application Framework, Applications, Activity, Fragments, Process and Threads. Android Development Environment Introduction to Android SDK, Android Emulator, Creating a Project, Project Directory Structure, DDMS, Android Manifest File, Permissions. Intents and Layouts: XML, Android View Hierarchies. What Is Intent? Android Intent Messaging via Intent Objects, Types of Intents, Using Intents with Activities, Sending Intents (Telephony, SMS), Broadcast Receivers	3
Unit 6: Input Controls, Input Events, and Dialogs: Input Controls, Menus, Notification and Action Bar, Android Database and App Market: Installing SQLite plugin, DbHelper, The Database Schema and Its Creation, Four Major Operations, Cursors, Example, publish app to the Android Market.	2

List of Experiments			
Exp. No.	**Name of Experiments**	**S/O**	**Hours**
1	Create html pages for website like login, registration and about us pages	O	2
2	Apply and design the created HTML pages using CSS	O	2

List of Experiments			
Exp. No.	**Name of Experiments**	**S/O**	**Hours**
3	Write a program demonstrating javascript functions and different validations	O	2
4	Write a program to read and write HTML contents with JQuery	O	2
5	Create a simple Testing Angular application	O	2
6	Write a program demonstrating NodeJs application	O	2
7	Create simple application using Flask	O	2
8	Write a program to create, modify and delete the contents using Postman.	O	2
9	Deploying the web application to a public server	O	2
10	Creating simple project and study of android project structure and installing apk on mobile device/tablet, configuring mobile device/tablet in Android Studio with developer option and running app directly on mobile device/tablet.	O	2
11	Write a program to use of different layouts.	O	2
12	Write a program to use of Intents for SMS and Telephony.	O	2
13	Program to demonstrate Buttons, Text Fields, Checkboxes, Radio Buttons, and Toggle Buttons with their events handler.	O	2
14	Program to demonstrate Touch Mode, Menus with their events handler.	O	2
15	Implement an application that implements Multi-threading.	O	2
16	Write a program to study and use of SQLite database.	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. Michael Bowers, DionysiosSynodinos and Victor Sumner, "Pro HTML5 and CSS3 Design Patterns", Apress edition (Unit I & II)
2. Amos Q. Haviv, "MEAN Web Development", PACKT PUBLISHING LTD (Unit III)
3. Sebastian Raschka & Vahid Mirjalili, "Python Machine Learning", Packt Publication (Unit IV)
4. Wei-Mag Lee, "Beginning Android application development", (Unit V & VI)

Reference Books:

1. Michael Bowers, DionysiosSynodinos and Victor Sumner, "Pro HTML5 and CSS3 Design Patterns", Apress edition
2. Ethan Brown, "Web Development with Node and Express", Published by O'Reilly Media
3. W. Jason Gilmore, "Learning Android by Marko Gargenta Publisher", O'Reilly Media
4. Wallace Jackson "Android Apps for Absolute Beginners",

Online Resources:

1. https://onlinecourses.swayam2.ac.in/ugc19_lb05/preview
2. https://www.udemy.com/course/machine-learning-learn-by-building-web-apps-in-python

Course Plan

Course Title : Deep Learning Lab	
Course Code : 201AIMLP408	**Semester: VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE : 25	**ESE-POE Marks : 25**

Course Description:

To solve complex AI based problems by applying the latest techniques and deep learning algorithms.

Course Objectives:

1. To learn the principles and practices of supervised learning and deep learning
2. To learn how to use neural networks
3. To learn how to use keras and TensorBoard
4. Will be able to gain knowledge about learning systems TensorFlow which will be introduced with working examples
5. To learn mathematics and programming for deep learning.

Course Outcomes (COs):

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

C408.1	Understand the fundamentals of tensor to perform mathematical operations.
C408.2	Apply fundamentals of tensorflow to implement neural networks.
C408.3	Apply basic CNN for image classification.
C408.4	Apply Recurrent Neural Networks.

Prerequisite:	Machine learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C408.1	3	3	3	-	-	-	-	-	-	-	-	-	3	-	2
C408.2	3	3	3	-	-	-	-	-	-	-	-	-	3	-	3
C408.3	2	3	3	-	-	-	-	-	-	-	-	-	3	-	3
C408.4	2	3	3	-	-	-	-	-	-	-	-	-	3	-	3

Sr. No.	Experiment	S/O	Hours
1	Installation of Tensorflow & Keras(Tensorflow (v1.0.0), TFLearn, Keras, and many other pre-installed python libraries (Numpy, pandas)	S	2
2	Data Manipulation (Numpy library) Operations Broadcasting Indexing and slicing	S	2
3	Data Preprocessing Reading the Dataset Handling Missing Data Conversion to the Tensor Format	S	2
4	Linear Algebra Tensors, Tensor arithmetic Implementing matrix multiplication	O	2
5	Implement McCulloch Pitts neural network using tensorflow	O	2

6	Forward pass with matrix multiplication Forward pass with hidden layer (matrix multiplication) Forward pass with matrix multiplication with Keras Forward pass with hidden layer (matrix multiplication)with Keras	O	2
7	FCNN with only one neuron and plotting FCNN with one hidden layer and plottingCase study: MNIST digit classification with and without hidden layers	O	2
8	A simple CNN Make a train and validation dataset of images with vertical and horizontal images Defining the CNN to predict the knowledge from image classification Visualizing the learned CNN Model	O	2
9	MNIST digit classification before and after shuffling Train CNN on Original Data Train CNN on shuffled data	O	2
10	Cifar10 classification with and without normalization CNN as classification model for the Cifar10 dataset CNN as classification model for the Cifar10 dataset	O	2
11	Using a pre-trained Imagenet network to predict images into one of the 1000 Imagenet classes	O	2
12	Implementation of Simple RNN and Implementation of Deep RNN	O	2
13	Case study of RNN shapes in image Captioning Case study of RNN shapes in Text Translation	S	2
14	Case study of RNN(LSTM) on prediction of time series data set	S	2
15	Case study of RNN(GRU) on building model to generate text	S	2

❖ **S-STUDY, O-OPERATIONAL**

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106184/
2. https://www.coursera.org/specializations/deep-learning

Course Plan

Course Title : Internet of Things Laboratory	
Course Code : 201AIMLP409	**Semester : VII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE- POE Marks : NA**

Course Description:

This course aims to develop experiments on Internet of Things which are embedded with sensors, software, and also other technologies to connect and exchange data with other systems and devices over the Internet.

Course Objectives:

1. To learn integration of IoT Devices for real life applications.
2. To apply concepts of IoT to solve real world problems.

Course Outcomes (COs):

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

C409.1	Understand core technology, applications, sensors used and IOT architecture along with the industry perspective.
C409.2	Understand Raspberry's / Arduino working and implementation.
C409.3	Understand various communication protocols used in IoT.
C409.4	Apply various IOT technologies in real-life applications

Prerequisite:	Python, R Programming

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C409.1	2	2	-	-	1	-	-	-	-	-	-	-	-	2	L-2
C409.2	2	1	1	-	1	-	-	-	-	-	-	-	1	2	L-2
C409.3	2	2	1	-	1	-	-	-	-	-	-	-	-	2	L-2
C409.4	1	1	-	1	1	-	-	-	-	-	-	-	-	2	L-3

List of Experiments			
Exp. No.	**Name of Experiment**	**S/O**	**Hours**
1	Study of Arduino/ Raspberry pi devices.	S	2
2	Led Control Using Arduino Board	O	2
3	Potentiometer and IR Sensor Interfacing With Arduino	O	2
4	Controlling Two Actuators Using Arduino	O	2
5	Actuator Controlling Through Cloud	O	2
6	Design a complete IOT architecture for Smart office based on AI technique.	O	2
7	Design a complete IOT architecture for Smart garden based on AI technique.	O	2
8	IoT Based Air Pollution Control System	O	2
9	TDS Sensor Interfacing With Arduino	O	2
10	Actuator Controlling by Mobile Using Arduino	O	2
11	Design a Smart Campus System.	O	2
12	Design of Smart City System	O	2
13	Mini Project on IoT devices (Mandatory Experiment).	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books :

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014

Reference Books:

1. Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1stEdition, Apress Publications, 2014.
2. CunoPfister, Getting Started with the Internet of Things, O Reilly Media, 2011 .
3. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing, 2015.

Online Resources:

1. NPTEL Course on “Introduction to Internet of Things” by Prof. Sudip Misra, IIT Kharagpur.
https://onlinecourses.nptel.ac.in/noc22_cs96/preview

Course Plan

Course Title : Internship	
Course Code : 201AIMLP410	Semester : VII
Teaching Scheme : L-T-P : 0-1-0	Credits : 4
Evaluation Scheme : ISE Marks : 100	ESE-POE- Marks : NA

Course Description:

An internship is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh graduates gain professional know-how and benefits the corporate sector. The internship also enhances the student's employability skills after graduating from technical institutions.

Course Objectives:

1. To expose technical students to the industrial environment, which cannot be simulated in the classroom, and hence create competent professionals in the industry.
2. To provide possible opportunities to learn, understand, and sharpen the real-time technical/managerial skills required at the job.
3. To get exposed to the current technological developments relevant to the subject area of training.
4. To learn to apply Technical knowledge in real industrial situations

Internship evaluation:

The students are expected to undergo 4 to 6 weeks Internship in the industry and work on the relevant area as assigned by the Industry. The work done should be monitored and evaluated by the concerned industry expert based on the report prepared by the student. The department has to assign faculty mentors to a student who has to communicate with the industry and monitor the entire internship related work periodically.
The scheme of evaluation will be as under: -

a) Industry expert/ supervisor: - 70%
b) Department & Faculty mentor: - 30%

Faculty mentor includes "Presentation and Submission of Report", to the Department at the beginning of the subsequent semester.
1) The Internship can be availed by the students during the summer vacations after completion of

semester IV or VI.
2) The Credit of the Internship will be considered in semester VII.
3) The Industry experts/ supervisor are expected to assign the work worth minimum 100 to 120 hours for 4 weeks' duration and should monitor and evaluate periodically.
4) At the completion of Internship work, the student is expected to prepare a report on the work done and get it certified from the industry expert.

Following is the distribution of internship evaluation of 30 marks.

Sr. No.	Criteria	30 Marks Distribution
1	Presentation	5
2	Communication	5
3	Technical Domain and Key takeaways from internship	10
4	Questions and Answers	5
5	Report	5

Course Plan

Course Title: Project-III	
Course Code: 201AIMLP411	Semester :VII
Teaching Scheme:L-T-P:0-0-4	Credits:2
Evaluation Scheme: ISE Marks: 50	ESE POE Marks: 50

Course Description:

Final Year Projects represent the culmination of study towards the Bachelor of Technology degree. Projects offer the opportunity to apply and extend material learned throughout the program. Students are supposed to find a suitable project and prepare a detailed plan for it. This will be the first part of the mega project, where students have to achieve the below mentioned objectives. Assessment is by means of a seminar presentation, the submission of a report, and a demonstration of work undertaken.

Course Objectives:

1. Identify the area of project work
2. Recognize the need and ability to engage in lifelong learning
3. Function effectively on teams and communicate effectively
4. Able to prepare the technical report

Course Outcomes (COs):

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

C411.1	Explain the need of a software project for the society
C411.2	Identify requirement analysis, like functional and technical requirements for the project
C411.3	Come up with design documents for the project consisting of Architecture, dataflow diagrams, class diagrams, algorithmic descriptions of various modules, collaboration diagram, ER Diagrams, Database Design Documents, Sequence diagrams, and Use Case Diagram
C411.4	Able to demonstrate analysis and design.
C411.5	Prepare the technical report consisting of Requirement specification, Analysis and Design of Project

Prerequisite:	Software Engineering, Mini Project.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C411.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	2
C411.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
C411.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	2
C411.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3
C411.5	2	-	-	-	2	-	1	-	-	-	-	1	1		2

Content

The project work is to be carried out in two semesters of Final Year Computer Science and Engineering.

The project should be undertaken preferably by a group of 3-4 students who will jointly work and implement the project in the two semesters.

In Semester VII, the group will select a project with the approval of the Guide (staff member) and submit
the Name of the project with a synopsis of the proposed work of not more than 02 to 08 pages before the second week of the semester.. The group is expected to complete detailed system design, analysis, data flow and 50% of Project work at the end of semester –VII as a part of the term work submission in the form of a joint report.

Project Calendar

Sr. No.	Task	Period
1	Project Topic Selection	2nd week
2	Requirement Analysis and Synopsis Presentation	5th week
3	Design of Project	8th week
4	Coding of 50 % Project work	14th week

- The term work assessment will be done jointly by teachers appointed by Head of the Department and the project coordinator.
- The oral examination will be conducted by an internal and external examiner.
- Participation is must in Inter/Intra College Project Competitions / Publication of research papers.

Note:

1. Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
2. Two mid-term evaluations should be done, which include presentations and demos of the work done.
3. Care should be taken to avoid copying and outsourcing of the project work.
4. Students should participate in Inter/Intra College Project Competitions.
5. Students should publish review papers based on their project title.
6. Report / Research paper should be **Plagiarism Free.**

Course Plan

Course Title: Applications of AI-ML	
Course Code: 201AIMLL412	**Semester: VIII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme: ISE+MSE Marks: 20+30	**ESE Mark: 50**

Course Description:

AI is a part of computer science based on the theoretical and applied principles of that field. This course is an introduction to the theoretical aspects of the design and implementation of applications of AI as well as ML. AI consists of understanding and implementing the basic application oriented principles and concepts of AI using an appropriate technique. AI-ML applications include the use of computers to do reasoning, pattern recognition, image and text processing learning, or some other form of inference.

Course Objectives:

1. To give deep knowledge of Artificial Intelligence & Machine Learning and how AI ML can be applied in various fields to make the life easy.
2. To develop professional skills that prepares them to recognize emotions using human face and body language.
3. To develop a self-driven system that can make student's industry ready.

Course Outcomes (COs):

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

C412.1	Develop an understanding of cloud based applications of Artificial Intelligence (AI) and Machine Learning methods and describe their foundations.
C412.2	Understand development of systems that process unstructured, uncurated data automatically using artificial intelligence (AI) frameworks and platforms.
C412.3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems and other machine learning models.
C412.4	Apply different methods to analyze Image, Text and video processing techniques.
C412.5	Implement AI frameworks and platforms to improve business, organizational, and technology outcomes.

Prerequisite:	Fundamentals of AI, Machine learning, Deep learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C412.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
C412.2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	2
C412.3	3	3	3	-	-	-	-	-	-	-	-	-	2	-	3
C412.4	3	3	3	-	-	-	-	-	-	-	-	-	2	-	3
C412.5	3	3	3	-	-	-	-	-	-	-	-	-	2	-	3

Content	Hours
Unit 1: AI with IoT & Cloud IOT reference model – IOT platforms – IOT verticals – Big data and IOT- Infusion of AI, industry standard for data mining – AI and IOT platforms. AI Platforms-Azure ML, Google AI, Swift AI.	08
Unit 2: AI based Object Detection & Recognition Emotion Recognition using human face and body language, AI based system to predict diseases early, AI based biometric system.	07
Unit 3: Image Processing Image Processing Image Processing and Pattern Recognition, Application in Bio-informatics, Applications in healthcare.	08
Unit 4: Text Mining Introduction to text mining, Methods and techniques of text mining, Application of text mining, Linguistic aspects of natural language processing.	08
Unit 5: AIML For business A.I. And Quantum Computing, Applications of Artificial Intelligence (AI) in business, ML in Social Problems Handling; Application in retails and finance.	07
Unit 6: Case Study 1. Handwriting detection 2. Application in Digital Forensics. 3. Heart/ Cancer disease detection.	07

Text Books:

1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley &Sons.
2. Artificial Intelligence & Soft Computing for Beginners, 3rd Edition-2018, byAninditaDas, Shroff Publisher Publisher.
3. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
4. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd

Reference Books:

1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson EducationIndia, 6 January2015.
2. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw HillEducation

Online Resources:

1. https://nptel.ac.in/courses/106/102/106102220/
2. https://onlinecourses.nptel.ac.in/noc21_ge20/preview
3. https://www.coursera.org/learn/machine-learning
4. https://nptel.ac.in/courses/106106139

Course Plan

Course Title: Augmented and Virtual Reality	
Course Code: 201AIMLL413	**Semester: VIII**
Teaching Scheme: L-T-P: 3-0-0	**Credits: 3**
Evaluation Scheme : ISE + MSE Marks: 20 +30	**ESE : 50**

Course Description:

This course provides an in-depth introduction to Augmented Reality (AR) and Virtual Reality (VR) technologies, exploring their fundamental principles, applications, and potential impact across various industries. Students will gain hands-on experience with creating AR/VR content and applications, using industry-standard software and development tools.

Course Objectives:

1. To gain knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
4. To learn the evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to gain practical knowledge

Course Outcomes (COs):

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

COs	
C413.1	Describe how AR,VR systems work and list the applications of AR,VR.
C413.2	Understand the design and implementation of the hardware that enables VR systems to be built.
C413.3	Understand the system of human vision and its implication on perception and rendering & Explain the concepts of motion and tracking in VR systems.
C413.4	Understand and analyse the hardware requirement of AR & Use computer vision concepts for AR and describe AR techniques
C413.5	Acquire knowledge of mixed reality

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C413.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C413.2	2	2	-	-	-	-	-	-	-	2	-	2	-	-	1
C413.3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3
C413.4	2	-	2	-	2	-	-	-	-	-	-	-	-	-	2
C413.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Prerequisite:	Mathematics, Physics, Programming and Problem Solving, Artificial Intelligence

Content	Hours
Unit 1 : Introduction to VR and AR Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality **What Is Augmented Reality** - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality **Augmented Reality Concepts-** How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.	8
Unit 2 : Representing Geometry & The Physiology of Virtual World Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR, Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR	8
Unit 3 : Visual Perception, Rendering, Motion & Tracking Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates, Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies	8
Unit 4 : Augmented Reality Hardware Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.	7
Unit 5 : Computer Vision for Augmented Reality & A.R. Software Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application	7
Unit 6 : Beyond A. R. - Mixed Reality Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM - dense tracking and mapping (DTAM), parallel tracking and mapping (PTAM) and semi-direct monocular visual odometry (SVO).	7

Text Books:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
4. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
5. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381 2.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Online Resources:

1. http://lavalle.pl/vr/book.html
2. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
3. https://docs.microsoft.com/en-us/windows/mixed-reality/
4. https://docs.microsoft.com/en-us/archive/msdn magazine/2016/november/hololensintroduction-to-the-hololens

Professional Elective-III
Course Plan

Course Title : Professional Elective-III : High Performance Computing with AI	
Course Code : 201AIMLL414	**Semester : VIII**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course is about the basic algorithmic techniques you'll need to do so. The practical aspect of this course is implementing the algorithms and techniques you'll learn to run on real parallel and distributed systems, so you can check whether what appears to work well in theory also translates into practice.

Course Objectives:

1. To teach the basic concepts of parallel computing
2. To equip students with knowledge to write parallel programs using industry-standard parallel programming frameworks.

Course Outcomes (COs):

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

C414.1	Comprehend parallel algorithm design and taxonomy of parallel architecture (K2)
C414.2	Understand OpenMP and MPI directives and libraries to implement parallel program (K2)
C414.3	Develop different parallel programs (K3)
C414.4	Analyze performance of parallel algorithms designed using Open MP. MPI and CUDA (K4)

Prerequisite:	Computer Architecture , Computer Algorithm

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C414.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	L-2
C414.2	2	1	1	-	-	-	-	-	-	-	-	-	1	-	L-2
C414.3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	L-3
C414.4	1	1	-	1	-	-	-	-	-	-	-	-	-	-	L-4

Content	Hours
Unit 1: Parallel Computing Need of ever-increasing performance, Building parallel systems, Need to write parallel programs , Analyze parallel programs	6
Unit 2: Parallel Systems The von Neumann architecture, Processes, multitasking, and threads SIMD systems, MIMD systems, Interconnection networks, Performance, Speedup and efficiency, Amdahl's law, Scalability	7
Unit 3: Shared-Memory Programming with OpenMP Shared memory programming, Parallel for loop, critical section, Writing OpenMP Programs, Compiling and running OpenMP programs, The reduction clause, The parallel for Directive	8
Unit 4: Distributed-Memory Programming with MPI Compilation and execution of MPI Programs , MPI Init and MPI Finalize, Communicators, MPI Comm size and MPI Comm rank, SPMD programs, Communication, MPI Send, MPI Recv, Message matching, Tree-structured communication , MPI All-reduce, Broadcast, Scatter, Gather, All-gather	8

Unit 5: Programming with CUDA GPGPU Architecture of NVIDIA, CUDA Model, Programming in CUDA, Examples	8
Unit 6: Application Scalability HPC Application Development, Parallel Computing libraries in python, Comparison of Serial and parallel examples.	8

Text Books:

1. An Introduction to Parallel Programming, Peter S. Pacheco, Morgan Kaufmann Publications 2011.
2. Parallel programming in C with MPI and OpenMP, Michael J Quinn, Tata McGraw Hill , 2003.
3. Programming Massively Parallel Processors, David B. Kirk and Wen-mei W. Hwu , Morgan Kaufmann , 2nd Edition , 2010.

Reference Books:

1. Introduction to Parallel Computing, Ananth Grama, George Karypis, Vipin Kumar & Anshul Gupta, Pearson Education Limited , Second Edition , 2003.
2. Multi-core Programming, Shameem Akhter and Jason Roberts, Intel Press , 2006.
3. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs , Shane Cook , Elsevier Inc , First Edition , 2013.

Online Resources:

1. Introduction to parallel programming with OpenMP and MPI, by Yogish Sabharwal, IIT Delhi.
   https://onlinecourses.nptel.ac.in/noc22_cs21/preview

2. GPU architecture and programming , by Prof. Dey , IIT Kharagpur.
   https://onlinecourses.nptel.ac.in/noc21_cs46/preview

Course Plan

Course Title : Professional Elective - III : Natural Language Processing	
Course Code : 201AIMLP415	**Semester : VIII**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE : 20 + MSE : 30	**ESE Marks : 50**

Course Description:

Natural Language Processing (NLP) is a rapidly developing field that aims to allow machines to break down and interpret human language. It combines the power of linguistics and computer science and takes advantage of machine learning techniques to learn the rules and structure of language and build intelligent systems that can understand, analyze and generate natural language text.

Course Objectives:

1. To introduce the fundamentals of language and the tools that are available to efficiently study and analyze large collections of text.
2. Gain a foundational understanding about the methods and evaluation metrics for various natural language processing tasks.
3. Learn how to evaluate the strengths and weaknesses of various NLP technologies and frameworks.
4. Gain practical experience in the NLP toolkits available.

Course Outcomes (COs):

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

C415.1	Understand language and the tools that are available to efficiently study and analyze large collections of text.
C415.2	Analyze and discuss the effects of electronic communication on our language
C415.3	Remember natural language processing with manual and automated approaches.
C415.4	Understand computational frameworks for natural language processing.

Prerequisite:	Machine learning, Deep learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C415.1	3	3	2	-	-	-	-	-	-	-	-	-	2	-	2
C415.2	3	2	2	-	-	-	-	-	-	-	-	-	2	-	4
C415.3	2	3	2	-	-	-	-	-	-	-	-	-	3	-	1
C415.4	3	3	3	-	-	-	-	-	-	-	-	-	2	-	2

Content	Hours
Unit 1: Introduction A computational framework for natural language, description of English or an Indian language in the framework, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, the different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.	09
Unit 2: Word Level Analysis Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine readable dictionaries and lexical databases, RTN, ATN. Module	08
Unit 3: Semantic Analysis Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning. Module	08

Unit 4: Natural Language Generation (NLG) Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.	08
Unit 5: Information retrieval and lexical resources Information Retrieval Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.	06
Unit 6: Dialogue Systems IR based question answering system – Entity linking – Knowledge based Q&A – Language models for Q&A – Evaluation of systems – Chatbots – Human dialogue – Frame based dialogue – Dialogue state architecture – Evaluating dialogue systems.	06

Text Books:

1. Natural Language Understanding by James Allen, Pearson Education, 2002.
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.
3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4. Natural Language Processing with TensorFlow, Thushan Ganegedara, Packt, 2018

Reference Books:

1. An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
2. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley

Online Resources:

https://www.coursera.org/specializations/natural-language-processing

Course Plan

Course Title : Professional Elective-III : Data Mining and Business Intelligence	
Course Code : 201AIMLL416	**Semester : VIII**
Teaching Scheme : L-T-P : 3-0-0	**Credits : 3**
Evaluation Scheme : ISE + MSE :Marks : 20 + 30	**ESE- Marks : 50**

Course Description

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be given to the Machine Learning methods as they provide the real knowledge discovery tools. Important related technologies, such as data warehousing and on-line analytical processing (OLAP) will also be discussed.

Course Objectives:

- To learn data mining Concepts
- To apply data preprocessing techniques and tools to solve business problems.
- To study data mining techniques and algorithms in business analytics.

Course Outcomes (COs):

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

C416.1	Define the concepts of data warehousing, data mining and data preprocessing
C416.2	Apply the concepts of classification of predication of data
C416.3	Apply the concepts of association rule mining
C416.4	Apply the concepts of Business Intelligence Data Mining
C416.5	Develop a prediction model using data mining tools

Prerequisite:	Database Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C416.1	2	-	3	2	-	-	-	-	-	-	-	-	-	-	L-2
C416.2	2	2	2	2	-	-	-	-	-	-	-	-	-	-	L-3
C416.3	2	-	2	1	-	-	-	-	-	-	-	-	-	-	L-3
C416.4	2	3	2	-	-	-	-	-	-	-	-	-	-	-	L-3
C416.5	2	-	2	2	-	-	-	-	-	-	-	-	-	-	L-3

Content	Hours
Unit 1: Data Mining basics Data Warehouse and OLAP, Data Warehouse and DBMS, Multidimensional data model, OLAP operations, OLAP Queries, Basic Data Mining Tasks, Data Mining Versus Knowledge Discovery in Data Bases, Data Mining Issues, Data Mining Matrices, Social Implications of Data Mining, Data Mining from Data Base Perspective.	7
Unit 2: Data Mining Techniques and Classifications Data Mining Techniques – a Statistical Perspective on data mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms. Classification: Introduction, Statistical – Based Algorithms, Distance Based Algorithms.	7
Unit 3: Clustering Tree Based Algorithms, Neural Network Based Algorithms, Rule Based Algorithms, and Combining Techniques: Introduction, Similarity and Distance Measures, Partitioning Methods, Hierarchical methods, Density-Based Methods, Grid- Based Methods – Model-Based Clustering Methods, Clustering High- Dimensional Data, Constraint- Based Cluster Analysis, and Outlier Analysis.	8

Unit 4: Association Rules Association Rules: Introduction - Large Item Sets, Basic Algorithms, Parallel& Distributed Algorithms, Comparing Approaches, Incremental Rules, Advanced Association Rules Techniques, Measuring the Quality of Rules.	7
Unit 5: Business Intelligence: Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle. Data for BI - Data Issues and Data Quality for BI. BI Implementation - Key Drivers, Key Performance Indicators and Performance Metrics, BI Architecture/Framework, Best Practices, Business Decision Making, Styles of BI-vent-Driven alerts - A cyclic process of Intelligence Creation. The value of Business Intelligence-Value driven & Information use.	8
Unit 6:Data Mining Tool for Business Intelligence Loading the data (Simple) - Filtering attributes (Simple) - Selecting attributes (Intermediate) – Training a classifier (Simple) - Building your own classifier (Advanced) - Tree visualization (Intermediate) - Testing and evaluating your models (Simple)Regression models (Simple) - Association rules (Intermediate) - Clustering (Simple) - Reusing models (Intermediate) - Data mining in direct marketing (Simple) - Using Weka for stock value forecasting (Advanced).	8

Text Book:

1. Jiawei Han &Micheline Kamber, “Data Mining Concepts & Techniques”, 2011, 3rd Edition.
2. Ian H. Witten and Eibe Frank – Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publication – 2016 4th Edition.
3. Rajiv Sabherwal “Business Intelligence” Wiley Publications, 2012.

Reference Books:

1. Margaret H.Dunbam, “Data Mining Introductory and Advanced Topics”, Pearson Education 2003.
2. Arun K. Pujari – Data Mining Techniques, Universities Press (India) Pvt. Ltd., 2013 Kindle Edition.

Online Reference:

1. NPTEL & MOOC courses on Data Mining https://nptel.ac.in/courses/106105174/

Professional Elective-IV
Course Plan

Course Title: Professional Elective-IV: Nature Inspired Algorithms	
Course Code:201AIMLL417	**Semester :VIII**
Teaching Scheme:L-T-P:3-1-0	**Credits:4**
Evaluation Scheme: ISE+MSE marks: 20+30	**ESE Marks: 50**

Course Description:

Nature-inspired computing is a field of study that draws inspiration from natural processes and phenomena to develop computational techniques for solving complex problems. This course provides an in-depth exploration of various nature-inspired algorithms and their applications.

Course Objectives:

1. To learn and understand concepts and principles of nature-inspired computing
2. To learn and understand various nature-inspired algorithms to solve complex problems.
3. To learn and understand nature-inspired computing techniques' strengths, limitations, and applications.
4. To build critical thinking and problem-solving skills through the analysis and evaluation of nature-inspired algorithms

Course Outcomes (COs):

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

C417.1	Explain the concepts and principles of nature-inspired computing.
C417.2	Develop skills for implementing and applying nature-inspired algorithms to solve complex problems.
C417.3	Outline the strengths, limitations, and applications of nature-inspired computing techniques.
C417.4	Prepare critical thinking and problem-solving skills by analyzing and evaluating nature-inspired algorithms.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C417.1	2	3	-	-	-	-	-	-	-	-	-	1	-	-	2
C417.2	2	1	2	-	-	-	-	-	-	-	-	1	-	-	2
C417.3	1	3	-	1	-	-	-	-	-	-	-	3	-	-	2
C417.4	3	2	2	3	-	2	-	3	-	-	-	3	3	3	3

Content	Hours
Unit 1: Introduction to Nature-Inspired Computing Overview of Nature-Inspired Computing: Definition, motivations, and historical background, Inspiration from Natural Systems: Introduction to biological and natural systems that serve as inspiration for nature-inspired algorithms.	07
Unit 2: Computational Intelligence Introduction to computational intelligence techniques, genetic algorithms, particle swarm optimization, ant colony optimization, and evolutionary strategies. Problem-Solving Paradigms	08
Unit 3: Genetic Algorithms Fundamentals of Genetic Algorithms: Representation, population initialization, selection mechanisms, crossover, and mutation operators. Multi-Objective Optimization: Techniques for handling multiple objectives in genetic algorithms	07
Unit 4: Swarm Intelligence and Optimization Particle Swarm Optimization (PSO): Concepts, behavior, and variations of PSO algorithms, Ant Colony Optimization (ACO): Principles of ant colony optimization, pheromone trails, and solution construction, Bee Algorithms: Introduction to bee-inspired optimization algorithms, such as the artificial bee colony algorithm, Firefly Algorithm: Basics of the firefly algorithm and its application in optimization problems	08

Unit 5: Artificial Neural Networks Introduction to neural networks and deep learning, Convolutional neural networks (CNN) and recurrent neural networks (RNN), Applications in classification, regression, and pattern recognition	08
Unit 6: Artificial Immune Systems & DNA Computing Overview of artificial immune systems (AIS), Cellular Automata, DNA Computing: Motivation, DNA Molecule, Adleman's experiment, Test tube programming language, Universal DNA Computers, Scope of DNA Computing.	07

List of Assignments

Asg. No.	Name of Assignment	S/O	Hours
1	Explain in detail, the motivations, and historical background of Nature-Inspired Computing	S	2
2	Explain in detail the Computational Intelligence	O	2
3	Explain in detail Genetic Algorithms	O	2
4	Explain in detail Multi-Objective Optimization & Genetic Algorithms	O	2
5	Explain Swarm Intelligence	O	2
6	Explain the Particle Swarm Optimization (PSO) algorithm	O	2
7	Explain the Ant Colony Optimization algorithm	O	2
8	Explain with an example how ANN	O	2
9	Explain Artificial Immune Systems	O	2
10	Explain DNA Computing.	O	2

Text Books:

1. Xin-She Yang, “Nature-Inspired Computation and Swarm Intelligence Algorithms, Theory, and Applications”, Elsevier, Academic Press, 2020.

Reference Books:

1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007. 2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.

Course Plan

Course Title: Professional Elective- IV : Computer Vision	
Course Code: 201AIMLL418	**Semester: VIII**
Teaching Scheme: L-T-P: 3-1-0	**Credits: 4**
Evaluation Scheme: ISE + MSE Marks: 20 + 30	**ESE Marks: 50**

Course Description:

Computer vision tasks include methods for acquiring, processing, analyzing, and understanding digital images, as well as the extraction of high-dimensional data from the real world in order to produce numerical or symbolic information data sets.

Course Objectives:

1. To review different image processing techniques for computer vision.
2. To study shape and region analysis.
3. To learn Hough, Transform, and its applications to detect lines, circles, and ellipses.
4. To introduce three-dimensional image analysis techniques.

Course Outcomes (COs):

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

C418.1	To understand & review image processing techniques for computer vision.
C418.2	Understand the concepts of shape and region analysis.
C418.3	Analyze the Hough, Transform and its applications to detect lines, circles, and ellipses.
C418.4	Explore the three-dimensional image analysis techniques.
C418.5	To apply computer vision algorithms to real life applications.

Prerequisite:	Image Processing

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C418.1	2	2	-	1	-	-	-	-	-	-	-	2	-	-	L-2
C418.2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	L-2
C418.3	1	3	-	2	-	-	-	-	-	-	-	-	-	-	L-4
C418.4	2	2	-	2	-	-	-	-	-	-	-	-	2	1	L-2
C418.5	1	2	3	2	2	-	-	-	-	-	-	3	2	1	L-3

Content	Hours
Unit 1: Image Processing Foundations Review of image processing techniques – classical filtering operations – thresholding techniques– edge detection techniques – corner and interest point detection mathematical morphology –texture	7
Unit 2: Shapes And Regions Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – Centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments	8
Unit 3: Hough Transform Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.	8

Unit 4: 3D Vision Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction	8
Unit 5: 3D Motion Introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – Spline-based motion – optical flow – layered motion.	6
Unit 6: Applications Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians	8

List of Assignments

Assg. No.	Name of Assignment	S/O	Hours
1	Review of image processing techniques and classical filtering operations.	S	1
2	To implement image segmentation by thresholding and edge detection techniques.	O	1
3	Binary shape analysis – Analysis of biomedical image.	S	1
4	Deformable shape analysis	S	1
5	Boundary length measures & Boundary descriptors	S	1
6	To implement RANSAC for straight line detection.	O	1
7	To implement Generalized Hough Transform (GHT)	O	1
8	Different Methods for 3D vision	S	1
9	Spline-based motion- SplineBased Motion Planning for Automated Driving	S	1
10	Optical flow – layered motion	S	1

11	Surveillance – foreground-background separation – particle filters	S	1
12	Analysis of In-vehicle vision system	S	1
13	Case study	S	1

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. D. L. Baggio et al., Mastering OpenCV with Practical Computer Vision Projects, PacktPublishing, 2012.
2. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
3. Jan Erik Solem, Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.

Reference Books:

1. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
2. R. Szeliski, Computer Vision: Algorithms and Applications, Springer 2011.
3. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

Online Resources:

1. https://nptel.ac.in/courses/106106145

Course Plan

Course Title :Professional Elective – IV : Optimization Techniques in Machine Learning	
Course Code : 201AIMLL419	**Semester : VIII**
Teaching Scheme : L-T-P : 3-1-0	**Credits : 4**
Evaluation Scheme : ISE + MSE Marks : 20 + 30	**ESE Marks : 50**

Course Description:

This course offers a holistic introduction to the fundamentals of mathematical optimization for machine learning and deep learning. Using a range of real datasets and basic Python libraries for data manipulation, vector/matrix algebra, and automatic differentiation. Fundamental optimization algorithms for popular machine learning / deep learning models

Course Objectives:

1. The students will be able to understand and analyze how to deal with changing data.
2. The students will also be able to identify and interpret potential unintended effects in your project.
3. The students will understand and define procedures to operationalize and maintain your applied machine learning model.

Course Outcomes (COs):

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

C419.1	Understand and analyze how to deal with changing data.
C419.2	Understand and interpret potential unintended effects in their project.
C419.3	Understand and define procedures to operationalize and maintain the applied machine learning model.
C419.4	Understand how to optimize the use of Machine Learning in real-life problems.

Prerequisite:	Linear Algebra and Vector Calculus, Python programming language

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C419.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	4
C419.2	2	1	1	-	-	-	-	-	-	-	-	-	1	-	2
C419.3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	2
C419.4	1	1	-	1	-	-	-	-	-	-	-	-	-	-	2

Content	Hours
Unit 1: Fundamentals of Convex Analysis Mathematical optimization , Convex optimization , Nonlinear optimization , Convex sets: Affine and convex sets , Convex functions : The conjugate function , Quasiconvex functions , Log-concave and log-convex functions	6
Unit 2: First-Order Methods Gradient Descent , Conjugate Gradient , Momentum , Nesterov Momentum , Adagrad , RMSProp , Adadelta , Adam and Hypergradient Descent	7
Unit 3: Cutting-plane Methods in Machine Learning Introduction to Cutting-plane Methods , Bundle Methods , Combinatorial Optimization , Regularized Risk Minimization , Bundle Method for Regularized Risk Minimization , BMRM Algorithm Accelerated by Line-Search, Multiple Kernel Learning , Convex Multiple Kernel Learning, , Min-Max Formulation of Multiple Kernel Learning.	8
Unit 4: Second-Order Methods Newton's Method , Secant Method , Quasi-Newton Methods , Direct Methods : Cyclic Coordinate Search , Generalized Pattern Search , Nelder-Mead Simplex Method	8

Unit 5: Projected Newton-type Methods in Machine Learning Projected Newton-type Methods , Building a Quadratic Model , Two-Metric Projection Methods , Inexact Projection Methods : Spectral Projected Gradient , SPG-based Inexact Projected Newton , Proximal Newton-like Methods	8
Unit 6: Interior-Point Methods in Machine Learning Introduction, Interior-Point Methods: Background , Interior-Point Methods for Machine Learning , Accelerating Interior-Point Methods	8

List of Assignments

Ass. No.	Name of Assignment	S/O	Hours
1	Analyze how to solve Mathematical Optimization problems.	S	1
2	Analyze how to solve Convex Optimization problems.	S	1
3	Describe Local Optimization and Global Optimization in Nonlinear optimization.	S	1
4	Lines and line segments , Affine sets , Convex sets , Cones	S	1
5	Definition and examples of conjugate function	S	1
6	Definition and examples of Quasiconvex functions	S	1
7	Implement Conjugate Gradient using Python	O	1
8	Implement Momentum and Nesterov Momentum	O	1
9	Implement Newton's Method using Python	O	1
10	Implement Quasi-Newton Methods Python	O	1
11	Analyze Projected Newton-type Methods	S	1
12	Analyze Interior-Point Methods for Machine Learning	S	1

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. S. Boyd and L. Vandenberghe, "Convex Optimization," Cambridge University Press, 2004. (Unit -1)
2. Algorithms for Optimization by Mykel J. Kochenderfer and Tim A. Wheeler, MIT Press, 2019.(Unit -2 , Unit-4)
3. Optimization for Machine Learning, Suvrit Sra, Sebastian Nowozin and Stephen J. Wright, MIT Press, 2011. (unit- 3 , unit- 5 , unit- 6)

Reference Books:

1. Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J. Kulkarni, Springer, 2019.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ee59/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs64/preview

Course Plan

Course Title : Applications of AI-ML Laboratory	
Course Code : 201AIMLP420	**Semester : VIII**
Teaching Scheme : L-T-P : 0-0-2	**Credits :1**
Evaluation Scheme : ISE Marks : 25	**ESE-POE Marks : 25**

Course Description:

To solve complex AI application based problems by applying the latest techniques and libraries. AI-ML applications include the use of computers to do reasoning, pattern recognition, Image and Text processing learning, or some other form of inference.

Course Objectives:

1. The students should be able to understand and use AI techniques for generating efficient, intelligent behaviour in different applications, such as gaming.
2. The students should be able to understand how AI is transforming the practice of medicine. The students should gain practical experience in applying machine learning to concrete problems in medicine.
3. The students should be able to understand the evolution of AI-driven online wealth management platforms, such as robo-advisors, and learn how they work and why they're successful.

Course Outcomes (COs):

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

C420.1	Apply various pre-processing techniques to different datasets.
C420.2	Construct machine learning programs for applications based on supervised, unsupervised, and Semi supervised learning models.
C420.3	Develop prediction model for applications of AIML with different libraries.
C420.4	Identify and Apply Artificial Intelligence & machine learning concepts to solve real world problems.

Prerequisite:	Machine learning, Deep Learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C420.1	3	3	2	-	-	-	-	-	-	-	-	-	2	-	3
C420.2	2	3	3	-	-	-	-	-	-	-	-	-	3	-	6
C420.3	2	3	3	-	-	-	-	-	-	-	-	-	3	-	6
C420.4	3	3	2	-	-	-	-	-	-	-	-	-	3	-	2

List of Experiments			
Exp. No.	**Name of Experiment**	**S/O**	**Hours**
1	Write a program to predict the user's next location.	O	2
2	Write a program to detect YouTube comment spam.	O	2
3	Write a program to identify the genre of a song.	O	2
4	Write a program for shock front classification.	O	2
5	Write a program to develop a human face recognition system.	O	2
6	Write a program to develop a speech recognition system.	O	2
7	Write a program to develop a system for email spam and malware filtering.	O	2
8	Building and training a model for medical image diagnosis.	O	2
9	Implement path finding algorithms for AI agents.	O	2
10	Study of virtual personal assistants.	S	2
11	Study of medical diagnosis.	S	2
12	Study of Intelligent robots.	S	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. Dr. Nilakshi Jain, Artificial Intelligence: Making a System Intelligent, John Wiley &Sons.
2. Artificial Intelligence & Soft Computing for Beginners, 3rd Edition-2018, by AninditaDas, Shroff Publisher Publisher.
3. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, 2010, Prentice Hall of India.
4. Practical Machine Learning Sunila Gollapudi Packt Publishing Ltd

Reference Books:

1. Dan W. Patterson, Introduction to Artificial Intelligence, Pearson EducationIndia, 6 January2015.
2. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw HillEducation

Online Resources:

1. https://github.com/atinesh-s/Coursera-Machine-Learning-Stanford
2. https://github.com/Kulbear/deep-learning-coursera

Course Plan

Course Title: Augmented and Virtual Reality Laboratory	
Course Code: 201AIMLP421	**Semester: VIII**
Teaching Scheme: L-T-P: 0-0-2	**Credits: 1**
Evaluation Scheme : ISE Marks: 25	**ESE POE- 25**

Course Description:

This course provides an in-depth introduction to Augmented Reality (AR) and Virtual Reality (VR) technologies, exploring their fundamental principles, applications, and potential impact across various industries. Students will gain hands-on experience with creating AR/VR content and applications, using industry-standard software and development tools.

Course Objectives:

1. To gain knowledge of historical and modern overviews and perspectives on virtual reality.
2. To learn the fundamentals of sensation, perception, and perceptual training.
3. To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.
4. To learn the evaluation of virtual reality from the lens of design.
5. To learn the technology of augmented reality and implement it to gain practical knowledge

Course Outcomes (COs):

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

COs	
C421.1	Understand fundamental Computer Vision, Computer Graphics and Human Computer Interaction Techniques related to VR/AR
C421.2	Understand the Virtual Environment
C421.3	Analyze and Evaluate VR/AR Technologies
C421.4	Apply various types of Hardware and Software in Virtual Reality systems
C421.5	Design and formulate virtual and augmented reality applications.

Prerequisite:	Mathematics, Physics, Programming and Problem Solving, Artificial

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C421.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C421.2	2	2	-	-	-	-	-	-	-	2	-	2	-	-	1
C421.3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	3
C421.4	2	-	2	-	2	-	-	-	-	-	-	-	-	-	2
C421.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2

Exp. No.	Name of the Experiment	S/O	Hours
1	Installation of Unity and Visual Studio, setting up Unity for VR development, and understanding documentation of the same.	S	2
2	Demonstration of the workings of HTC Vive, Google Cardboard, Google Daydream, and Samsung Gear VR.	S	2
3	Develop a scene in Unity that includes: i. a cube, plane, and sphere, apply transformations to the 3 game objects. ii. add a video and audio source.	S	2
4	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click.	O	2
5	Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects. Write a C# program to grab and throw the sphere using vr controller	O	2
6	Develop a simple UI (user interface) menu with images, canvas, sprites and buttons. Write a C# program to interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene	O	2

7	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or using available 3D models.	S	2
8	Include animation and interaction in the immersive environment created in Assignment 7.	S	2
9	Develop a VR Ball Game. The scene should contain a play area surrounded by four walls and a ball that acts as a player. The objective of the game is to keep the ball rolling without colliding with the walls. If it collides with either of the walls, the wall color should change and a text should display on the screen indicating the collision.	O	2
10	Develop a VR Golf Game. The scene should contain a play area (golf course), which consists of a series of cups/holes each having different scores. Display the score card.	O	2
11	Develop a VR game in Unity such that on each gun trigger click, destroy the cubes placed on the plane and gain a score point . Make a score UI and display it on the screen .	S	2
12	Develop a VR Basketball Game. The scene should contain a basketball court. The developed game should be a single player game. The objective of the game is to let the player put the ball in the basket the maximum number of times. Display the score card.	O	2
13	Develop an AR bowling game with one image target .The image target should include 3d models as per requirement. Write a c# program to develop score point system for bowling game. Build an apk. (Note : Vuforia plugin should be installed in unity.)	O	2
14	Develop a VR environment for flying helicopter/moving car simulation.	O	2
15	**Mini-Projects/ Case Study** A) Create a virtual environment for any use case. The application must include at least 4 scenes that can be changed dynamically, a good UI, animation, and interaction with game objects. (e.g VR application to visit a zoo) B) Create a multiplayer VR game (battlefield game). The game should keep track of score, no. of chances/lives, levels (created using different scenes), involve interaction, animation, and immersive environment.	O	2

❖ **S-STUDY, O- OPERATIONAL**

Text Books:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
4. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
5. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381 2.
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Online Resources:

1. http://lavalle.pl/vr/book.html
2. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
3. https://docs.microsoft.com/en-us/windows/mixed-reality/
4. https://docs.microsoft.com/en-us/archive/msdn magazine/2016/november/hololensintroduction-to-the-hololens

Professional Elective-III Laboratory
Course Plan

Course Title : Professional Elective-III Laboratory : High Performance Computing with AI	
Course Code : 201AIMLP422	**Semester : VIII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE-POE Marks : NA**

Course Description:

This course focuses on optimizing serial code by using parallel programming paradigms such as OpenMP, MPI and CUDA. It also discusses the speed and scalability of serial/parallel programs. It covers profiling of a code.

Course Objectives:

1. To introduce software tools and techniques needed to implement parallel programs.
2. To demonstrate different parallel programming paradigms.

Course Outcomes (COs):

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

C422.1	Write parallel algorithm design and taxonomy of parallel architecture.
C422.2	Understand OpenMP and MPI directives and libraries to implement parallel program.
C422.3	Develop different parallel programs.
C422.4	Analyze performance of parallel algorithms designed using Open MP. MPI and CUDA.

Prerequisite:	Computer Architecture , C , C++

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C422.1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	L-3
C422.2	2	1	1	-	-	-	-	-	-	-	-	-	1	-	L-2
C422.3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	L-3
C422.4	1	1	-	1	-	-	-	-	-	-	-	-	-	-	L-4

List of Experiments			
Exp. No.	Name of Experiment	S/O	Hours
1	Study of Processor architecture and networking.	S	2
2	Analytical modeling of sequential algorithm.	O	2
3	Feasibility study of parallel approach.	O	2
4	Implement vector addition using Open MP programming.	O	2
5	Implement matrix multiplication using Open MP Programming.	O	2
6	Implement vector addition using MPI Programming	O	2
7	Implement matrix multiplication using MPI Programming	O	2
8	Implement vector addition using CUDA Programming.	O	2
9	Implement matrix multiplication using CUDA Programming.	O	2
10	Implement a vector addition program using OpenACC	O	2
11	Implement numeric functionality using CuPy	O	2
12	Study of advanced parallel tools like Digits, CuDNN	S	2

13	Develop an application using parallel programming paradigms	O	2
14	Profiling of serial and parallel code	O	2
15	Running code on Deep learning server	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Books:

1. An Introduction to Parallel Programming, Peter S. Pacheco, Morgan Kaufmann Publications 2011.
2. Parallel programming in C with MPI and OpenMP , Michael J Quinn , Tata McGraw Hill , 2003.
3. Programming Massively Parallel Processors, David B. Kirk and Wen-mei W. Hwu , Morgan Kaufmann , 2nd Edition , 2010.

Reference Books:

1. Introduction to Parallel Computing, Ananth Grama, George Karypis, Vipin Kumar & Anshul Gupta, Pearson Education Limited, Second Edition , 2003.
2. Multi-core Programming, Shameem Akhter and Jason Roberts, Intel Press , 2006.
3. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs , Shane Cook , Elsevier Inc , First Edition , 2013.

Online Resources:

1. Introduction to parallel programming with OpenMP and MPI, by Yogish Sabharwal, IIT Delhi.
   https://onlinecourses.nptel.ac.in/noc22_cs21/preview

2. GPU architecture and programming, by Prof. Dey , IIT Kharkpur.
   https://onlinecourses.nptel.ac.in/noc21_cs46/preview

Course Plan

Course Title :Professional Elective-III Laboratory : Natural Language Processing	
Course Code : 201AIMLP423	**Semester : VIII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE-POE Marks : NA**

Course Description:

To demonstrate a Natural Language Processing model using fundamental deep learning algorithms. Also, to build applications based on speech processing and natural language processing.

Course Objectives:

1. Be competent with fundamental concepts for natural language processing.
2. To understand technologies involved in developing speech and language applications.
3. To demonstrate use of deep learning for building applications in natural language processing

Course Outcomes (COs):

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

C423.1	Describe ways to represent speech and words.
C423.2	Demonstrate the working of sequence models for text.
C423.3	Adapt a dialogue system to a specific domain.
C423.4	Execute trials of language systems.

Prerequisite:	Deep Learning

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	Pos												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C423.1	3	2	2	-	-	-	-	-	-	-	-	-	2	-	2
C423.2	2	2	3	-	-	-	-	-	-	-	-	-	2	-	3
C423.3	2	2	3	-	-	-	-	-	-	-	-	-	3	-	2
C423.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-	4

List of Experiments			
Ass. No.	**Name of Experiments**	**S/O**	**Hours**
1	Text preprocessing – Tokenization, handling special chars, Stemming, Lemmatization.	O	2
2	Implement a program to perform word generation.	O	2
3	Implement programs related to morphology, N-Grams, N-Grams Smoothing.	O	2
4	Implementation of Hidden Markov Models.	O	2
5	Creating/using Word2vec and Glov2vec models and testing their performance.	O	2
6	Implement a program to perform automatic word analysis.	O	2
7	Machine translation from German to English/ or Indian language to English.	O	2
8	Program to build POS Tagger, Chunker.	O	2
9	Case Study: i) Language translation ii)Digital phone calls. iii) Data analysis. iv) Text analytics.	S	2
10	Creating a chatbot like a hostel help desk.	O	2

11	Case Study: Alexa speech enabled application development	S	2
12	Google voice API based speech transcription.	O	2

S-STUDY, O-OPERATIONAL:

Text Books:

1. Natural Language Processing with TensorFlow, Thushan Ganegedara, Packt, 2018

Online Resources:

1. https://www.coursera.org/specializations/natural-language-processing

Course Plan

Course Title : Professional Elective-III Laboratory : Data Mining and Business Intelligence Laboratory	
Course Code : 201AIMLP424	**Semester : VIII**
Teaching Scheme : L-T-P : 0-0-2	**Credits : 1**
Evaluation Scheme : ISE Marks : 25	**ESE-POE : -NA**

Course Description:
It covers the implementation of Data Mining algorithms related to prediction and forecasting, and generally improves their performance through interaction with data. Special emphasis will be given to the Machine Learning methods as they provide the real knowledge discovery tools. The related technologies, such as data warehousing and on-line analytical processing (OLAP) will also be discussed. Weka can be used to solve data mining problems.

Course Objectives:
- To apply data preprocessing techniques and tools to solve business problems.
- To study data mining techniques and algorithms in business analytics.

Course Outcomes (COs):

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

C424.1	Apply the concepts of classification of predication of data
C424.2	Apply the concepts of association rule mining
C424.3	Apply the concepts of Business Intelligence Data Mining
C424.4	Develop a prediction model using data mining tools

Prerequisite:	Database Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C424.1	2	-	3	2	3	2	-	-	-	-	-	-	-	-	L-3
C424.2	2	2	2	2	2	-	-	-	-	-	-	-	-	-	L-3
C424.3	2	-	2	1	2	3	-	-	-	-	-	-	-	-	L-3
C424.4	2	3	2	-	2	2	-	-	-	-	-	-	-	-	L-3

List of Experiments			
Exp. No.	Name of Experiments	S/O	Hours
1	Basics of Information Retrieval	S	2
2	Implementation of Decision Tree Algorithm	O	2
3	Implementation of Support Vector Machine algorithm	O	2
4	Implement OLAP Queries	O	2
5	Implementation of Association Rule Mining	O	2
6	Implementation of K means Clustering Algorithm	O	2
7	Implementation of K Nearest Neighbor Algorithm	O	2
8	Build a BI Framework for Decision Making using Weka	O	2
9	Build a BI Framework to display graphs using Weka	O	2
10	Installation of Weka	O	2
11	Use of Weka tool for prediction	O	2
12	Use of Weka tool for Outlier detection	O	2

13	Use of Tableau for data mining	O	2
14	Use of PowerBI for data mining	O	2
15	Mini project	O	2

❖ **S-STUDY, O-OPERATIONAL**

Text Book:

1. Jiawei Han & Micheline Kamber, "Data Mining Concepts & Techniques", 2011, 3rd Edition.
2. Ian H. Witten and Eibe Frank – Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publication – 2016 4th Edition.
3. Rajiv Sabherwal "Business Intelligence" Wiley Publications, 2012.

Reference Books:

1. Margaret H.Dunbam, "Data Mining Introductory and Advanced Topics", Pearson Education 2003.
2. Arun K. Pujari – Data Mining Techniques, Universities Press (India) Pvt. Ltd., 2013 Kindle Edition.

Online Resources:

1. Data Mining by Prof. Pabitra Mitra, IIT Kharagpur
https://nptel.ac.in/courses/106105174/

Course Plan

Course Title: Project-IV	
Course Code: 201AIMLP425	**Semester :VIII**
Teaching Scheme:L-T-P:0-0-4	**Credits:2**
Evaluation Scheme: ISE Marks: 50	**POE Marks: 50**

Course Description:

This course covers theoretical and practical concepts needed to develop a real world application. The course includes practicing the abilities pertaining to the planning, analysis, design, and implementation and testing of software applications. The project - IV is the final part of the work on the report and presents its practical part. During the implementation of the project, undergraduates work out on the results of scientific research obtained at the previous stages of work on the dissertation. Final project allows the student to gain professional skills and experience in research activities.

Course Objectives:

1. Students should learn to design and develop usable User Interface
2. Students should learn to analyze and apply emerging technologies in development of a project
3. Students should learn to test the modules in Project
4. Students should learn to demonstrate working of project

Course Outcomes (COs):

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

C425.1	Design and develop usable User Interface
C425.2	Analyze and apply emerging technologies in development of a project
C425.3	Test the modules in Project
C425.4	Demonstrate working of the project

Prerequisite:	Project - III

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
C425.1	1	2	1	-	-	-	-	-	-	-	-	2	-	-	2
C425.2	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
C425.3	2	3	2	2	1	-	-	-	-	-	-	2	2	-	2
C425.4	2	3	2	2	1	-	-	-	-	-	-	2	2	-	3

Contents

The group will continue to work on the project selected during semester VII and submit the completed Project work to the department at the end of semester VIII as mentioned below.:

1. The workable project.
2. The project report in the bound journal is complete in all respects with the following: -
   i. Problem specifications
   ii. System definition – requirement analysis.
   iii. System design – dataflow diagrams, database design
   iv. System implementation – algorithm, code documentation
   v. Test results and test report.
   vi. In case of object-oriented approach – appropriate process be followed.

Project Calendar

Sr. No.	Task	Period
1	Project Coding	2nd week
2	Testing	5th week
3	Deployment of Project	8th week
4	Documentation	14th week

External Oral Examination will be jointly assessed by a panel of teachers appointed by the head of the Institution.

POE examination will be conducted by internal and external examiners.

Note:

1. Project work should be continually evaluated based on the contributions of the group members, originality of the work, innovations brought in, research and developmental efforts, depth and applicability, etc.
2. Two mid-term evaluations should be done, which includes presentations and demos of the work done.
3. Care should be taken to avoid copying and outsourcing of the project work.
4. Students should participate in Inter College Project Competitions.
5. Students should publish research papers in conferences/ journals based on their project title.
6. Report / Research Paper should be **Plagiarism free.**