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08 Sept 23

UNIVERSITY SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRAMME STRUCTURE

B.TECH. ARTIFICIAL INTELLIGENCE
2019-2023

30.01.01
08.09.23

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

School of ICT
Gautam Buddha University
Greater Noida, (U.P.)

SEMESTER I

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	MA101	Engineering Mathematics-I	3	1	0	4	GE1
2	CY101	Engineering Chemistry	3	1	0	4	GE2
3	CS101	Fundamentals of Computer Programming	3	1	0	4	CC1 / FC
4	CS105	Introduction of Artificial Intelligence	2	0	0	2	CC2 / FC
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	CY103	Engineering Chemistry Lab	0	0	2	1	GE-L2
9	CS181	Computer Programming Lab	0	0	2	1	CC-L1 / SEC
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	MA102	Engineering Mathematics-II	3	1	0	4	GE4
2	PH102	Engineering Physics	3	1	0	4	GE4
3	EE102	Basic Electrical Engineering	3	1	0	4	GE6
4	ME101	Engineering Mechanics	3	1	0	4	GE7
5	ES101	Environmental Studies	3	1	0	4	OE2 / AECC
6	AI102	Introduction to Python	2	0	0	2	CC3
7	PH104	Engineering Physics Lab	0	0	2	1	GE L4
8	EE104	Basic Electrical Engineering Lab	0	0	2	1	GE L5
9	EN151	Language Lab	0	0	2	1	OE-L1 / SEC
10	ME102	Workshop Practice	1	0	2	2	GE-L6
11	AI182	Python Lab	0	0	2	1	CC-L2
12	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**5**	**10**	**28**	

SEMESTER III

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Annexure 30.1.1

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S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI201	Software Engineering	3	0	0	3	CC4
2	AI203	Intelligent Systems	3	0	0	3	CC5
3	AI205	Theory of Automata	3	0	0	3	CC6
4	AI207	Database Management Systems	3	0	0	3	CC7
5	AI209	Computer Vision	3	0	0	3	CC8
6	AI211	Introduction to R Programming	3	1	0	4	CC9 / SEC
7	AI281	Database Management Systems Lab	0	0	3	2	CC-L3
8	AI283	Computer Vision Lab	0	0	3	2	CC-L4
9	AI285	R Programming 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	AI202	Machine Learning	3	1	0	4	CC10
2	AI204	Operating System	3	0	0	3	CC11
3	AI206	Biometric Security	3	0	0	3	CC12
4	AI208	Introduction to MATLAB	3	0	0	3	CC13 / SEC
5	AI210	Quantum Computing	3	0	0	3	CC14
6	AI212	Compter Networks	3	0	0	3	CC15
7	AI282	Machine Learning using Python Lab	0	0	3	2	CC-L6 / SEC
8	AI284	Operating System Lab	0	0	3	2	CC-L7
9	AI286	MATLAB	0	0	3	2	CC-L8 / SEC
10	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**18**	**1**	**9**	**25**	

SEMESTER V

S.No.	Course Code	Course Name	L	T	P	Credits	Types

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1	AI301	Big Data Analytics	3	0	0	3	CC16
2	AI303	Compiler Design	3	0	0	3	CC17
3	AI305	Deep Learning and Reinforcement Learning	3	0	0	3	CC18 / SEC
4	AI307	Operational Information Security Management and Biometric	3	1	0	4	CC19
5		Elective 1	3	0	0	3	E1 / DSE
6		Elective 2	3	0	0	3	E2 / DSE
7	AI381	Deep Learning Lab using Python	0	0	3	2	CC-L9 / SEC
8	AI383	Compiler Design Lab	0	0	3	2	CC-L10
9	AI385	Big Data Analytics Lab	0	0	3	2	CC-L11
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	AI302	IoT and Its Applications	3	0	0	3	CC20
2	AI304	Expert Systems	3	0	0	3	CC21
3	AI306	Robot Kinematics	3	0	0	3	CC22
4	AI308	Convex Optimization	3	1	0	4	CC23
5		Elective 3	3	0	0	3	E3 / DSE
6		Elective 4	3	0	0	3	E4 / DSE
7	AI382	Internet of Things Lab	0	0	3	2	CC-L12
8	AI384	Expert Systems Lab	0	0	3	2	CC-L13 / SEC
9	AI386	Robot Kinematics Lab	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 VII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	MA402	Modeling and Simulation	3	1	0	4	GE8

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2	AI401	Computational Intelligence	3	0	0	3	CC24
3	AI403	Robotics and Drones	2	0	0	2	CC25
4	AI405	Natural Language Processing	3	0	0	3	CC26
5		Elective 5	3	0	0	3	E5 / DSE
6	AI481	Robotics and Drones Lab	0	0	3	2	CC-L15
7	AI491	Minor Project	0	0	6	3	IT1 / E
8	AI493	Industrial Traning	0	0	10	5	MP1 / E
9	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**15**	**1**	**19**	**25**	

SEMESTER VIII

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI490	Seminar	0	0	3	2	S / E
2	AI492	Major Project	0	0	16	8	I / E
3	AI494	Intenship	0	0	30	15	MP2 / E
4	GP	General Proficiency	Non Credit				
		Total Hours and Credits	**0**	**0**	**49**	**25**	

GRAND TOTAL OF CREDITS = 203

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.

ELECTIVES FROM DCSE

S.No.	Course Code	Course Name	L	T	P	Credits	Types
1	AI309	Computer Graphics	3	0	0	3	E1
2	AI311	Introduction to Brain and Neuroscience	3	0	0	3	E1

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3	AI313	Stochastic Processes	3	0	0	3	E1
4	AI315	Computer Based Numerical & Statistical Techniques	3	0	0	3	E1
5	AI317	Seuence Models	3	0	0	3	E1
6	AI319	Bayesian Data Theory	3	0	0	3	E2
7	AI321	Speech Analysis and Systems	3	0	0	3	E2
8	AI323	Graph Theory	3	0	0	3	E2
9	AI325	Distributed Database	3	0	0	3	E2
10	AI327	Embedded Systems	3	0	0	3	E2
11	AI310	Digital Image Processing	3	0	0	3	E3
12	AI312	Gaming	3	0	0	3	E3
13	AI314	Knowledge Engineering	3	0	0	3	E3
14	AI316	Predictive Analysis	3	0	0	3	E3
15	AI318	Digital Fabrication	3	0	0	3	E3
16	AI320	AI Enabled Cyber Security	3	0	0	3	E4
17	AI322	Evolutionary Computation	3	0	0	3	E4
18	AI324	Fuzzy logic	3	0	0	3	E4
19	AI326	Distributed Operating System	3	0	0	3	E4
20	AI328	Pattern Recognition	3	0	0	3	E4
21	AI407	Automation and Robotics	3	0	0	3	E5
22	AI409	Optimization Techniques	3	0	0	3	E5
23	AI411	3D Printing	3	0	0	3	E5
24	AI413	Parallel Distributed Systems	3	0	0	3	E5
25	AI415	Time Series Analysis and Applications	3	0	0	3	E5

I Artificial Intelligence

CC Core Course from USICT for Type of Course

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 Skil 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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Parallel Processing and CUDA Programming			
Course Code:	AI 401	**Course Credits:**	4
Course Category:CC	CC	**Course (U / P)**	
Course Year (U / P):U	4U	**Course Semester (U / P):**	7U
No. of Lectures + Tutorials H rs/Week):	3+ 01	**id Sem. Exam Hours:**	1
Total No. of Lectures (L + T):30	45+ 15	**End Sem. Exam Hours:**	3

COURSE OBJECTIVES
1. Define terminology commonly used in parallel computing, such as efficiency and speedup.
2. Describe common GPU architectures and programming models
3. Implement efficient algorithms for common application kernels, such as matrix multiplication
4. Given a problem, develop an efficient parallel algorithm to solve it.
5. Given a problem, implement an efficient and correct code to solve it, analyze its performance, and gi onvincing written and oral presentations explaining the achievements

COURSE OUTCOMES
At the end of the course the students should be able to:
1.Understand the distributed and parallel computing systems
2. Familiar with parallel and distributed languages MPI, Pthread, OpenMP, and CUDA
3. Design parallel and distributed algorithms using these parallel languages
4. Writing Parallel Programs.
5 Able to meaure performance metrics

Unit-1 Introduction

Introduction to Parallel Computers ,Message-Passing Computing and Programming, Multithread Programming , Parallel Programming Paradigms, Parallel Architecture, Parallel Architecture (case studies)

Unit-2

CUDA Programming , OpenMP Programming , Embarrassingly Parallel Computation, GPU-Compute Architecture, CUDA, Memory organization in CUDA Multi- Core CPU programming, MPI, PVM, Performance evaluation and scalability

Unit-3

Partitioning and Divide-and-Conquer Strategies , Pipelined Computation ,Synchronous Computations, Pipelining and Throughput Latency and Latency hiding

Unit-4

Synchronous Computations,Load Balancing and Termination Detection,Distributed Shard Memory, Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU

Unit-5

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Sorting Algorithms, Min/Max, Sum Searching, Merging, Sorting, Prefix operations N- body problems, Matrix operations

REFERENCE BOOKS:

1. David Kirk and Wen-mei Hwu, Programming Massively Parallel Processors: A Hands-On Approach, 2nd Edition, Publisher: Morgan Kaufman, 2012, ISBN: 9780124159921.
2. Shane Cook, CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, Morgan Kaufman; 2012 (ISBN: 978-0124159334
3. An Introduction to Parallel Algorithms by Joseph Jaja (Addison-Wesley Professional)
4. Introduction to Parallel Computing by Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta (Pearson)
5. Parallel Programaming in C with MPI and openMP by Michael J Quinn (McGraw Hill).

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BIOMETRIC SECURITY			
CourseCode:	AI310	CourseCredits:	3
CourseCategory:CC	E3	Course(U/P)	U
CourseYear(U/P):U	3U	CourseSemester(U/P):	6U
No.ofLectures+Tutorials(Hrs/Week):	03+00	MidSem.ExamHours:	1
TotalNo.ofLectures(L+ T):30	45+00	EndSem.ExamHours:	3
COURSEOBJECTIVES			
1.To provide students with understanding of biometrics.			
2.Make aware of different types of biometrics devices.			
3.Learn different process equipment and their working.			
4.Understanding of Security and standards applied to the security.			
5.To understand attacks in security from malicious attackers.			
COURSEOUTCOMES			
At the end of the course the students should be able to:			
.Demonstrate knowledge of the basic physical and biological science and engineering Principles underlying biometric systems.			
.Understandandanalyzebiometricsystems at the component level and be able to analyze And design basic biometric system application.			
3.Be able to work effectively in teams and express their work and ideas orally and in writing..			
4.Identifythe sociological and acceptance issues associated with the design and Implementation of biometric systems.			
5.Understand various Biometric security issues.			

UNIT I INTRODUCTION TO BIOMETRICS

Introduction- benefits of biometrics over traditional authentication systems -benefits of biometrics identification systems-selecting a biometric for a system –Applications - Key biometric terms andprocesses- biometric matching methods-Accuracy in biometric systems.

UNIT II PHYSIOLOGICAL BIOMETRIC TECHNOLOGIES

Physiological Biometric Technologies: Fingerprints - Technical description –characteristics - Competingtechnologies-strengths–weaknesses–deployment-Facialscan-Technicaldescription- characteristicsweaknesses-deployment - Iris scan - Technical description – characteristics - strengths – weaknesses –deployment-Retina vascular pattern

UNIT III MEMORY & STORAGE MANAGEMENT

Technical description – characteristics - strengths – weaknesses – deployment - Hand scan – Technical description-characteristics - strengths – weaknesses deployment – DNA biometrics. Behavioral Biometric Technologies: Handprint Biometrics -DNA Biometrics.

UNIT IV SIGNATURE AND HANDWRITING TECHNOLOGY

Signature and handwriting technology - Technical description – classification – keyboard / keystroke dynamics- Voice – data acquisition - feature extraction - characteristics - strengths – weaknesses-deployment.

UNIT V MULTIBIOMETRICS

Multi biometrics and multi factor biometrics - two-factor authentication with passwords - tickets and tokens– executive decision- implementation plan.

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AUGMENTED AND VIRTUAL REALITY			
Course Code:	**AI322**	**Course Credits:**	**3**
Course Category:	**E4**	**Course (U / P)**	**U**
Course Year (U / P):	**3U**	**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. To gain the 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 have practical knowledge.

COURSE OUTCOMES
At the end of the course the students should be able to:
1. Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR and AR experiences. .
2. Describe how VR and AR systems work.
3. Choose, develop, explain, and defend the use of particular designs for AR and VR experience s.
4. Evaluate the benefits and drawbacks of specific AR and VR techniques on the human body.
5. Identify and examine state-of-the art AR and VR design problems and solutions from the industry and academia..

Unit 1: Introduction :
Introduction to Augmented-Virtual and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR ,VR and MR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality. VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.

Unit 2: Stereoscopic Vision & Haptic rendering :
Fundamentals of the human visual system, Depth cues, Stereopsis, Retinal disparity, Haptic sense, Haptic devices, Algorithms for haptic rendering and parallax, Synthesis of stereo pairs, Pipeline for stereo images.

Unit 3: VR software development :
Challenges in VR software development, Master/slave and Client/server architectures, Cluster rendering, Game Engines and available sdk to develop VR applications for different hardware (HTC VIVE, Oculus, Google VR). 3D interaction techniques: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation.

Unit 4: AR software development :
AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

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Unit 5: Application of VR in Digital Entertainment:
VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

Reference Books:

1. George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009.
2. The VR Book: Human-Centered Design for Virtual Reality, by Jason Jerald
   Learning Virtual Reality by Tony Parisi, O' Reilly
3. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition.Wiley-IEEE Press, 2003/2006.
4. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013

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BUSSINESS ANALYTICS			
Course Code:	**AI328**	**Course Credits:**	**3**
Course Category:CC	E4	**Course (U / P)**	
Course Year (U / P):U	**3U**	**Course Semester (U / P):**	**6U**
No. of Lectures + Tutorials H rs/Week):	**3+ 00**	**id Sem. Exam Hours:**	**1**
Total No. of Lectures (L + T):30	**45+ 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1.Ability to apply course concepts to real business problems.			
2. focuses on honing your understanding of key concepts			
3. managerial judgment			
4. To impart knowledge about business analytics, business management, and key analytical kills to make business decisions			
5. Focuses on key business and economical concepts through the study			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Understanding of both national and international business and economics.			
2. Knowledge of overall business analytics through the subjects like organizational behavior			
ata management, business intelligence, financial management			
4. Focuses include empirical analysis, analytical modeling, and methodology development.			
5. Suggest supply chain management business analytics operations and project management.			

Unit-I Describing and Summarizing Data

Recognize trends in data and detect outliers, Summarize data sets concisely ,Analyze relationships between variables, Create visual representations of data in Excel ,Define and calculate descriptive statistics, Create scatter plots and calculate the correlation coefficient

Unit II **Sampling and Estimation**

Create representative samples and draw conclusions about the larger population, Craft sound survey questions, Calculate sample statistics and apply the properties of the normal distribution,Calculate confidence intervals to estimate the accuracy of statistics

Unit III: **Hypothesis Testing**

Quantify the evidence in favor of or against your hypothesis in order to make managerial decisions

,Develop and test hypotheses in Excel to assess the impact of changes on an entire population or estimate differences between populations, Interpret the results of a series of website A/B tests

Unit IV **Single Variable Linear Regression**

Analyze the relationship between two variables and develop forecasts for values outside the data set ,Identify the best fit line for a data set and interpret its equation through an analysis of housing data, Perform a regression analysis of box office and home video sales using Excel and interpret the output

Unit V **Multiple Regression**

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Identify relationships among three or more variables to improve understanding of data and provide better forecasts , Estimate the relative predictive power of different combinations of variables by performing and interpreting a multiple variable regression analysis using Excel ,Apply multiple regression analysis to a staffing challenge faced by a hotel , Expand the range of your analysis by using dummy and lagged variables

Texts Books

1. Microsoft Excel Data Analysis and Business Modeling by Wayne L. Winston
2. Naked Statistics: Stripping the Dread from the Data by Charles Wheelan
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by Wes McKinney
4. SQL in 10 Minutes a Day by Ben Forta
5. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic
6. Practical Tableau: 100 Tips, Tutorials, and Strategies from a Tableau by Ryan Sleeper
7. The Hundred-Page Machine Learning Book by Andriy Burkov
8. The Pyramid Principle: Logic in Writing and Thinking by Barbara Minto
9. Scoring Points: How Tesco Continues to Win Customer Loyalty by Terry Hu

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