

# Dayananda Sagar University

## School of Engineering

Kudlu Gate, Hosur Road, Bengaluru 560068  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**(Artificial Intelligence & Machine Learning)**



### SCHEME - B.TECH – 2020-21 ONWARDS

### VII SEM - COMPUTER SCIENCE & ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S/P	C	SEM	COURSE CODE
1	121	PE	PROFESSIONAL ELECTIVE – 4	CR	3	-	-	-	3	*	AS INDICATED IN THE ELECTIVE LIST
2	121	PE	PROFESSIONAL ELECTIVE – 5	CR	3	-	-	-	3	*	
3	121	OE	OPEN ELECTIVE-3	CR	3	-	-	-	3	*	***
4	121	PROJECT	MAJOR PROJECT PHASE – I	CR	-	-	-	6	3	*	***
					<b>09</b>			<b>06</b>	<b>12</b>		

CR – CREDIT, AU – AUDIT, L – LECTURE, T – TUTORIAL, P – PRACTICAL, S/P – SEMINAR/PROJECT, C – NO. OF CREDITS

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**VII SEM-PROFESSIONAL ELECTIVE – IV&V**



SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PRE-REQUISITE	
			L	T	P	S / P	C	SEM	COURSE CODE
1	20AM47XX	MACHINE VISION	3			-	03	-	-
2	20AM47XX	MACHINE LEARNING FOR HEALTHCARE	3			-	03	VI	20AM360 1
3	20AM47XX	SPEECH AND NLP	3			-	03	-	-
4	20AM47XX	ADVANCED DEEP LEARNING	3				03	VI	20AM360 1
5	20AM47XX	CLOUD COMPUTING	3				03		
6	20AM47XX	GPU ARCHITECTURE AND PROGRAMMING	3				03	-	-
7.	20AM47XX	UG RESEARCH PROJECT-I	-			06	03	-	-

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SCHEME - B.TECH – 2020-21 ONWARDS  
VIII SEM - COMPUTER SCIENCE & ENGINEERING (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

SL	PROGRAM CODE	COURSE CODE	COURSE TITLE	CR / AU	SCHEME OF TEACHING					PRE-REQUISITE	
					L	T	P	S / P	C	SEM	COURSE CODE
1	121	PE	PROFESSIONAL ELECTIVE – 6	CR	3	-	-	-	3	*	AS INDICATE DIN THE ELECTIVE LIST
2	121	Project	MAJOR PROJECT PHASE – I	CR	-	-	-	12	6	*	** *
3	121	INTERNSHIP	INTERNSHIP	CR	-	-	-	6	3		
					<b>03</b>	-	-	<b>18</b>	<b>12</b>		

CR – Credit, AU – Audit, L – Lecture, T – Tutorial, P – Practical, S/P – Seminar/Project, C – No. of Credits

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### VIII SEM-PROFESSIONAL ELECTIVE – VI

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					PREREQUISITE	
			L	T	P	S / P	C	SEM	COURSE CODE
1	20AM48XX	MOBILE COMPUTING AND ANDROID APPLICATION DEVELOPMENT	3			-	03	VI	20AM3604
2	20AM48XX	RESPONSIBLE AI AND ETHICS	3			-	03	-	-
3	20AM48XX	HUMAN-COMPUTER INTERFACE	3			-	03	-	-
4	20AM48XX	UG RESEARCH PROJECT-II	-			06	03	-	-

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### MACHINE VISION

[As per Choice Based Credit System (CBCS) scheme]

### SEMESTER – VII

<b>Subject Code</b> : 20AM47XX	<b>Credits</b> : 03
<b>Hours / Week</b> : 03 Hours	<b>Total Hours</b> : 39 Hours
<b>L-T-P-S</b> : 3-0-0-0	

#### Course Learning Objectives:

This course will enable students to:

1. **Describe** the fundamentals of Machine Vision.
2. **Use** the appropriate techniques for the segmentation of the image data.
3. **Distinguish** between the different edge detection techniques on the given data.
4. **Outline** the concepts of optics, shading and depth.
5. **Apply** the object recognition technique on the given data.

#### Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show **Video/animation** films to explain the functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. Discuss how every **concept can be applied to the real world**.

### UNIT – I

08 Hours

Introduction- Machine vision -Relationship to other fields -Image definitions levels of computation- Binary image processing - Thresholding - Run length encoding Binary algorithms- Definitions - Component labeling - Size filter -Euler number -Region boundary - Area perimeter- compact Distance measures- Distance transforms- Medial axis -Thinning expanding and shrinking, Morphological operators- Simple problems.

Textbook 1- Chapter 2

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### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (Artificial Intelligence & Machine Learning)

UNIT - II	08 Hours
Regions and Edges - Region's segmentation- Automatic thresholding, Limitations of Histogram methods- Region representation- array representation - Hierarchical representation - Split and merge- region merging - Removing weak edges-Region splitting - split and merge - Region growing.	
Text book 1 – Chapter 3	
UNIT - III	08 Hours
EDGE DETECTION: Gradient-Steps in edge deduction-Robert's operator -sober operator- Prewitt operator -Comparison Second derivative operator, Laplacian operator, second derivative- Simple problems using various edge detectors- Gaussian edge Detection -Canny edge detector -Subpixel location estimation -Edge detector performance- methods of Evaluating performance - Figure of merit.	
TEXT BOOK 1- Chapter 5	
UNIT - IV	08 Hours
OPTICS, SHADING AND DEPTH: Optics - lens equation -image resolution -the importance of focallength- depth of field- view volume - exposure- shading - image inductance -illumination - reflector -surface orientation -shape from shading- stereo imaging - cameras in arbitrary position and orientation - stereo matching -edge matching - region correlation shape from x - range imaging - structural lighting - imaging radar- active vision.	
TEXT BOOK 1 – Chapter 8, 9 and 11	
UNIT - V	07 Hours
object recognition- system components - complexity of object recognition - object representation – observer - centered – object-centered representations - feature detection - recognition strategies - classification - Matching Feature indexing - verification - Temperature matching - morphological approach - symbolic- Analogical methods.	
TEXT BOOK 1 – Chapter 15	

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### Course Outcomes:

At the end of the course the student will be able to:

1. **Explain** the fundamentals of Machine Vision.
2. **Utilize** the appropriate techniques for segmentation of the image data.
3. **Compare and contrast** the different edge detection techniques on the given data.
4. **Summarize** the concept of OPTICS, SHADING AND DEPTH.
5. **Apply** the object recognition technique on the given data.

**Table: Mapping Levels of COs to POs / PSOs**

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering Knowledge	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and sustainability	Ethics	team work	Communication	Life-long learning	Project management and team work	Apply the principles of AI	Apply the knowledge gained pertaining to data	develop, and test principles of AI concepts on
CO 1	1	-	-	-	-	-	-	-	-	-	-	-	1	1	1
CO 2	3	2	-	-	-	-	-	-	2	-	-	-	2	2	2
CO 3	3	2	-	-	-	-	-	-	2	-	-	-	2	2	2
CO 4	3	2	-	-	-	-	-	-	2	-	-	-	2	2	2
CO 5	3	2	-	-	-	-	-	-	2	-	-	-	2	2	2

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### **TEXT BOOKS:**

1. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, Machine Vision Published by McGraw-Hill, and IndoAmerican Books, 2016.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications," Springer, 2011.
3. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision," Third Edition, CL Engineering, 2013.

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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**(Artificial Intelligence & Machine Learning)**

### **REFERENCE BOOKS:**

1. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
2. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.

### **E-Resources:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_cs58/preview](https://onlinecourses.nptel.ac.in/noc19_cs58/preview)
2. [https://onlinecourses.nptel.ac.in/noc23\\_ee39/preview](https://onlinecourses.nptel.ac.in/noc23_ee39/preview)

### **Activity Based Learning (Suggested Activities in Class)**

1. Presentation based on Research Papers.
2. Collaborative Activity is minor project development with a team of 4 students.

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MACHINE LEARNING FOR HEALTHCARE [As per Choice Based Credit System (CBCS) scheme]	
SEMESTER – VII	
Subject Code : 20AM47XX	Credits : 03
Hours / Week : 03 Hours	Total Hours : 39 Hours
L-T-P-S : 3-0-0-0	
<p><b>Course Learning Objectives:</b> This course will enable students to:</p> <ol style="list-style-type: none"> <li><b>Summarize</b> the different types of medical data and its Medical Standards, Challenges.</li> <li><b>Explain</b> the different techniques to handle the image and clinical data.</li> <li><b>Apply</b> Modelling techniques, Reinforcement Learning and Natural Language Processing for healthcare data.</li> <li><b>Utilize</b> the suitable Machine Learning and Deep Learning algorithms for various types of healthcare applications.</li> <li><b>Get the idea</b> to build a chatbot and develop a project using the appropriate case study in the healthcare.</li> </ol>	
<p><b>Teaching-Learning Process (General Instructions)</b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li><b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li><b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>	
<b>UNIT – I</b>	<b>08 Hours</b>
<p>Knowing Healthcare Industry: Introduction to healthcare informatics, Introduction to Machine Learning and Deep Learning in Healthcare, Medical Standards and Coding Types, Health Level Seven (HL7); Global Healthcare Challenges and Trends; Past-Present-Future of AI&amp;ML in Healthcare, Electronic Medical Records (EMR), Electronic Health Records (EHR) - Dataflow of EHR, Difference between EHR and EMR.</p>	
<b>UNIT – II</b>	<b>08 Hours</b>

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Advanced Analytics in Health Care: Overview of Clinical Data, Data Types; Data handling techniques – Imputation technique for handling missing data; Synthetic Minority Oversampling Technique for handling imbalanced data, Different types of Data Analysis techniques, Risk Stratification; Survival Modelling; Disease progression Modelling.	
<b>UNIT – III</b>	<b>08 Hours</b>
Medical Image Diagnostics and its Preprocessing: Biomedical Imaging Modalities - Computed Tomography, Magnetic Resonance Imaging, Positron Emission Tomography; Biomedical Signal: Electrocardiogram (ECG), Electroencephalogram (EEG), Segmentation – Thresholding and Region based Segmentation, Image Registration; ML applications in medical Ology space (Cardiology, oncology).	
<b>UNIT – IV</b>	<b>08 Hours</b>
AI/ML and NLP for healthcare: Automating clinical workflow, Regulation of AI/ML, Challenges in deploying ML model, NLP for Healthcare, Re-enforcement learning in healthcare applications, Wearable devices and Medical Bots.	
<b>UNIT – V</b>	<b>07 Hours</b>
Applications of Machine learning models (Linear regression, SVM, Random Forest) and Deep learning models (CNN, RNN....) for the Healthcare area (Case study)	
<b>Course Outcomes:</b> At the end of the course the student will be able to: <ol style="list-style-type: none"> <li><b>1. Explain</b> the different types of medical data and its Medical Standards, Challenges.</li> <li><b>2. Utilize</b> the appropriate techniques to handle the image and clinical data.</li> <li><b>3. Make use of the</b> Modelling techniques, Reinforcement Learning and Natural LanguageProcessing for various healthcare applications</li> <li><b>4. Apply</b> the suitable Machine Learning and Deep Learning algorithms for various typesof healthcare applications.</li> <li><b>5. Build</b> a chatbot and develop a project using the appropriate case study in the healthcare.</li> </ol>	

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**Table: Mapping Levels of COs to POs / PSOs**

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and sustainability	Ethics	team work	Communication	Life-long learning	Project management and	Apply the principal	Apply the knowledge gained pertaining to data	develop, and test principles of AI concepts on
CO1	2	1	-	-	-	-	-	-	2	2	-	-	2	2	2
CO2	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO3	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO4	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO5	3	3	2	-	1	-	-	-	2	2	-	-	2	2	2

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### TEXT BOOKS:

1. SumeetDua, U. RajendraAcharya, PrernaDua , Machine Learning in Healthcare nformatics,Intelligent Systems Reference Library 56, Springer Nature 2014.
2. Sergio Consoli, Diego ReforgiatoRecupero, Milan Petkovic, Data Science for HealthcareMethodologies and Applications.

### REFERENCE BOOKS:

1. Thomas M. Deserno, Fundamentals of Bio-Medical Image processing, Biological andMedical Physics, Biomedical Engineering, Springer, ISBN 978-3-642-15816-2, 2011.
2. Silberschatz, Korth and Sudharshan: "Database System Concepts", Seventh Edition, Mc- GrawHill, 2019.
3. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", EightEdition, Pearson Education, 2012.

### E-Resources:

1. <https://stellar.mit.edu/S/course/HST/sp19/HST.956/>
2. <https://www.coursera.org/learn/fundamental-machine-learning-healthcare>.
3. <https://www.coursera.org/learn/introduction-clinical-data>

### Activity Based Learning (Suggested Activities in Class)

1. Group discussion on different Health Care Problems.
2. Collaborative Activity is minor project development with a team of 4 students.

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### SPEECH PROCESSING AND NATURAL LANGUAGE PROCESSING

[As per Choice Based Credit System (CBCS) scheme]

#### SEMESTER – VII

<b>Subject Code</b>	<b>: 20AM47XX</b>	<b>Credits</b>	<b>: 03</b>
<b>Hours / Week</b>	<b>: 03 Hours</b>	<b>Total Hours</b>	<b>: 39 Hours</b>
<b>L-T-P-S</b>	<b>: 3-0-0-0</b>		

#### **Course Learning Objectives:**

This course will enable students to:

1. Overview and language modeling.
2. Word level and syntactic analysis
3. Extracting Relations from Text: From Word Sequences to Dependency Paths, Semantic Role Labeling
4. Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models
5. Information Retrieval and Lexical Resources

#### **Teaching-Learning Process (General Instructions)**

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show **Video/animation** films to explain the functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the student's understanding.

#### UNIT – I

**08 Hours**

Overview: Past present and future of NLP, Classical problems on text processing; Necessary Math concepts for NLP; Words & Sentences, N-grams, Part of Speech tagging and challenges of Language and Grammar-Processing Indian Languages- NLP Applications, Information Retrieval. Language Modeling: Various Grammar-based Language Models, Statistical Language Model.

#### **TEXT BOOK 1, TEXT BOOK 2 (CHAPTER 4, CHAPTER 5)**

#### UNIT – II

**08 Hours**

**Extracting Relations from Text: From Word Sequences to Dependency Paths:** Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation, Word Matching, Latent Semantic Analysis, and Topic Models.

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<b>Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles:</b> Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling. <b>TEXT BOOK 2</b> <b>CHAPTER 2 AND CHAPTER 4</b>	
<b>UNIT - III</b>	<b>08 Hours</b>
Speech production process - speech sounds and features - Phonetic Representation of Speech - representing-speech in time and frequency domains - Short-Time Analysis of Speech - Short- Time Energy and Zero-Crossing Rate - Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT)- Speech Spectrum - Cepstrum - Mel-Frequency Cepstrum Coefficients - Hearing and Auditory Perception - Perception of Loudness - Critical Bands - Pitch Perception	
<b>TEXT BOOK 3 : CHAPTER 9</b>	
<b>UNIT - IV</b>	<b>08 Hours</b>
Pulse Code Modulation (PCM), Sampling and Quantization of Speech - Adaptive differential PCM - Delta Modulation - Vector Quantization- Introduction to Linear predictive coding (LPC) of Speech - Parameter Estimation- LP Formulation using Generalized Inverse of Matrices - Sample Selective Linear Prediction.	
<b>TEXT BOOK 3</b>	
<b>UNIT - V</b>	<b>07 Hours</b>
Case study to illustrate classical Linear Predictive Coding (LPC) method of speech compression used to reduce the bit rate in digital speech transmission systems.	
<b>TEXT BOOK 5</b>	
<b>Course Outcomes:</b> At the end of the course the student will be able to: <ol style="list-style-type: none"> <li><b>Apply</b> Boolean, Vector-space, and Probabilistic models to retrieve information from a giventext.</li> <li>From a given text, <b>distinguish</b> relations among the sentences and words. <b>examine</b> dependency path from Word Sequences.</li> <li>From a given text, <b>interpret</b> the semantic texts and <b>examine</b> the meaning of the text.</li> <li><b>Formulate</b> correlation between a given speech at a given time applying Short-Time Autocorrelation Function - Short-Time Fourier Transform (STFT).</li> <li><b>Construct</b> NLP model for speech compression using LPC.</li> </ol>	

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**Table: Mapping Levels of COs to POs / PSOs**

Cos	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering knowledge	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and sustainability	Ethics	team work	Communication	Life-long learning	Project management and finance	Apply the principal concepts of AI Engineering	Apply the knowledge gained pertaining to data develop, and test principles of AI	concepts on
CO1	3	2	2	-	-	-	-	-	2	2	-	-	2	2	2
CO2	3	3	2	2	3	-	-	-	2	2	-	-	2	2	2
CO3	3	3	2	2	2	-	-	-	2	2	-	-	2	2	2
CO4	3	3	2	2	3	-	-	-	2	2	-	-	3	2	2
CO5	3	3	3	3	3	2	-	-	2	2	-	-	3	2	2

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### TEXT BOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval," Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer Verlag London Limited 2007.
3. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2008.
4. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummings publishing company, 1995.
5. Author(s): R. E. Stone Source: Digital Signal Processing: principles, devices and applications, 1990, Publication date January 1990.
6. Elsa Harrington, Speech and Language Processing: Computational Linguistics and Natural Language Processing, 2022

### REFERENCE BOOKS:

1. Raju, Kavitha. (2014). Speech Based Voice Recognition System for Natural Language Processing. International Journal of Computer Science and Information Technology.
2. Reshamwala, Alpa & Mishra, Dharendra & Pawar, Prajakta. (2013). REVIEW ON NATURAL LANGUAGE PROCESSING. IRACST – Engineering Science and Technology: An International Journal (ESTIJ). 3. 113-116.
3. A. Celesti, M. Fazio, L. Carnevale and M. Villari, "A NLP-based Approach to



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**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**(Artificial Intelligence & Machine Learning)**

Improve Speech Recognition Services for People with Speech Disorders," 2022  
IEEE Symposium on Computers and Communications (ISCC), Rhodes, Greece,  
2022, pp. 1-6, doi: 10.1109/ISCC55528.2022.9912940.

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### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (Artificial Intelligence & Machine Learning)

4. Santosh Kumar Behera, Mitali M Nayak, Natural Language Processing for Text and Speech Processing: A Review Paper, International Journal of Advanced Research in Engineering and Technology, 11(11), 2020, pp. 1947-1952.

#### **E-Resources:**

1. [https://onlinecourses.nptel.ac.in/noc23\\_cs45/preview](https://onlinecourses.nptel.ac.in/noc23_cs45/preview)

#### **Activity-Based Learning (Suggested Activities in Class)**

1. Better Understanding the concept of Sampling and Semantic Role Labeling Quantization of Speech and using group discussion.
2. Collaborative Activity is minor project development with a team of 4 students.

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ADVANCED DEEP LEARNING [As per Choice Based Credit System (CBCS) scheme]	
SEMESTER – VII	
<b>Subject Code</b> : 20AM47XX	<b>Credits</b> : 03
<b>Hours / Week</b> : 03 Hours	<b>Total Hours</b> : 39 Hours
<b>L-T-P-S</b> : 3-0-0-0	
<p><b><u>Course Learning Objectives:</u></b> This course will enable students to:</p> <ol style="list-style-type: none"> <li><b>Understand</b> the building blocks and working principles of advanced Deep learning models</li> <li><b>Design</b> deep learning models to address novel challenges in practical applications.</li> <li><b>Make use of</b> regularization, training optimization, and hyperparameter selection on deep learning models.</li> </ol>	
<p><b>Teaching-Learning Process (General Instructions)</b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li><b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li><b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>To make <b>Critical thinking</b>, ask at least three Higher-order Thinking questions in the class.</li> <li>Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>	
<b>UNIT – I</b>	<b>08 Hours</b>
<b>INTRODUCTION TO RNN:</b> Basics of RNN, RNN's Computational Graph across Time, RNN's For Sequence Modeling- Language Modeling, Back Propagation Through Time, Standard RNN Gradient Flow, LSTM Network	
<b>UNIT – II</b>	<b>08 Hours</b>
<p><b>REGULARIZATION AND OPTIMIZATION OF DEEP NEURAL NETWORKS:</b> Hyperparameter Tuning of RNN, Regularization- Different types of regulations, Regularization techniques- Lasso Regularization, Ridge Regularization, Elastic Net Regularization, Optimization, optimization techniques- Batch and Minibatch Algorithms. Adam, Challenges in Neural Network Optimization</p>	

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<b>UNIT - III</b>		<b>08 Hours</b>
<b>DEEP LEARNING MODELS:</b> RESNET- Types, YOLO-object detection with YOLO, Fast R-CNN-components and classification, Faster R-CNN-components, and classification, RCNN vs Fast R-CNN vs Faster R-CNN		
<b>UNIT - IV</b>		<b>08 Hours</b>
<b>GENERATIVE MODELS:</b> Generative Modelling-Hidden Markov Models (HMMs), Gaussian mixture model, Autoencoders, Variational Autoencoders, Latent Perturbations, Variational autoencoders vs Generative modeling		
<b>UNIT - V</b>		<b>07 Hours</b>
<b>SUCCESS STORIES AND LIMITATIONS OF USING DL:</b> Limitations and New Frontiers, Bias and Fairness, Taming Dataset Bias, Success Stories from Industry Domains <b>APPLICATIONS OF RNN:</b> Music Generation, Sentiment Classification, Machine Translation, Environment Modeling, Stock Market Prediction, Next Word Prediction.		
<b>Course Outcomes:</b> At the end of the course, the student will be able to: <ol style="list-style-type: none"> <li>1. Identify and <b>apply</b> the learnt deep learning algorithms on specific tasks in various domains</li> <li>2. <b>Implement</b> deep learning algorithms and solve real-world problems in various domains</li> <li>3. To <b>use</b> learnt models for solving a few real-life problems.</li> <li>4. <b>Understand</b> and <b>analyze</b> the Applications of Deep Learning Work in teams to implement/simulate applications of CNN and RNN</li> <li>5. <b>Apply</b> new deep learning models to address novel challenges in practical applications</li> </ol>		

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**Table: Mapping Levels of COs to POs / PSOs**

COs	Program Outcomes (POs)												PSOs		
	Engineering Problem Design	Conduct investigation of complex tool usage	The engineer Environment and Ethics teamwork	Communications	Life-long Project management	Apply the principal concepts of AI	Apply the knowledge gained pertaining to	develop, and test principles of AI concepts							
CO1	3	1	2	-	3	1	-	3	2	-	2	3	-	1	
CO2	3	2	2	2	3	1	-	2	3	2	2	3	2	2	
CO3	3	3	3	-	3	1	-	-	3	2	-	2	3	-	
CO4	3	3		-	3	2	-	-	3	2	-	2	3	2	
CO5	3	1	2	-	3	1	-	-	3	2	-	2	3	-	

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

### TEXT BOOKS:

1. Aston Zhang, Zachary C. Lipton, Mu Li, And Alexander J. Smola, "Dive Into Deep Learning", April 2021
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016.

### REFERENCE BOOKS:

1. Palash Goyal Sumit Pandey Karan Jain, "Deep Learning For Natural Language Processing : Creating Neural Networks With Python", Apress, 2018
2. Umberto Michelucci, "Applied Deep Learning A Case-Based Approach To Understanding Deep Neural Networks", 2018
3. Aurelien Geron, Hands-On Machine Learning With Scikit-Learn & Tensorflow: Concepts, Tools, And Techniques To Build Intelligent Systems, O'Reilly, 2017
4. Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly Media; 1 Edition (August 19, 2017)

### E-Resources:

1. Deep Learning A-Z™: Hands-On Artificial Neural Networks | Udemy
2. Deep Learning by deeplearning.ai | Coursera

### Activity Based Learning (Suggested Activities in Class)

1. The Applications of Deep Learning using group discussion.
2. Collaborative Activity is minor project development with a team of 4 students.

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
(Artificial Intelligence & Machine Learning)

CLOUD COMPUTING [As per Choice Based Credit System (CBCS) scheme]	
SEMESTER – VII	
Subject Code : 20AM47XX	Credits : 03
Hours / Week : 03 Hours	Total Hours : 39 Hours
L-T-P-S : 3-0-0-0	
<p><b>Course Learning Objectives:</b> This course will enable students to:</p> <ol style="list-style-type: none"> <li><b>Understand</b> various basic concepts related to cloud computing technologies.</li> <li><b>Contrast</b> various programming models used in cloud computing.</li> <li><b>Choose</b> appropriate cloud model for a given application.</li> </ol>	
<p><b>Teaching-Learning Process (General Instructions)</b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li><b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li><b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and role-playing.</li> <li>Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>	
UNIT – I	08 Hours
<p><b>INTRODUCTION TO CLOUD COMPUTING</b></p> <p>Introduction, Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing</p> <p><b>Text Book 1: Chapter 1</b></p>	
UNIT – II	08 Hours

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<b>TYPES OF CLOUDS</b> Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges.  Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects. <b>Text Book 1: Chapter 4</b>	
<b>UNIT - III</b>	<b>08 Hours</b>
<b>CLOUD SERVICES AND PLATFORMS</b>  Building Cloud Computing Environments, Application Development, Infrastructure and System Development. Computing Platforms and Technologies, Amazon Web Services (AWS), Google AppEngine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka. Cloud Computing Architecture-Introduction, Cloud Reference Model- Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service.  <b>Text Book 1: Chapter 1, Chapter 4</b>	
<b>UNIT - IV</b>	<b>08 Hours</b>
<b>CLOUD APPLICATION PLATFORM-ANEKA</b>  Aneka: Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.  <b>Text Book 1: Chapter 5</b>	
<b>UNIT - V</b>	<b>07 Hours</b>

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### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (Artificial Intelligence & Machine Learning)

#### CLOUD PLATFORMS IN INDUSTRY

Concurrent Computing: Thread Programming, Introducing Parallelism for Single Machine Computation.

Cloud Platforms in Industry, Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

#### Text Book 1: Chapter 9

#### Course Outcomes:

At the end of the course the student will be able to:

1. **Discuss** the reference models, characteristics, and benefits of cloud computing.
2. **Compare and contrast** cloud architecture, computing platforms, and technologies.
3. **Illustrate** different types of clouds.
4. **Describe** the framework, cloud deployment mode and services in Aneka.
5. **Apply** the web services and search engines in industry.

**Table: Mapping Levels of COs to POs / PSOs**

Cos	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering	Problem analysis	Design	Conduct investigations of complex problems	tool usage	The engineer and	Environment and sustainability	Ethics	teamwork	Communication	Life-long learning	Project management and finance	Apply the principal concepts of AI	Apply the knowledge gained pertaining to develop, and test principles of AI	
CO1	3	1	-	-	-	-	-	-	-	-	-	1		1	-
CO2	3	1	-	-	-	-	-	-	-	-	-	1		1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1		1	-
CO4	3	1	-	-	-	-	-	-	-	-	-	1		1	-
CO5	2	2	-	-	-	-	-	-	-	-	-	1		1	-

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

#### TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education, 2013.

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#### **(Artificial Intelligence & Machine Learning)**

#### **REFERENCE BOOKS:**

1. Cloud Computing, Dr. Kumar Saurabh, Wiley Publications, 2012
2. Guide to Cloud Computing, Richard hill, Springer Publications, 2013
3. Cloud Computing A Practical Approach, Anthony T Velte et.al, MC Graw Hill publications, 2014

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- 4.
5. Cloud Computing Principles and Paradigms, Rajkumar Buyya et.al, Wiley Publications, 2015
6. Cloud Computing Technologies and Strategies of the Ubiquitous data center, Brain J.S et.al, CRC Press

### **Activity Based Learning (Suggestion Activities in Class)**

- Presentation
- Collaborative Activity is minor project development with a group of 4 students.

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### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

(Artificial Intelligence & Machine Learning)

GPU ARCHITECTURE AND PROGRAMMING [As per Choice Based Credit System (CBCS) scheme]	
SEMESTER – VII	
Subject Code : 20AM47XX	Credits : 03
Hours / Week : 03 Hours	Total Hours : 39 Hours
L-T-P-S : 3-0-0-0	
<b>Course Learning Objectives:</b> This course will enable students to: <ol style="list-style-type: none"> <li>1. To understand the basics of GPU architectures</li> <li>2. To write programs for massively parallel processors</li> <li>3. To understand the issues in mapping algorithms for GPUs</li> <li>4. To introduce different GPU programming models</li> </ol>	
<b>Teaching-Learning Process (General Instructions)</b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> <li>1. <b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li>2. <b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>3. Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>4. Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>5. Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>	
<b>UNIT – I</b>	<b>08 Hours</b>
<b>Evolution of GPU architectures</b> – Understanding Parallelism with GPU – Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory. <b>(Text Book-1: Chapter 1: 1.1 to 1.4, 1.6, Chapter 2: 2.1, 2.2, 2.4)</b>	
<b>UNIT – II</b>	<b>08 Hours</b>
<b>CUDA PROGRAMMING Using CUDA</b> – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions. <b>(Text Book-1: Chapter 3: 3.1 to 3.3).</b>	
<b>UNIT – III</b>	<b>08 Hours</b>
<b>PROGRAMMING ISSUES Common Problems:</b> CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors. <b>(Text Book-1: Chapter 5: 5.2, 5.3) (Text Book-2 Chapter 1: 1.1 to 1.5)</b>	
<b>UNIT – IV</b>	<b>08 Hours</b>

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**(Artificial Intelligence & Machine Learning)**

<b>OPENCL BASICS</b> OpenCL Standard – Kernels – Host Device Interaction – Execution Environment –Memory Model – Basic OpenCL Examples. <i>(Text Book-1: Chapter 14: 14.1 to 14.5).</i>	
<b>UNIT – V</b>	<b>07 Hours</b>
<b>ALGORITHMS ON GPU</b> Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster. <i>(Text Book-2: Chapter 20: 20.1 to 20.5, Chapter 21: 21.1 to 21.3, Chapter 22: 22.1 to 22.4)</i>	
<b>Course Outcomes:</b> At the end of the course the student will be able to: <ol style="list-style-type: none"> <li>1. Outline GPU computing architecture.</li> <li>2. Make use of parallel programming to decompose a problem</li> <li>3. Demonstrate GPU programming environments.</li> <li>4. Design programs that make efficient use of the GPU processing power.</li> <li>5. Experiment with GPU to provide massive acceleration for specialized tasks such as AI.</li> </ol>	

Table: Mapping Levels of COs to POs / PSOs																
CO s	Program Outcomes (POs)												PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
	Engineering knowledge	Problem analysis	Design	Conduct investigations	tool usage	The engineer and	Environment and	Ethics	team work	Communication	Life-long learning	Project management and finance	Apply the principal concepts of AI	Apply the knowledge gained pertaining to	develop, and test principles of AI	concepts on Intelligent
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO 1	3	3	2	-	-	-	-	-	-		-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	2	2	-	-	-	-	-	-
CO 3	3	2	1	-	1	-	-	-	2	2	-	-	1	2	-	-
CO 4	3	1	1	-	1	-	-	-	2	2	-	-	2	2	-	-
CO 5	3	2	2	-	2	-	-	-	2	2	-	-	3	2	-	-
3: Substantial (High)      2: Moderate (Medium)      1: Poor (Low)																

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### DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

#### (Artificial Intelligence & Machine Learning)

#### TEXT BOOKS:

1. Shane Cook, CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012
2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, —Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.

#### REFERENCE BOOKS:

1. Learn CUDA Programming - Jaegeun Han, Bharatkumar Sharma Packt Publishing, 27-Sept-2019 - 508 pages.
2. Parallel Computing for Data Science (Chapman & Hall/CRC The R Series) 1st Edition

#### E-Resources:

<https://developer.nvidia.com/cuda-toolkit>  
<https://developer.nvidia.com/opencl>  
<https://leonardoaraujosantos.gitbook.io/opencl/chapter1>  
<https://github.com/topics/opencl>  
<https://github.com/mikeroyal/OpenCL-Guide>

#### Activity Based Learning (Suggested Activities in Class)

1. Group discussion on how to optimize the machine learning algorithms or a whole neural network using CUDA.
2. Collaborative Activity is minor project development with a team of 4 students.

#### Prerequisites:

- Basic understanding of CPU scheduling, process and threading and memory handling.

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**(Artificial Intelligence & Machine Learning)**

UG RESEARCH PROJECT-I			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – VII			
<b>Subject Code</b>	: 20AM47XX	<b>Credits</b>	: 03
<b>Hours / Week</b>	: 0	<b>Total Hours</b>	: Hours
<b>L-T-P-S</b>	: 0-0-0-6		
<p><b><u>Course Learning Objectives:</u></b> This course will enable students to:</p> <ol style="list-style-type: none"> <li><b>To identify</b> key research questions within a field to carry out research in a team.</li> <li><b>To identify</b> and summarize the literature review of the relevant field.</li> <li><b>To demonstrate</b> relevant referencing and inculcate new skills in various aspects of academic writing.</li> <li><b>To demonstrate</b> the knowledge and understanding of writing the publication/report.</li> <li><b>To showcase</b> the strong evidence on the clarity of the argument, understanding of the selected domain area and presentation of its technical information.</li> <li><b>To detail description</b> of the process of carrying out the independent research in written document along with results and conclusions with reference to the existing literature.</li> <li><b>To analyze</b> and synthesize the new research findings.</li> </ol>			
<p><b><u>Teaching-Learning Process (General Instructions)</u></b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li>Lecture method means it includes not only the traditional lecture method but a different type of teaching method that may be adopted to develop the course outcomes.</li> <li>Interactive Teaching: Adopt Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>Show Video/animation films to explain the functioning of various concepts.</li> <li>Encourage Collaborative (Group Learning) Learning in the class.</li> <li>To make Critical thinking, ask at least three Higher-order Thinking questions in the class.</li> <li>Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the student's understanding.</li> </ol>			

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#### (Artificial Intelligence & Machine Learning)

#### **COURSE CONTENT:**

The research topic proposed by both the guide and the student team should be approved by the department chairman to proceed further. A degree of industrial input and involvement will be encouraged, and can be facilitated through existing academic-industrial collaborations or by addressing specific topics that are of interest to industrial partners.

All projects will be closely supervised by the Project Guide with ongoing feedback and guidance at all stages of the project from conception to completion.

The following criteria will be checked by the department chairman to approve for the research proposal:

- a. Department staff as course guide
  1. Ability to provide research direction to the student in the chosen field of interest
  2. Ability to design an appropriate research strategy and methodology to carry out the research by student
  3. Ability to provide and evaluate the strong literature review document for the chosen research topic
  4. Ability to train students on research paper / technical writing skills
  5. Conduct reviews in regular time period and submit the evaluation to department chairman
- b. Student Team
  1. To be dedicated and committed to work on a new research topic by learning new technical skills
  2. To have fair knowledge on what is product development or research topic
  3. To have constant interaction with allocated guide by providing weekly updates
  4. To be committed to complete the project and submitting the technical paper within the stipulated time framed by the university

#### **Evaluation:**

There will be CIA evaluation as well as the Semester end evaluation of the work done. It will be done by a committee of senior researchers of the Department.

#### **Course Outcomes:**

At the end of the course the student will be able to:

1. Develop the research project by selecting an appropriate research problem.
2. Compare the papers relevant to the selected problem domain.
3. Construct the model and perform the model evaluation and analysis.
4. Draft of the Publication or Demonstration of the Proof-of- concept product, Draft of patent application.

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Table: Mapping Levels of COs to POs / PSOs															
CO s	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering knowledge	Problem analysis	Design	Conduct investigations	tool usage	The engineer and	Environment and	Ethics	team work	Communication	Life-long learning	Project management and finance	Apply the principal concepts of AI	Apply the knowledge gained pertaining to	develop, and test principles of AI concepts on Intelligent
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	2	-	2	-	-	2	-	3	2	2	3	3	2
CO 2	2	1	-	-	-	-	-	2	-	3	2	2	1	1	1
CO 3	3	3	3	2	3	1	-	2	-	3	2	2	3	3	3
CO 4	3	3	3	2	1	-	-	2	-	3	2	1	2	2	2
3: Substantial (High)                      2: Moderate (Medium)                      1: Poor (Low)															

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING  
(Artificial Intelligence & Machine Learning)

<b>MOBILE COMPUTING AND APPS DEVELOPMENT</b> [As per Choice Based Credit System (CBCS) scheme]	
<b>SEMESTER – VIII</b>	
<b>Subject Code : 20AM48XX</b>	<b>Credits : 03</b>
<b>Hours / Week : 03 Hours</b>	<b>Total Hours : 39 Hours</b>
<b>L-T-P-S : 3-0-0-0</b>	
<b><u>Course Learning Objectives:</u></b> This course will enable students to: <ol style="list-style-type: none"> <li>1. Understand the basic concepts of mobile computing</li> <li>2. Learn the setup of the Android development environment</li> <li>3. Illustrate the interaction of the app with the user interface and handling various activities</li> <li>4. Identify the options for saving the persistent application data</li> <li>5. Gain knowledge about different mobile platforms and application development</li> </ol>	
<b><u>Teaching-Learning Process (General Instructions)</u></b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none"> <li>1. <b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li>2. <b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>3. Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>4. Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>5. Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>	
<b>UNIT – I</b>	<b>08 Hours</b>
<b>INTRODUCTION TO MOBILE COMPUTING</b>  Introduction to mobile computing, Architecture of mobile network, Generations of mobile communication, mobile operating systems, Application of mobile communication, Challenges of mobile communication.	



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**(Artificial Intelligence & Machine Learning)**

UNIT - II	08 Hours
Introduction, trends, platforms, Android Development Setup like, Android Studio, Eclipse, Android SDK, tools. Emulator setup. App behavior on the Android Runtime (ART). Platform Architecture. Application framework and basic App Components resources. Hello World program in Android Studio.	
UNIT - III	08 Hours
MOBILE APP DEVELOPMENT USING ANDROID:	
Android user Interface – Layouts (Linear, Absolute, Table, Relative, Frame and Scroll), values, assetXML representation, generate R.java file, Android manifest file. Activities, Intent and UI Design - activities life-cycle. Android Components – layouts, fragments, basic views (Button, Edit Text, Check box, Toggle Button, Radio Button), list views, picker views, adapter views, Spinner views, Menu, Action Bar and Managing data using SQLite database (Database create, Read, Update and delete).	
UNIT - IV	08 Hours
MESSAGING AND LOCATION BASED SERVICES Sending SMS and mail, Google Maps – Displaying Google Maps in Android application, Networking – How to connect to Web using HTTP, Publishing Android Applications – how to prepare application for deployment, exporting application as an APK file and signing it with new certificate, Introduction to new android application and publish the android application on market place	
UNIT - V	07 Hours
DATA PERSISTENCE AND GOOGLE APIS FOR ANDROID: Introduction of Google APIs for Android. SQLite Databases. CROSS-PLATFORM APP DEVELOPMENT - Introduction to Cross platform App Development - Difference to native apps, Pros and cons, Development tools.	
<b>Course Outcomes:</b> At the end of the course, the student will be able to: <ol style="list-style-type: none"> <li>1. <b>Create</b>, test, and debug Android applications by setting up the Android development environment.</li> <li>2. <b>Implement</b> adaptive and responsive user interfaces that work across various devices.</li> <li>3. <b>Demonstrate</b> the techniques involved to store, share, and retrieve data in Android applications.</li> <li>4. <b>Acquire</b> technical competency and skills in developing applications using Android and cross-platform.</li> </ol>	





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Table: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	Engineering knowledge	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and	Ethics	team work	Communication	Life-long learning	Project management and finance	Apply the principal concepts of AI	Apply the knowledge gained pertaining to data storage	develop, and test principles of AI concepts
C01	3	1	-	-	1	-	-	-	2	2	-	-	2	2	2
C02	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
C03	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
C04	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2

3: Substantial (High)

2: Moderate (Medium)

1: Poor (Low)

### TEXT BOOKS:

1. Mobile Cloud Computing by Debashis De, CRC Press, Taylor & Francis Group, 2016.
2. Head First Android Development by Jonathan Simon O'reilly Publication, 2021.

### REFERENCE BOOKS:

1. Learning Android by Marko Gargenta O'reilly Publications, 2011.
2. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, NewDelhi, 2007.
3. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles ofMobile Computing", Springer, 2003.
4. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India PvtLtd, 2014.
5. F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, WileyIndia Pvt Ltd, 2016



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#### **E-Resources:**

1. <https://stellar.mit.edu/S/course/HST/sp19/HST.956/>
2. <https://www.coursera.org/learn/fundamental-machine-learning-healthcare>.
3. <https://www.coursera.org/learn/introduction-clinical-data>

#### **Activity Based Learning (Suggested Activities in Class)**

1. Group discussion on skills in developing applications using Android and cross-platform.
2. Collaborative Activity is minor project development with a team of 4 students.

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**RESPONSIBLE AI AND ETHICS**

[As per Choice Based Credit System (CBCS) scheme]

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SEMESTER – VIII			
<b>Subject Code</b>	<b>: 20AM48XX</b>	<b>Credits</b>	<b>: 03</b>
<b>Hours / Week</b>	<b>: 03 Hours</b>	<b>Total Hours</b>	<b>: 39 Hours</b>
<b>L-T-P-S</b>	<b>: 3-0-0-0</b>		
<p><b><u>Course Learning Objectives:</u></b> This course will enable students to:</p> <ol style="list-style-type: none"> <li>1. <b>Understand</b> the impact of analytics and AI/ML on individuals and society.</li> <li>2. <b>Identify</b> the problems associated with Big Data using the appropriate technique.</li> <li>3. <b>Apply</b> AI/ML techniques on identifying fairness and bias issues.</li> <li>4. <b>Use</b> Tools and methods to quantify bias.</li> <li>5. <b>Develop</b> the project using the case study.</li> </ol>			
<p><b>Teaching-Learning Process (General Instructions)</b> These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.</p> <ol style="list-style-type: none"> <li>7. <b>Lecture method</b> means it includes not only the traditional lecture method but a different <i>type of teaching method</i> that may be adopted to develop the course outcomes.</li> <li>8. <b>Interactive Teaching: Adopt Active learning</b> that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.</li> <li>9. Show <b>Video/animation</b> films to explain the functioning of various concepts.</li> <li>10. Encourage <b>Collaborative</b> (Group Learning) Learning in the class.</li> <li>11. To make <b>Critical thinking</b>, ask at least three Higher-order Thinking questions in the class.</li> <li>12. Discuss how every <b>concept can be applied to the real world</b> - and when that's possible, it helps improve the student's understanding.</li> </ol>			
<b>UNIT – I</b>			<b>08 Hours</b>
Data, Individuals, and Society: The power and impact that analytics and AI/ML have on individuals and society, especially concerning issues such as fairness and bias, ethics, legality, data collection and public use.			
<b>UNIT – II</b>			<b>09 Hours</b>
Big Data: Components of big data, basic statistical techniques to data scenarios, and understand the issues faced when learning from big data, ranging from data biases, overfitting, causation vs			

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correlation, etc.	
<b>UNIT - III</b>	<b>10 Hours</b>
Privacy and Fairness in AI/ML: Use of AI/ML techniques to data scenarios, with a focus on identifying fairness and bias issues found in the design of decision-making systems. Technical approaches to current AI/ML applications such as facial recognition, natural language processing, and predictive algorithms, all while being mindful of its social and legal context.	
<b>UNIT - IV</b>	<b>12 Hours</b>
Tools and methods to quantify bias and examine ways to use algorithmic fairness to mitigate this bias, taking into consideration ethical and legal issues associated with it. Knowledge of analytics and AI/ML to transform a current biased data-set into a more objective solution.	
<b>UNIT - V</b>	<b>07 Hours</b>
Case Studies : <ol style="list-style-type: none"> <li>1. Robustness and beneficial AI</li> <li>2. Benefits and dangers of super-intelligence</li> <li>3. Rationality in Advanced Artificial Agents</li> <li>4. Artificial Morality</li> </ol>	
<b><u>Course Outcomes:</u></b> At the end of the course the student will be able to: <ol style="list-style-type: none"> <li>1. <b>Explain</b> impact of analytics and AI/ML on individuals and society.</li> <li>2. <b>Analyse</b> the problems associated with Big Data using the appropriate technique.</li> <li>3. <b>Apply</b> AI/ML techniques on identifying fairness and bias issues.</li> <li>4. <b>Apply</b> Tools and methods to quantify bias.</li> <li>5. <b>Develop</b> the project using the case study.</li> </ol>	



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**Table: Mapping Levels of COs to POs / PSOs**

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering knowledge	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and sustainability	Ethics	team work	Communication	Life-long learning	Project management and	Apply the principal	Apply the knowledge gained pertaining to data	develop, and test principles of AI concepts on Intelligent
CO 1	1	1	-	-	-	-	-	-	2	2	-	-	2	2	2
CO 2	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO 3	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO 4	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO 5	3	3	2	-	1	-	-	-	2	2	-	-	2	2	2

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

**TEXT BOOKS:**

1. O'neil, Cathy. Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books, 2016.
2. Kearns, Michael, and Aaron Roth. The ethical algorithm: The science of socially aware algorithm design. Oxford University Press, 2019.

**REFERENCE BOOKS:**

1. S. J. Russell, D. Dewey, and M. Tegmark, 'Research priorities for robust and beneficial artificial intelligence', AI Magazine, 2015.
2. Bostrom, N. (2014), Superintelligence: Paths, Dangers, Strategies, Oxford University Press, Chapters 2-6.



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3. Bostrom, N. (2012). The Superintelligent Will: Motivation and Instrumental Rationality in Advanced Artificial Agents. Minds & Machines 22: 71-85.
4. Allen, C., Smit, I., Wallach, W. (2005) 'Artificial morality: Top-down, bottom-up, and hybrid approaches', Ethics and Information Technology ; 7, 149-155
5. Lake, B. M., Ullman, T. D., Tenenbaum, J. B., Gershman, S. J. (2017) 'Building machines that learn and think like people', Behavioral and Brain Sciences, e253.

### **E-Resources:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_ee56/](https://onlinecourses.nptel.ac.in/noc19_ee56/)
2. <https://nptel.ac.in/courses/106106046>

### **Activity Based Learning (Suggested Activities in Class)**

1. Group Discussion.
2. Collaborative Activity on case studies with a team of 4 students.

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### HUMAN-COMPUTER INTERFACE

[As per Choice Based Credit System (CBCS) scheme]

#### SEMESTER - VIII

<b>Subject Code</b>	<b>: 20AM48XX</b>	<b>Credits</b>	<b>: 03</b>
<b>Hours / Week</b>	<b>: 03 Hours</b>	<b>Total Hours</b>	<b>: 39 Hours</b>
<b>L-T-P-S</b>	<b>: 3-0-0-0</b>		

#### Course Learning Objectives:

This course will enable students to:

1. **Describe** effective and usable graphical computer interfaces.
2. **Describe and apply** core theories, models, and methodologies from the field of HCI.
3. **Choose** an appropriate approach for interface designing.
4. **Make use of** the components to build new and navigation schemes in windows.
5. **Build** the model in the field of HCI.

#### Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. **Interactive Teaching: Adopt Active learning** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show **Video/animation** films to explain the functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. Discuss how every **concept can be applied to the real world** - and when that's possible, it helps improve the student's understanding.

<b>UNIT - I</b>	<b>08 Hours</b>
Introduction: Introduction: Importance of user Interface – definition, the importance of 8 good designs. Benefits of good design. A brief history of Screen design. The graphical user interface – the popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.	
<b>UNIT - II</b>	<b>09 Hours</b>



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Design Process: Human interaction with computers, the importance of 8 human characteristics human consideration, Human interaction speeds, and understanding of business junctions. III Screen Designing: Design goals – Score.	
<b>UNIT – III</b>	<b>10 Hours</b>
Screen Designing: Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – visually pleasing composition – the amount of information – focus and emphasis – presentation of information simply and meaningfully – information retrieval on the web – statistical graphics – Technological consideration in interface design.	
<b>UNIT – IV</b>	<b>12 Hours</b>
Windows: New and Navigation schemes selection of window, 8 selection of devices based and screen-based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.	
<b>UNIT – V</b>	<b>07 Hours</b>
Software Tools Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	
<b>Course Outcomes:</b> At the end of the course the student will be able to: <ol style="list-style-type: none"> <li>1. <b>Describe</b> effective and usable graphical computer interfaces.</li> <li>2. <b>Design</b> effective HCI for individuals and persons with disabilities.</li> <li>3. <b>Choose</b> an appropriate approach for interface designing and <b>assess the importance of user feedback</b>.</li> <li>4. <b>Make use of</b> the components to build new and navigation schemes in windows.</li> <li>5. <b>Demonstrate</b> the HCI implications for designing multimedia/eCommerce/e-learning websites.</li> </ol>	





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**Table: Mapping Levels of COs to POs / PSOs**

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	Engineering knowledge	Problem analysis	Design	Conduct investigations of	tool usage	The engineer and society	Environment and sustainability	Ethics	team work	Communication	Life-long learning	Project management and	Apply the principles	Apply the knowledge gained pertaining to data	develop, and test principles of AI concepts on
CO 1	1	2	-	-	-	-	-	-	2	2	-	-	2	2	2
CO 2	3	2	2	-	1	-	-	-	2	2	-	-	2	2	2
CO 3	3	2	-	-	1	-	-	-	2	2	-	-	2	2	2
CO 4	3	2	2	-	1	-	-	-	2	2	-	-	2	2	2
CO 5	3	3	2	-	1	-	-	-	2	2	-	-	2	2	2
3: Substantial (High)			2: Moderate (Medium)						1: Poor (Low)						

### TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition rentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer nteraction, Wiley, 2010.
3. Samit Bhattacharya. (2019). Human-Computer Interaction: User-Centric Computing for Design, McGraw Hill Education (1st ed).
4. Bruce R Maxim & Roger S Pressman (2019). Software Engineering: A Practitioner's Approach. (8th ed). McGraw Hill Education.

### REFERENCE BOOKS:

1. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer

### E-Resources:

1. <https://archive.nptel.ac.in/courses/106/106/106106177/>



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2. [https://onlinecourses.nptel.ac.in/noc22\\_cs125/](https://onlinecourses.nptel.ac.in/noc22_cs125/)

### Activity Based Learning (Suggested Activities in Class)

1. Quiz.
2. Collaborative Activity is minor project development with a team of 4 students.

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UG RESEARCH PROJECT-II			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – VII			
Subject Code	: 20AM48XX	Credits	: 03
Hours / Week	: 0	Total Hours	: Hours
L-T-P-S	: 0-0-0-6		
<p><b>Course Learning Objectives:</b> This course will enable students to:</p> <ol style="list-style-type: none"> <li>1. <b>To identify</b> key research questions within a field to carry out research in a team.</li> <li>2. <b>To identify</b> and summarize the literature review of the relevant field.</li> <li>3. <b>To demonstrate</b> relevant referencing and inculcate new skills in various aspects of academic writing.</li> <li>4. <b>To demonstrate</b> the knowledge and understanding of writing the publication/report.</li> <li>5. <b>To showcase</b> the strong evidence on the clarity of the argument, understanding of the selected domain area and presentation of its technical information.</li> <li>6. <b>To detail description</b> of the process of carrying out the independent research in written document along with results and conclusions with reference to the existing literature.</li> <li>7. <b>To analyze</b> and synthesize the new research findings.</li> </ol>			



### Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

13. Lecture method means it includes not only the traditional lecture method but a different type of teaching method that may be adopted to develop the course outcomes.
14. Interactive Teaching: Adopt Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
15. Show Video/animation films to explain the functioning of various concepts.
16. Encourage Collaborative (Group Learning) Learning in the class.
17. To make Critical thinking, ask at least three Higher-order Thinking questions in the class.
18. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the student's understanding.

### COURSE CONTENT:

The research topic proposed by both the guide and the student team should be approved by the department chairman to proceed further. A degree of industrial input and involvement will be encouraged, and can be facilitated through existing academic-industrial collaborations or by addressing specific topics that are of interest to industrial partners.

All projects will be closely supervised by the Project Guide with ongoing feedback and guidance at all stages of the project from conception to completion.

The following criteria will be checked by the department chairman to approve for the research proposal:

- a. Department staff as course guide
  1. Ability to provide research direction to the student in the chosen field of interest
  2. Ability to design an appropriate research strategy and methodology to carry out the research by student
  3. Ability to provide and evaluate the strong literature review document for the chosen research topic
  4. Ability to train students on research paper / technical writing skills
  5. Conduct reviews in regular time period and submit the evaluation to department chairman
- b. Student Team
  1. To be dedicated and committed to work on a new research topic by learning new technical skills
  2. To have fair knowledge on what is product development or research topic



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3. To have constant interaction with allocated guide by providing weekly updates
4. To be committed to complete the project and submitting the technical paper within the stipulated time framed by the university

### **Evaluation:**

There will be CIA evaluation as well as the Semester end evaluation of the work done. It will be done by a committee of senior researchers of the Department.

### **Course Outcomes:**

the end of the course the student will be able to:

1. Develop the research project by selecting an appropriate research problem.
2. Compare the papers relevant to the selected problem domain.
3. Construct the model and perform the model evaluation and analysis.
4. Draft of the Publication or Demonstration of the Proof-of- concept product, Draft of patent application.



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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	2	-	2	-	-	2	-	3	2	2	3	3	2
CO 2	2	1	-	-	-	-	-	2	-	3	2	2	1	1	1
CO 3	3	3	3	2	3	1	-	2	-	3	2	2	3	3	3
CO 4	3	3	3	2	1	-	-	2	-	3	2	1	2	2	2

**3: Substantial (High)**

**2: Moderate (Medium)**

**1: Poor (Low)**

\*\*\*\*\*