Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

SEMESTER – VII

Subject: Computer Vision	
Course Code: PEC-AIDS 701B	**Semester:** VII
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical:	Continuous Assessment:25
Credit: 3	

Aim:	
Sl. No.	
1.	Students will learn basic principles of image formation, image processing algorithms and different algorithms for reconstru ction and recognition from single or multiple images

Objective:	
Sl. No.	
1.	To implement fundamental image processing techniques required for computer vision
2.	Understand Image formation process
3.	Extract features form Images and do analysis of Images
	To develop applications using computer vision techniques

Pre-Requisite:	
Sl. No.	
1.	Programming
2.	Mathematic course

Contents		Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis	3	10
02	Edge detection, Edge detection performance, Hough transform, corner detection	6	10
03	Segmentation, Morphological filtering, Fourier transform	3	10

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

04	Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing	9	10
05	**Pattern Analysis:** Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semisupervised Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA,LDA, ICA, and Non-parametric methods.	9	20
06	Recent trends in Activity Recognition, computational photography, Biometrics	6	10
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100

Assignments:
Based on the curriculum as covered by subject teacher.

List of Books Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Richard Szeliski	Computer Vision: Algorithms and Applications		
Goodfellow, Bengio,and Courville	Deep Learning		
Reference Books:			
Fisher et al	. Dictionary of ComputerVision and Image Processing		

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Subject: Data Visualization	
Course Code: PEC-AIDS 701C	
Duration:36 Hrs.	**Semester: VII**
Teaching Scheme	**Maximum Marks:100**
Theory:3	**Examination Scheme**
Tutorial: 0	End Semester Exam:70
Practical:0	Attendance : 5
Credit:3	Continuous Assessment: 25

Aim:	
Sl. No.	
1	Ability to create visualizations from data
2	Ability to gain a better understanding of data from visualizations
3	Skill to make sense of trends in data from visualizations

Objective:	
Sl. No.	
1	To understand the need and benefits of data visualization
2	To systematically create univariate and bivariate graphs from data
3	To analyse and draw conclusions from visualizations

Pre-Requisite:	
Sl. No.	
1	Fundamentals of Python Programming

Contents		Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** About data visualization, The need for data visualization, Brief history of data visualization	2	2
02	**Statistical Preliminaries** Different types of data, Measures of Centrality, Measures of Dispersion, Measures of Association	4	8
03	**Univariate Visualizations** Stem-and-Leaf Plot, Pie Chart, Bar Graph, Histogram, Line Chart, Box Plot, Analysis and drawing conclusions	6	12
04	**Bivariate Visualizations** Scatter Plot, Bivariate Line Chart, Hex Plot, Analysis and drawing conclusions	4	8
04	**Python NumPy Library** NumPy and its advantages, NumPy n-dimensional array (ndarray), Creating ndarrays in NumPy, Slicing ndarrays, ndarray operations, Broadcasting	8	16
05	**Data Visualizations in Python** Plotting with matplotlib, Univariate graphs using matplotlib, Bivariate graphs using matplotlib, Plotting through pandas, Improving plot aesthetics	12	24
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100
List of Books:			

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Sheldon M Ross	Introduction to Probability and Statistics for Engineers and Scientists		Elsevier Academic Press
B. Lubanovic	Introducing Python		O'Reilly
Reference Books:			
Murray R. Spiegel, Larry J. Stephens	Schaum's Outlines on Statistics		McGraw-Hill
Eric Matthes	Python Crash Course		No Starch Press
Ivan Idris	Numpy Beginner's Guide		Packt Publishing

Subject: Deep Learning		
Course Code: PEC-AIDS 701D	**Semester: VII**	
Duration: 36 Hrs.	**Maximum Marks: 100**	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	End Semester Exam: 70	
Tutorial: 0	Attendance : 5	
Practical:	Continuous Assessment:25	
Credit: 3		
Aim:		
Sl. No.		
1.	To improve the performance of a Deep Learning model	
2.	to the reduce the optimization function which could be divided based on the classificationand the regression problems	
Objective:		
Sl. No.		
1.	To acquire knowledge on the basics of neural networks.	
2.	To implement neural networks using computational tools for variety of problems.	
3.	To explore various deep learning algorithms.	
Pre-Requisite:		
Sl. No.		
1.	Calculus, Linear Algebra	
2.	Probability & Statistics	
3.	Ability to code in R/Python	

Contents		Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

02	**Feed forward neural network** Artificial Neural Network, activation function, multi-layer neural network, cardinality, operations, and properties of fuzzy relations.	6	10
03	**Training Neural Network** Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	6	15
04	**Conditional Random Fields** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	15
05	**Deep Learning** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	6	15
06	**Deep Learning research** Object recognition, sparse coding, computer vision, natural language	6	10
	Sub Total:	36	70
	Internal Assessment Examination & Preparation of Semester Examination	4	30
	Total:	40	100

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Goodfellow, I.,Bengio,Y., andCourville A.,	Deep Learning		MIT Press
Satish Kumar	Neural Networks: A Classroom Approach		Tata McGraw-Hill

Reference Books:

Bishop, C. ,M.	Pattern Recognition and Machine Learning		Springer
Yegnanarayana, B.	Artificial NeuralNetworks		PHI Learning Pvt. Ltd
Golub, G.,H., and VanLoan,C.,F.	Matrix Computations		JHU Press

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

SOCIAL NETWORK ANALYSIS [3 0 0 3]-PEC-AIDS 701A

Introduction to Social Web, Nodes, Edges and Network Measures, Describing Nodes and Edges, Describing Networks, Layouts, Visualizing network features, The role of Tie strength, Measuring Tie strength and its network structures, network propagation, Link prediction, entity resolution, Case study, Introduction to community discovery, communities in context, quality functions, The Kernighan-Lin algorithm, Agglomerative algorithms, spectral algorithms, multi-level graph partitioning, Markov clustering, Other approaches, Introduction to social influence, Influence related statistics, social similarity and influence, Homophily, Existential Test for social influence, Influence and actions, Influence and interactions, influence maximization in viral marketing.

References:
1. Jennifer Golbeck., *Analysing the Social Web,* Morgan Kaufmann publications, 2013
2. Charu C. Aggarwal, *Social Network Data Analytics*, Springer publications, 2011
3. John Scott, *Social Network Analysis*, (3e), Sage publications limited, 2013
4. Jay Goldman, *Facebook Cookbook*, O'Reilly, 2009
5. Shamanth Kumar, Fred Morstatter, Huan Liu, *Twitter Data Analytics*, Springer publications, 2013

Information Theory and Coding
Code:PEC- AIDS702B
Contact: 3L

Name of the Course:	**Information Theory and Coding**		
Course Code: **PEC-AIDS702B**	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs./week	Mid Semester exam: 15		
Tutorial: NIL	Assignment and Quiz: 10 marks		
	Attendance: 5 marks		
Practical:NIL	End Semester Exam: 70 Marks		
Credit Points:	3		
Unit	Content	Hrs/Unit	Marks/Unit
1	**Source Coding [7L]** Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	7	
2	**Channel Capacity And Coding [7L]** Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	7	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

3	**Linear And Block Codes For Error Correction [8L]** Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4.	**Cyclic Codes [7L]** Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes..	7	
5	**BCH Codes [8L]** Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	8	
6	**Convolutional Codes [8L]** Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	8	

Text book and Reference books:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Digital Signal Processing
Code: PEC- AIDS702D
Contacts: 3L

Name of the Course:	**Digital Signal Processing**		
Course Code: **PEC-AIDS702D**	Semester: VII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs./week	Mid Semester exam: 15		
Tutorial: NIL	Assignment and Quiz : 10 marks		
	Attendance: 5 marks		
Practical:	End Semester Exam: 70 Marks		
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Module 1: Discrete-time signals and systems (6 hours) Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	6	
2	Module 2: Z-transform (6 hours) z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	6	
3	Module 2: Discrete Fourier Transform (10 hours) Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.	10	
4.	Module 3:Designof Digital filters (12 hours) Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	12	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

	Module 4: Applications of Digital Signal Processing (6 hours) Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	6	

Text book and Reference books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

E-Commerce & ERP:
Code: PEC-AIDS 702A
Contacts: 3L

1. Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [3 L]
2. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [5 L]
3. Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L]
4. E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L]
5. Four C's : (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

7. Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [3 L]

8. E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]

9. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [1 L]

10. Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]

11. Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]

12. Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

Reference :

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Name of the subject:	**DATA SECURITY AND ACCESS CONTROL**
Course Code: **PECAIDS702-C**	Semester: **VII**
Duration: **6 month**	Maximum marks: **100**
Teaching Scheme	**Examination Scheme**
Theory: 3 **hrs./week**	Mid Semester exam: **15 Marks**
Tutorial : Nil	Assignment and Quiz: **10 marks**
Practical: **hr./week**	End Semester exam: **70 marks**
Credit : **3**	

		CONTENTS	Hr. /Wk.	Contents
Chapter		Name of the Topic	Hours	Marks
01		**Software and System Security** Control hijacking attacks – buffer overflow, integer overflow, bypassing browser memory protection, Sandboxing and Isolation,Tools and techniques for writing robust application software	8	10
02		Security vulnerability detection tools, and techniques – program analysis (static, concolic and dynamic analysis), Privilege, access control, and Operating System Security, Exploitation techniques, and Fuzzing	8	15
03		**Network Security & Web Security** Security Issues in TCP/IP – TCP, DNS, Routing (Topics such as basic problems of security in TCP/IP,, IPsec, BGP Security, DNS Cache poisoning etc),Network Defense tools – Firewalls, Intrusion Detection, Filtering, DNSSec, NSec3, Distributed Firewalls, Intrusion Detection tools,Threat Models, Denial of Service Attacks, DOS-proof network architecture	10	20
04		Security architecture of World Wide Web, Security Architecture of WebServers, and Web Clients Web Application Security – Cross Site Scripting Attacks, Cross Site RequestForgery, SQL Injection Attacks, Content Security Policies (CSP) in web Session Management and User Authentication, Session Integrity, Https,SSL/TLS, Threat Modeling, Attack Surfaces, and other comprehensiveapproaches to network design for security	10	25
05		**Security in Mobile Platforms** Android vs. ioS security model, threat models, information tracking, rootkits,Threats in mobile applications, analyzer for mobile apps to discover security vulnerabilities, Viruses, spywares, and keyloggers and malware detection	6	15
06		**Issues in Critical Infrastructure and SCADA Security** Security issues in SCADA,IP Convergence Cyber Physical System Security threats,Threat models in SCADA and various protection approaches,Machine learning and SCADA Security	6	15

Required Textbooks

Making Sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Recommended Texts

➢ *The Visual Display of Quantitative Information,* by Edward R. Tufte
➢ *Visualizing Data: Exploring and Explaining Data with the Processing Environment,* by Ben Fry
➢ *Exploratory Data Mining and Data Cleaning,* by Tamraparni Dasu

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Internet of Things
Code: OEC-AIDS701A
Contacts: 3L

Course Code	OEC-AIDS 701A
Course Name	**Internet of Things**
Credits	3
Pre-Requisites	Wireless Networks
LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit 2: Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit 3: Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit 4: Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit 5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit 6: Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

References:
1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Jeeva Jose, Internet of Things, Khanna Publishing House.

4. Internet of Things, Arsheep Bahga and Vijay Madisetti

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Subject: Bioinformatics	
Course Code: OECAIDS 701B	**Semester: VII**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3hrs./week	**End Semester Exam: 70**
Tutorial:	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit:3	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1.	To give students an introduction to the basic practical techniques of bioinformatics. Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems.
2.	The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.

Objective:	
Sl. No.	After completion of the course, students will be able to:
1.	Describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge
2.	Explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming
3.	Predict the secondary and tertiary structures of protein sequences.

Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways	7	12
02	Sequence Databases 2 Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	7	14
03	DNA SEQUENCE ANALYSIS 14 Syllabus for B.Tech(Information Technology) Up to Fourth Year Revised Syllabus of B.Tech IT DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays,	8	18

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

	Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.			
04	Introduction Probabilistic models used in Computational Biology 8 Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	7	12	
05	Biological Data Classification and Clustering 6 Assigning protein function and predicting splice sites: Decision Tree	7	14	
	Sub Total:	36	70	
	Internal Assessment Examination & Preparation of Semester Examination	4	30	
	Total:	40	100	

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Des Higgins (Editor), Willie Taylor.	Bioinformatics: Sequence, Structure and Databanks: A Practical Approach	ISBN: 978-0199637904. 1st edition,	Oxford University Press.
David W. Mount.	Bioinformatics: Sequence and Genome Analysis	ISBN: 978-0879697129 2nd edition,	Cold spring harbor laboratory press.
Reference Books:			
	Introduction to Bioinformatics	ISBN: 978-8178085074 1st edition	Pearson Education.
	Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins	ISBN: 978-0471478782. Second Edition,	John Wiley & Sons, Inc., Publication.

End Semester Examination Scheme.   Maximum Marks-70.   Time allotted-3hrs.

Group	Unit	Objective Questions (MCQ only with the correct answer)	Subjective Questions

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 5	10	10				
B	1 to 5			5	3	5	60
C	1 to 5			5	3	15	

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to be set	Question to be answered
A	All	1	10	10
B	All	5	5	3
C	All	15	5	3

Robotics
Code: OEC-AIDS 701C
Contacts: 3L

Name of the Course:	**Robotics**	
Course Code: **OEC-AIDS 701C**	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction :**Introduction -- brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.	1	
2	**Elements of robots – links, joints, actuators, and sensors** Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link	5	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

	representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.		
3	**Kinematics of serial robots** Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.	4	
4.	**Kinematics of parallel robots** Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.	5	
5.	**Velocity and static analysis of robot manipulators** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.	5	
6	**Dynamics of serial and parallel manipulators** Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple.	4	
7	**Motion planning and control** Joint and Cartesian space trajectory planning and generation, Classical	6	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

	control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. 8 Module 8: Modeling and		
8	**Modeling and control of flexible robots** Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.	4	
9	**Modeling and analysis of wheeled mobile robots** 3Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS.	3	
10	**Selected advanced topics in robotics** Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over- constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).	3	

Text book and Reference books:

1. Robotics Process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

Compiler Design
Code: OEC-AIDS 701D
Contact: 3L

Name of the Course:	**Compiler Design**	
Course Code: **OEC-AIDS 701D**	Semester: VII	
Duration:6 months	Maximum Marks:100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam:70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Compiling** [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.	3	
2	**Lexical Analysis** [6L] The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expressionto an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).	6	
3	**Syntax Analysis** [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non- recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	9	
4	**Syntax directed translation** [5L] Syntax director definitions, Construction of syntaxtrees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	**Type checking** [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

6	**Run time environments** [5L] Source language issues (Activation trees, Controlstack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameterpassing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	**Intermediate code generation** [4L] Intermediate languages, Graphical representation,Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).	4	
8	**Code optimization** [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representationof basic blocks, The principle sources of optimization, Loops in flowgraph, Peephole optimization.	5	
9	**Code generations** [4L] Issues in the design of code generator, a simple code generator, Register allocation & assignment.	4	

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Artificial Intelligence and Data Science
(Applicable from the academic session 2020-2021)

11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]

12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Text Books and References

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Project-I
Code: PROJ-AIDS 781
Contact: 12P
Credit-6

| **Project work I** |

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.