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**UNIVERSITY SCHOOL
OF
INFORMATION AND COMMUNICATION TECHNOLOGY**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME STRUCTURE

**B.TECH. COMPUTER SCIENCE AND ENGINEERING
SPECIALIZATION IN MACHINE LEARNING**

2022-2026

30.1.06

08.09.23



**GAUTAM BUDDHA UNIVERSITY
GAUTAM BUDH NAGAR, GREATER NOIDA, UP, INDIA**

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Gautam Buddha University
Greater Noida, UP

SEMESTER I

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CS101	Fundamentals of Computer Programming	3	1	0	4	CC1 / FC
2	CM101	Fundamental of Machine Learning	2	0	0	2	CC2 / FC
3	MA101	Engineering Mathematics-I	3	1	0	4	GE1
4	PH102	Engineering Physics	3	1	0	4	GE2
5	EC101	Basic Electronics Engineering	3	1	0	4	GE3 / FC
6	EN101	English Proficiency	2	0	0	2	OE1 / AECC
7	CE103	Engineering Graphics Lab	1	0	2	2	GE-L1
8	CS181	Computer Programming Lab	0	0	2	1	CC-L1 / SEC
9	PH104	Engineering Physics Lab	0	0	2	1	GE-L2
10	EC181	Basic Electronics Engineering Lab	0	0	2	1	GE-L3
11	GP	General Proficiency	Non Credit				
Total Hours and Credits			17	4	8	25	

SEMESTER II

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM102	Introduction to Python	2	0	0	2	CC3 / FC
2	CM104	Computer Organistaion and Architecure	3	0	0	3	CC4 / SEC
3	MA102	Engineering Mathematics-II	3	1	0	4	GE4
4	EE102	Basic Electrical Engineering	3	1	0	4	GE5
5	ME101	Engineering Mechanics	3	1	0	4	GE6
6	ES101	Environmental Studies	3	1	0	4	OE2 / AECC
7	CM182	Python Programming Lab	0	0	2	1	CC-L2 / SEC
8	EE104	Basic Electrical Engineering Lab	0	0	2	1	GE-L4
9	ME102	Workshop Practice	1	0	2	2	GE-L5
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			16	4	6	25	

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SEMESTER III

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM201	Internet Technology	3	0	0	3	CC5 / SEC
2	CM203	Operating Systems	3	0	0	3	CC6
3	CM205	Data Structure & Algorithms	3	0	0	3	CC7 / SEC
4	CM207	Image Processing and Computer Vision	3	0	0	3	CC8
5	CM209	Introduction to R Programming	3	0	0	3	CC9
6	MA201	Engineering Mathematics-III	3	1	0	4	GE7
7	CM281	R Programming Lab	0	0	3	2	CC-L3
8	CM283	Data Structure & Algorithms Lab	0	0	3	2	CC-L4 / SEC
9	CM285	Internet Technology Lab	0	0	3	2	CC-L5 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER IV

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM202	Software Engineering	3	0	0	3	CC10
2	CM204	Database Management System	3	0	0	3	CC11 / SEC
3	CM206	Java Programming	3	0	0	3	CC12
4	CM208	Artificial Intelligence	3	0	0	3	CC13
5	CM210	Theory of Automata	3	0	0	3	CC14
6	CM212	Natural Language Processing	3	1	0	4	CC15 / SEC
7	CM282	Database Management System Lab	0	0	3	2	CC-L6 / SEC
8	CM284	Java Programming Lab	0	0	3	2	CC-L7 / SEC
9	CM286	Natural Language Processing Lab	0	0	3	2	CC-L8 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

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SEMESTER V

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM301	Compiler Design	3	0	0	3	CC16 / AECC
2	CM303	Soft Computing Techniques	3	0	0	3	CC17
3	CM305	Analysis and Design of Algorithms	3	0	0	3	CC18
4	CM307	Big Data Analytics	3	0	0	3	CC19
5	CM309	Machine Learning	3	1	0	4	CC20 / SEC
6		Elective 1	3	0	0	3	E1 / DSE
7	CM381	Analysis and Design of Algorithms Lab	0	0	3	2	CC-L9 / SEC
8	CM383	Big Data Analytics Lab	0	0	3	2	CC-L10 / SEC
9	CM385	Machine Learning Lab using Python	0	0	3	2	CC-L11 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER VI

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM302*	Applications of Machine Learning in Industries	3	0	0	3	CC21
2	CM304	Deep Learning	3	0	0	3	CC22
3	CM306	Reinforcement Learning	3	1	0	4	CC23
4	CM308	Human Machine Interaction	3	0	0	3	CC24
5	CM310	Cloud Computing	3	0	0	3	CC25 / SEC
6		Elective 2	3	0	0	3	E2 / DSE
7	CM382*	Applications of Machine Learning in Industries Lab	0	0	3	2	CC-L12
8	CM384	Deep Learning Lab using Python	0	0	3	2	CC-L13
9	CM386	Reinforcement Learning Lab using Python	0	0	3	2	CC-L14
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

Industrial Training will be done by candidate individually after third year during the summer break and it will be of minimum 4 weeks. It will be evaluated as per University Examination in VII semester.

SEMESTER V

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM301	Compiler Design	3	0	0	3	CC16 / AECC
2	CM303	Soft Computing Techniques	3	0	0	3	CC17
3	CM305	Analysis and Design of Algorithms	3	0	0	3	CC18
4	CM307	Big Data Analytics	3	0	0	3	CC19
5	CM309	Machine Learning	3	1	0	4	CC20 / SEC
6		Elective 1	3	0	0	3	E1 / DSE
7	CM381	Analysis and Design of Algorithms Lab	0	0	3	2	CC-L9 / SEC
8	CM383	Big Data Analytics Lab	0	0	3	2	CC-L10 / SEC
9	CM385	Machine Learning Lab using Python	0	0	3	2	CC-L11 / SEC
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

SEMESTER VI

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM302	Machine Learning Operations	3	0	0	3	CC21
2	CM304	Deep Learning	3	0	0	3	CC22
3	CM306	Reinforcement Learning	3	1	0	4	CC23
4	CM308	Human Machine Interaction	3	0	0	3	CC24
5	CM310	Cloud Computing	3	0	0	3	CC25 / SEC
6		Elective 2	3	0	0	3	E2 / DSE
7	CM382	Machine Learning Operations Lab	0	0	3	2	CC-L12
8	CM384	Deep Learning Lab using Python	0	0	3	2	CC-L13
9	CM386	Reinforcement Learning Lab using Python	0	0	3	2	CC-L14
10	GP	General Proficiency	Non Credit				
Total Hours and Credits			18	1	9	25	

Industrial Training will be done by candidate individually after third year during the summer break and it will be of minimum 4 weeks. It will be evaluated as per University Examination in VII semester.

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SEMESTER VII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM401	Parallel Processing and CUDA Programming	3	1	0	4	CC26
2	CM403	Data Visualization	3	0	0	3	CC27
3	CM405	Applied Machine Learning	2	0	0	2	CC28 / SEC
4		Elective 3	3	0	0	3	E3 / DSE
5		Elective 4	3	0	0	3	E4 / DSE
6	CM481	Applied Machine Learning Lab	0	0	3	2	CC-L15
7	CM491	Minor Project	0	0	10	5	MP1 / E
8	CM493	Industrial Traning	0	0	6	3	IT1 / E
9	GP	General Proficiency	Non Credit				
Total Hours and Credits			14	1	19	25	

SEMESTER VIII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM490	Seminar	0	0	3	2	S / E
2	CM492	Major Project	0	0	16	8	MP2 / E
3	CM494	Intenship	0	0	30	15	I / E
4	GP	General Proficiency	Non Credit				
Total Hours and Credits			0	0	49	25	

GRAND TOTAL OF CREDITS = 200

In the Seminar, student need to study and present individually, on latest research paper of their specialized area and It will be evaluated as per University Examination Rules.

The Internship in Industry will be done by candidate individually during the 8th semester and it will be for a minimum of 4 (-6) months. It will be evaluated as per University Examination Rules.

Minor and Major Project will be in a group and It will be evaluated as per University Examination Rules.

USICT will provide a mentor/supervisor for industrial training, seminar, internship, minor and major projects.

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ELECTIVES FROM DCSE

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	CM311	Computational Intelligence	3	0	0	3	E1
2	CM313	Stochastic Processes	3	0	0	3	E1
3	CM315	Data Mining	3	0	0	3	E1
4	CM317	Decision Thinking and Algorith Design	3	0	0	3	E1
5	CM319	Statistical Machine Learning	3	0	0	3	E1
6	CM312	Artificial Neural Networks	3	0	0	3	E2
7	CM314	Knowledge Engineering	3	0	0	3	E2
8	CM316	Graph Theory	3	0	0	3	E2
9	CM318	Expert Systems	3	0	0	3	E2
10	CM320	Fuzzy logic	3	0	0	3	E2
11	CM407	Computational Neuroscience	3	0	0	3	E3
12	CM409	Intelligent Machining	3	0	0	3	E3
13	CM411	Introduction to Brain and Neuroscience	3	0	0	3	E3
14	CM413	Digital Fabrication	3	0	0	3	E3
15	CM415	Internet of Things	3	0	0	3	E3
16	CM417	Digital Image Processing	3	0	0	3	E4
17	CM419	Ensemble learning	3	0	0	3	E4
18	CM421	Predictive Analysis	3	0	0	3	E4
19	CM423	Embedded Systems	3	0	0	3	E4
20	CM425	Machine Intelligence for Medical Image Analysis	3	0	0	3	E4

CM Computer Science & Engineering / Machine Learning for Course Code

CC Core Course from USICT for course type

GE General Elective from related discipline of other Deptt./School

GE L General Elective Lab from related discipline of other Deptt./School

OE Open Elective from other discipline of other Deptt./School

AECC Ability Enhancement Compulsary Course

DSE Discipline Specific Course

SEC Skill Enhancement Course

E Elective from USICT

CC-L Core Course Lab from USICT

IT1 Industrial Training

MP Minor / Major Project

S Seminar

I Internship

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Image Processing and Computer Vision			
Course Code:	CM207	Course Credits:	3
Course Category:	CC	Course (U / P)	U
Course Year (U / P):	2U	Course Semester (U / P):	3U
No. of Lectures + Tutorials (Hrs/Week):	03 + 00	Mid Sem. Exam Hours:	1
Total No. of Lectures (L + T):	45 + 00	End Sem. Exam Hours:	3

COURSE OBJECTIVES

- 1 Computer Vision focuses on development of algorithms and techniques to analyze and interpret the visible world around us.
- 2 This requires understanding of the fundamental concepts related to multi-dimensional signal processing, feature extraction, pattern analysis visual geometric modeling, stochastic optimization etc.
- 3 Focus on early processing of images and the determination of structure: edges, lines, shapes
- 4 Aims at calculating the structure and depth of objects in a scene from a set of multiple views or images..
- 5 Understanding the various image segmentation and feature extraction methods .

COURSE OUTCOMES

At the end of the course the students should be able to:

- 1 Identify basic concepts, terminology, theories, models and methods in the field of computer vision.
- 2 Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.
- 3 Assess methods to use for solving a given problem, and analyse the accuracy of the methods .
- 4 Recognize the object using the concept of computer vision K4
- 5 Detect a moving object in video using the concept of motion analysis K3.

UNIT I:- Digital Image Formation and low-level processing Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement Restoration, Histogram Processing.

UNIT II:- Depth estimation and Multi-camera views Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homograph, Rectification, DLT, RANSAC, 3- D reconstruction framework; Auto-calibration.

UNIT III:- Feature Extraction and Image Segmentation Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH

UNIT IV:- Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.

UNIT V:- **Shape from X**

Light at Surfaces; Phong Model; Reflectance Map; Aledo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

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Text Books

Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag
London Limited 2011.

Computer Vision: A Modern Approach, D.A. Forsyth, J. Ponce, Pearson Education, 2003.

Reference Books

Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition,
Cambridge University Press, March 2004.

R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison-Wesley, 1992.

K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan
Kaufmann, 1990.

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NATURAL LANGUAGE PROCESSING			
Course Code:	CM212	Course Credits:	3
Course Category:	CC	Course (U / P)	P
Course Year (U / P):	4U	Course Semester (U / P):	7U
No. of Lectures + Tutorials (Hrs/Week):	03 + 00	Mid Sem. Exam Hours:	1
Total No. of Lectures (L + T):	45 + 00	End Sem. Exam Hours:	3
COURSE OBJECTIVES			
1. Understanding the basics of natural language processing and understand various steps in it.			
2. To introduce the fundamentals of language processing from the algorithmic viewpoint.			
3. To discuss various issues that make natural language processing a hard task.			
4. Understand the importance and need of information retrieval system.			
5. To discuss some well-known applications of natural language processing			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Appreciate the fundamental concepts of natural language processing.			
2. Design algorithms for natural language processing tasks.			
3. Develop useful systems for language processing and related tasks involving text processing.			
4. Learns about machine translation.			
5. Ability to perform independent research and analysis.			

UNIT I INTRODUCTION

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues – Applications – The role of machine learning – Probability Basics – Information theory – Collocations -N-gram Language Models – Estimating parameters and smoothing – Evaluating language models.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS

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.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION

Natural Language Generation: 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.

UNIT V : INFORMATION RETRIEVAL AND LEXICAL RESOURCES

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, and Alternative Models of Information Retrieval – valuation Lexical Resources: WorldNet-Frame Net-Stemmers- POS Tagger- Research Corpora.

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REFERENCE BOOKS:

1. Daniel Jurafsky, James H. Martin, "Speech & language processing", Pearson publications.
2. Allen, James. Natural language understanding. Pearson, 1995.





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Natural Language Processing lab			
Course Code:	CM286	Course Credits:	2
Course Category:	CC	Course (U / P)	U
Course Year (U / P):	3U	Course Semester (U / P):	5U
No. of Lectures + Tutorials + Practicals (Hrs/Week):	00 + 00+ 03	Mid Sem. Exam Hours:	
Total No. of Lectures (L + T+P):	00 + 00+	End Sem. Exam Hours:	3
COURSE OBJECTIVES			
1. The concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.			
2. The mathematical foundations, probability theory with linguistic essentials such as syntactic and semantic analysis of text.			
3. The Statistical learning methods and cutting-edge research models from deep learning.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. the knowledge of complex language behaviour in terms of phonetics, Remember morphology etc			
2. Apply the CORPUS linguistics to compile and analyze the texts based on digestive approach (Text Corpus Method)			
3. Apply Part-of-speech (POS) tagging for a given natural language and suitable			

List of Experiments:

1. To Preprocessing of text (Tokenization, Filtration, Script validation, stop word removal, Stemming).
2. To Morphological analysis.
3. To N-Gram Model.
4. To POS Tagging.
5. To Chunking
6. To name Entity Recognition.
7. To Virtual Lab on Word Generator.
8. To Building Chunker.

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