MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Curriculum Structure

Semester I							
Sl. No.	**CBCS Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	CC-1	BITAIC101 BITAIC191	Programming Fundamentals	**4**	**0**	**4**	**6**
2	CC-2	BITAIC102 BITAIC192	**Discrete Structure**	5	1	0	6
3	AECC-1	BITAIA101	**Soft skills**	**2**	**0**	**0**	**2**
4	GE-1	BITAIG101 BITAIG102 BITAIG103 BITAIG104	1. MOOCS Basket 1 2. MOOCS Basket 2 3. MOOCS Basket 3 4. MOOCS Basket 4 ...	**4 / 5**	**0 / 1**	**2 / 0**	**6**
				Total Credit			20

Semester II							
Sl. No.		**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	CC-3	BITAIC201 BITAIC291	**Data Structures with python**	**4**	**0**	**4**	**6**
2	CC-4	BITAIC202 BITAIC292	**Operating System**	**4**	**0**	**4**	**6**
3	AECC-2	BITAIA201	**Environmental Science**	**2**	**0**	**0**	**2**
4	GE-2	BITAIG201 BITAIG202 BITAIG203 BITAIG204	1. MOOCS Basket 1 2. MOOCS Basket 2 3. MOOCS Basket 3 4. MOOCS Basket 4	4 / 5	0 / 1	2 / 0	6
Sessional							
5	SEC-1	BITAIS281	Project and Entrepreneurship	0	0	4	**2**
				Total Credit			**22**

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Semester III							
Sl. No.	**CBCS Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	CC-5	BITAIC301 BITAIC391	**Database Management System**	**4**	**0**	**4**	**6**
2	CC-6	BITAIC302 BITAIC392	**Machine Learning**	**4**	**0**	**4**	**6**
3	CC-7	BITAIC303	**Artificial Intelligence**	5	1	0	6
4	GE-3	BITAIG301 BITAIG302 BITAIG303 BITAIG304	1. MOOCS Basket 1 2. MOOCS Basket 2 3. MOOCS Basket 3 4. MOOCS Basket 4	4 / 5	0 / 1	4 / 0	6
5	SEC-2	BITAIS381	Object Oriented Programming	1	0	4	3
				Total Credit			27

Semester IV							
Sl. No.	**CBCS Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	CC-8	BITAIC401 BITAIC491	**Computer Networks**	**4**	**0**	**4**	**6**
2	CC-9	BITAIC402 BITAIC492	**Software Engineering**	**4**	**0**	**4**	**6**
3	CC-10	BITAIC403 BITAIC493	**Data Visualisation**	4	0	4	6
4	GE-4	BITAIG401 BITAIG402 BITAIG403 BITAIG404	1. MOOCS Basket 1 2. MOOCS Basket 2 3. MOOCS Basket 3 4. MOOCS Basket 4	4 / 5	0 / 1	4 / 0	6
5	SEC-3	BITAIS481	Minor Project and Entrepreneurship II	0	0	4	**2**
						Total Credit	**26**

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Semester V							
Sl. No.	**CBCS Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory + Practical							
1	CC-11	BITAIC501 BITAIC591	Deep Learning	**4**	**0**	**4**	**6**
2	CC-12	BITAIC502 BITAIC592	Image Processing	4	0	4	6
3	DSE-1	BITAID501	**Elective-I**	5	1	0	6
			A. Pattern Recognition				
			B. Security and Authentication				
			C. Health Informatics				
4	DSE-2	BITAID502	**Elective-II**	5	1	0	6
			A. Soft Computing				
			B. Network Security				
			C. Internet of Things				
5	SEC-4	BITAIS581	Industrial Training and Internship	0	0	4	**2**
			Total Credit				26

Semester VI							
Sl. No.	**CBCS Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
Theory							
1	CC-13	BITAIC601 BITAIC691	**Cloud Computing**	**4**	**0**	**4**	**6**
2	CC-14	BITAIC602 BITAIC692	Robotics	4	0	4	6
3	DSE-4	BITAID601	**Elective-III**				
			A. Intrusion Detection & Prevention Systems	5	1	0	6
			B. Bioinformatics				
			C. Big Data Analytics				
Sessional							
4	SEC-5	BITAIS681	Grand Viva	0	0	2	**1**
5	DSE-5	BITAID682	Major Project & Entrepreneurship II	0	0	8	**4**
6	SEC-6	BITAID683	Seminar	0	0	4	**2**
						Total Credit	25

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Semester	Credit
I	20
II	22
III	27
IV	26
V	26
VI	25
TOTAL	**146**

Name of the Course: B.Sc. in Information Technology (AI) **Subject:** Programming Fundamentals & Programming Fundamentals Lab			
Course Code: BITAIC101 & BITAIC191		**Semester: I**	
Duration: 36 Hrs.		**Maximum Marks: 200**	
Teaching Scheme		**Examination Scheme**	
Theory: 4		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4		**Continuous Assessment: 25**	
Credit: 4 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	Implement your algorithms to build programs in the C programming language		
2.	Use data structures like arrays, linked lists, and stacks to solve various problems		
3.	Understand and use file handling in the C programming language		
Objective:			
Sl. No.			
1.	To write efficient algorithms to solve various problems		
2.	To understand and use various constructs of the programming language		
3.	To apply such as conditionals, iteration, and recursion in programming		
Pre-Requisite:			
Sl. No.			
1.	**Basic Knowledge of Computer System**		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	**Introduction to Computers** Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.	**6**	**10**
02	**Conditional Control Statements** Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, DoWhile and Examples. Continue, Break and Goto statements Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.	**8**	**10**
03	**Preprocessors and Arrays** Preprocessor Commands Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.	**8**	**16**
04	**Pointers** Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, Lvalue and Rvalue, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command Line Arguments. Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.	**8**	**16**
05	**Structures and File** Definition and Initialization of Structures, Accessing Structures,	**6**	**18**

	Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types. Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.		
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:
Intellectual skills:

1. The ability to learn concepts and apply them to other problems. ...
2. Basic mathematical skills.
3. A passion for problem solving.
4. Confidence around a computer programming Language.

List of Practical: Sl. No. 1 to10 compulsory & at least three from the rest)

1. Write a c program to display the word "welcome".
2. Write a c program to take a variable int and input the value from the user and display it.
3. Write a c program to add 2 numbers entered by the user and display the result.
4. Write a c program to calculate the area and perimeter of a circle.
5. Write a C program to find maximum between two numbers.
6. Write a C program to check whether a number is divisible by 5 and 11 or not.
7. Write a C program to input angles of a triangle and check whether triangle is valid or not.
8. Write a C program to check whether a year is leap year or not.
9. Write a C program to input basic salary of an employee and calculate its Gross salary according to following:
   Basic Salary <= 10000 : HRA = 20%, DA = 80%
   Basic Salary <= 20000 : HRA = 25%, DA = 90%
   Basic Salary > 20000 : HRA = 30%, DA = 95%
10. Write a c program to print “welcome” 10 times.
11. Write a c program to print first n natural numbers using while loop.
12. Write a c program to print all the odd numbers in a given range.
13. Write a c program to add first n numbers using while loop.
14. Write a c program to print all numbers divisible by 3 or 5 in a given range.
15. Write a c program to add even numbers in a given range.
16. Write a c program to find the factorial of a given number.
17. Write a c program to find whether a number is prime or not.
18. Write a c program to print the reverse of a number.
19. Write a c program to add the digits of a number.
20. Write a c program to print the Fibonacci series in a given range using recursion.

21. Write a c program to check whether a number is an Armstrong number or not.
22. Write a c program to find g.c.d. and l.c.m. of two numbers using function.

Assignments:

1. Based on theory lectures.

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
YashavantKanetkar,	Let us C	13th Edition	BPB Publication
E. Balaguruswamy	Programming in ANSI C		Tata McGraw-Hill
Gary J. Bronson	A First Book of ANSI C	4th Edition	ACM
Reference Books:			
Byron Gottfried	Schaum's Outline of Programming with C		McGraw-Hill
Kenneth A. Reek	Pointers on C		Pearson
Brian W. Kernighan and Dennis M. Ritchie	The C Programming Language		Prentice Hall of India

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	1,2,3,4,5	10	10				
B	3, 4, 5			5	3	5	60

C	1,2,3,4,5			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

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (AI) **Subject: Discrete Structure**	
Course Code: BITAIC102	**Semester: I**
Duration: 36 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory:5	End Semester Exam: 70
Tutorial:1	Attendance: 5
Practical:0	Continuous Assessment: 25
Credit:6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	The aim of this course is to introduce you with a new branch of mathematics which is discrete mathematics, the backbone of Computer Science.
2.	In order to be able to formulate what a computer system is supposed to do, or to prove that it does meet its specification, or to reason about its efficiency, one needs the precision of mathematical notation and techniques. The Discrete Mathematics course aims to provide this mathematical background.

Objective: Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following

Sl. No.	
1.	Use mathematically correct terminology and notation.
2.	Construct correct direct and indirect proofs.
3.	Use division into cases in a proof.
4.	Use counterexamples.
5.	Apply logical reasoning to solve a variety of problems.

Pre-Requisite:

Sl. No.	
1.	**Knowledge of basic algebra**

2.	**Ability to follow logical arguments.**		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Set Theory** Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle. Relation: Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation. Function: Definition and types of function, composition of functions, recursively defined functions.	**7**	**14**
02	**Propositional logic** Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradictions, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification. Notion of proof: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.	**8**	**14**
03	**Combinatorics** Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.)	**7**	**14**
04	**Algebraic Structure** Binary composition and its properties definition of algebraic structure, Groyas Semi group, Monoid Groups, Abelian Group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).	**6**	**10**

05	**Graphs** Graph terminology, types of graph connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number. Tree: Definition, types of tree(rooted, binary), properties of trees, binary search tree, tree	**8**	**18**
	traversing (preorder, inorder, post order). Finite Automata: Basic concepts of Automation theory, Deterministic finite Automation (DFA), transition function, transition table, Non Deterministic Finite Automata (NDFA), Mealy and Moore Machine, Minimization of finite Automation.		
	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**
Kenneth H. Rosen	Discrete Mathematics and its Applications		Tata Mc.Graw Hill
eymourLipschutz, M.Lipson	Discrete Mathematics		Tata Mc.Graw Hill
Reference Books:			
V. Krishnamurthy	Combinatorics:Theory and Applications		East-West Press
Kolman, Busby Ross	Discrete Mathematical Structures		Prentice Hall International

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

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

		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 question (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**

Name of the Course: B.Sc. in Information Technology (AI) **Subject:** Soft Skills	
Course Code: BITAIA101	**Semester: I**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 2	**End Semester Exam: 70**
Tutorial: 0	**Attendance: 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 2	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:	
Sl. No.	
1.	Ability to read English with ability to read English with understanding and decipher paragraph patterns, writer techniques and conclusions
2.	Skill to develop the ability to write English correctly and master the mechanics of writing the use of correct punctuation marks and capital letter
3.	Ability to understand English when it is spoken in various contexts.

Objective:	
Sl. No.	
1.	To enable the learner to communicate effectively and appropriately in real life situation
2.	Touse English effectively for study purpose across the curriculum
3.	To use R,W,L,S and integrate the use of four language skills, Reading, writing , listening and speaking.
4.	To revise and reinforce structures already learnt.

Pre-Requisite:	
Sl. No.	
1.	Basic knowledge of English Language.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Grammar** Correction of sentence, Vocabulary/word formation, Single word for a group of words, Fill in the blank, transformation of sentences, Structure of sentences – Active / Passive Voice – Direct / Indirect Narration.	**6**	**15**
02	**Essay Writing** Descriptive – Comparative – Argumentative – Thesis statement- Structure of opening / concluding paragraphs – Body of the essay.	**5**	**5**
03	**Reading Comprehension** Global – Contextual – Inferential – Select passages from recommended text.	**5**	**10**
04	**Business Correspondence** Letter Writing – Formal.Drafting.Biodata- Resume′- Curriculum Vitae.	**5**	**8**
05	**Report Writing** Structure, Types of report – Practice Writing.	**5**	**5**

06	**Communication skills** Public Speaking skills, Features of effective speech, verbal-nonverbal.	**5**	**15**
07	**Group discussion** Group discussion – principle – practice	**5**	**12**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Assignments:
Based on theory lectures.

List of Books
Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
R.C. Sharma and K.Mohan	Business Correspondence and Report Writing		Tata McGraw Hill , New Delhi , 1994
.Gartside	Model Business Letters		Pitman , London , 1992
Reference Books:			
Mark MaCormack	Communication		
John Metchell	How to write reports		
S R Inthira&amp, V Saraswathi	Enrich your English – a) Communication skills b) Academic skills		CIEFL &amp, OUP
Longman	Longman Dictionary of Contemporary English/Oxford Advanced Learner's Dictionary of Current English		OUP , 1998
Maxwell Nurnberg and Rosenblum Morris	All About Words		General Book Depot, New Delhi , 1995
	A Text Book for English for Engineers &amp, Technologists		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer
2.	Audio Devices
3.	Visual Devices
4.	Language lab Devices and the dedicated software

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

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Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5, 6	10	10				
B	3, 4, 5, 6			5	3	5	60
C	1,2,3,4,5, 6			5	3	15	

- Only multiple choice type question (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

Name of the Course: BSc. in Information Technology (Data Science) **Subject:** Data Structures with python and lab	
Course Code: BITAIC201 BITAIC291	**Semester: II**
Duration: 36 Hrs	**Maximum Marks:200**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam:70
Tutorial: 0	Attendance: 5
Practical: 4	Continuous Assessment: 25
Credit: 4+2	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	The point of this course is to give you a vibe for algorithms and data structures as a focal area of what it is to be a computer science student.
2.	You ought to know about the way that there are regularly a few calculations for some issue, and one calculation might be superior to another, or one calculation better in certain conditions and another better in others.
3.	You should have some idea of how to work out the efficiency of an algorithm.
4.	You will be able to use and design linked data structures
5.	You will learn why it is good programming style to hide the details of a data structure within an abstract data type.
6.	You should have some idea of how to implement various algorithm using python programming.

Objective:

Sl. No.	
1.	To impart the basic concepts of data structures and algorithms.
2.	To understand concepts about searching and sorting techniques.
3.	To understand basic concepts about stacks,queues,lists,trees and graphs.
4.	To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Pre-Requisite:

Sl. No.			
1.	**Basics of programming language.**		
2.	**Logic building skills.**		
Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction to Data Structure** Abstract Data Type.	**1**	**2**
02	**Arrays** 1D, 2D and Multi-dimensional Arrays, Sparse Matrices .Polynomial representation .	**3**	**4**
03	**Linked Lists** Singly, Doubly and Circular Lists, Normal and Circular representation of Self Organizing Lists, Skip Lists, Polynomial representation.	**4**	**7**
04	**Stacks** Implementing single / multiple stack/s in an Array, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another, Applications of stack, Limitations of Array representation of stack.	**4**	**10**
05	**Queues** Array and Linked representation of Queue, Circular Queue, De-queue, Priority Queues.	**4**	**7**
06	**Recursion** Developing Recursive Definition of Simple Problems and their implementation, Advantages and Limitations of Recursion, Understanding what goes behind Recursion (Internal Stack Implementation)	**4**	**5**
07	**Trees** Introduction to Tree as a data structure, Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals of Binary Search Trees), Threaded Binary Trees (Insertion, Deletion, Traversals), Height-Balanced Trees (Various operations on AVL Trees).	**5**	**15**

08	**Searching and Sorting** Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Merge Sort, Quick sort, Shell Sort, Comparison of Sorting Techniques	**6**	**15**
09	**Hashing** Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function.	**5**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Skill to analyze algorithms and to determine algorithm correctness and their time efficiency.
2. Knowledge of advanced abstract data type (ADT) and data structures and their implementations.
3. Ability to implement algorithms to perform various operations on data structures.

List of Practical:

1. Implementation of array operations.
2. Stacks and Queues: adding, deleting elements .
3. Circular Queue: Adding & deleting elements
4. Merging Problem : Evaluation of expressions operations on Multiple stacks & queues
5. Implementation of linked lists: inserting, deleting, inverting a linked list.
6. Implementation of stacks & queues using linked lists:
7. Polynomial addition, Polynomial multiplication
8. Sparse Matrices : Multiplication, addition.
9. Recursive and Non Recursive traversal of Trees Threaded binary tree traversal.AVL tree implementation Application of Trees.
10. Application of sorting and searching algorithms Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

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
Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia	Data Structures and Algorithms in Python	1118476735, 9781118476734	John Wiley & Sons
Rance D Necaise	Data Structures and Algorithms Using Python	9788126562169	John Wiley & Sons
Reference Books:			
Sartaj Sahni	DataStructures, Algorithms and applications in C++	Second Edition	Universities Press

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer with moderate configuration
2.	Python 2.7 or higher and other softwares as required.

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1 to 9	10	10				
B	1 to 9			5	3	5	60
C	1 to 9			5	3	15	

- Only multiple choice type question (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**
Examination Scheme for Practical Sessional examination:				
Practical Internal Sessional Continuous Evaluation				
Internal Examination:				
Continuous evaluation				**40**
External Examination: Examiner-				
Signed Lab Note Book			**10**	
On Spot Experiment			**40**	
Viva voce			**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Operating System and Operating System Lab	
Course Code: BITAIC202 BITAIC292	**Semester: II**
Duration: 36	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical:4	Continuous Assessment:25
Credit: 4+2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:

Sl. No.	
1.	General understanding of structure of modern computers
2.	Purpose, structure and functions of operating systems
3.	Illustration of key OS aspects by example

Objective:

Sl. No.	
1.	To learn the fundamentals of Operating Systems.
2.	To learn the mechanisms of OS to handle processes and threads and their communication
3.	To learn the mechanisms involved in memory management in contemporary OS
4.	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5.	To know the components and management aspects of concurrency management
6.	To learn programmatically to implement simple OS mechanisms

Pre-Requisite:

Sl. No.	

1.	Strong programming skills (Knowledge of C)
2.	Computer architecture
3.	Elementary data structures and algorithms

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Introduction** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	**3**	**5**
02	**Processes** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	**8**	**20**
03	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	**4**	**5**
04	**Deadlocks** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	**4**	**10**

05	**Memory Management** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	**8**	**10**
06	**I/O Hardware** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.	**6**	**10**
07	**Disk Management** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	**3**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Course Code: BITAI391

Credit: 2

Skills to be developed:

Intellectual skills:

1. Can be able to Identify the purpose of the analysis.
2. Can be considered a reliable source of information.
3. Can able to use a variety of techniques to extend the original idea.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Basics of UNIX commands.

2. Shell programming

3. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority

4. Implement all file allocation strategies

5. Implement Semaphores

6. Implement Bankers algorithm for Dead Lock Avoidance

7. Implement an Algorithm for Dead Lock Detection

9. Implement the all page replacement algorithms a) FIFO b) LRU c) LFU 10. Implement Shared memory and IPC

10. Implement Paging Technique f memory management.

11. Implement Threading & Synchronization Applications

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
AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia	Operating System Concepts Essentials	978-1-119-32091-3	
William Stallings	Operating Systems: Internals and Design Principles	5th Edition	Prentice Hall of India
Reference Books:			
Charles Crowley	Operating System: A Design-oriented Approach	1st Edition	Irwin Publishing
J. Nutt, Addison-Wesley	Operating Systems: A Modern Perspective	2nd Edition	

Maurice Bach	Design of the Unix Operating Systems	8th Edition	Prentice-Hall of India
Daniel P. Bovet, Marco Cesati	Understanding the Linux Kernel	3rd Edition	O'Reilly and Associates

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	**Computer**
2.	**Linux/Ubantu operating system**

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 7**	**10**	**10**				**60**
B	**1 to 7**			**5**	**3**	**5**	
C	**1 to 7**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (AI) **Subject: Environmental Science**			
Course Code: BITAIA201		**Semester: II**	
Duration: 36 Hrs		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 2		End Semester Exam: 70	
Tutorial:0		Attendance: 5	
Practical:0		Continuous Assessment: 25	
Credit: 2		Practical Sessional internal continuous evaluation: NA	
		Practical Sessional external examination: NA	
Aim:			
Sl. No.			
1.	To enable critical thinking in relation to environmental affairs.		
2.	Understanding about interdisciplinary nature of environmental issues		
3.	Independent research regarding environmental problems in form of project report		
Objective:			
Sl. No.			
1.	To create awareness about environmental issues.		
2.	To nurture the curiosity of students particularly in relation to natural environment.		
3.	To develop an attitude among students to actively participate in all the activities regarding environment protection		
4.	To develop an attitude among students to actively participate in all the activities regarding environment protection		
Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	**Introduction** Basic ideas of environment, basic concepts, man, society &amp, environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non- renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management, Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.	**3**	**10**
02	**Ecology**	**7**	**10**
	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban), Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.		

03	**Air pollution and control** Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere,Tropopause and Mesopause. Energy balance:Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).	**6**	**15**
04	**Water Pollution and Control** Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Wastewater treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.	**6**	**15**

05	**Land Pollution** Lithosphere, Internal structure of earth, rock and soil 1L Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	**4**	**10**
06	**Pollution** Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level,(18hr Index), Ldn. Noise pollution control.	**5**	**5**
07	**Environmental Management** Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	**5**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
G. M.Masters,	Introduction to Environmental Engineering and Science		Prentice-Hall of India Pvt. Ltd., 1991
Reference Books:			
A. K. De	Environmental Chemistry		New Age International

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

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

Name of the Course: B.Sc. in Information Technology (AI) **Subject:** Project and Entrepreneurship	
Course Code: BITAIS281	**Semester: II**
Duration: 12Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Database Management System and Database Management System Lab	
Course Code: BITAIC301 BITAIC391	**Semester: III**
Duration: 36	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory:4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical:4	Continuous Assessment:25
Credit: 4+2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:

Sl. No.	
1.	To store and transform data into information
2.	To organize the data in the form of table, schema and report forms
3.	To provide security of data
4.	Data is stored in either hierarchical form or a navigational form

Objective:

Sl. No.	
1.	Understand the uses the database schema and need for normalization
2.	Experience with SQL
3.	Use different types of physical implementation of database
4.	Use database for concurrent use

Pre-Requisite:

Sl. No.	
1.	Elementary knowledge about computers including some experience using UNIX or Windows
2.	Computer Programming & Utilization

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	**Database system architecture** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	**6**	**15**
02	**Relational query languages** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	**12**	**25**
03	**Storage strategies** Indices, B-trees, hashing.	**6**	**10**
04	**Transaction processing** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	**6**	**10**
05	**Database Security** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	**3**	**5**
06	**Advanced topics** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	**3**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Course Code: BITAIC391

Credit: 2

Skills to be developed:

Intellectual skills:

1. Can be able to implement the plan .
2. Can be able to use a variety of techniques to extend the original idea.
3. Can be able to analyze relevant data.
4. Can be considered valid by the fact of it.

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Design a Database and create required tables. For e.g. Bank, College Database
2. Apply the constraints like Primary Key , Foreign key, NOT NULL to thetables.
3. Write a sql statement for implementing ALTER,UPDATE and DELETE
4. Write the queries to implement the joins
5. Write the query for implementing the following functions: MAX(),MIN(),AVG(),COUNT()
6. Write the query to implement the concept of Intergrity constrains
7. Write the query to create the views
8. Perform the queries for triggers
9. Perform the following operation for demonstrating the insertion , updation and deletion using the referential integrity constraints.
10. Write the query for creating the users and their role.

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**
Abraham Silberschatz, Henry F. Korth, S.	Database System Concepts	6th Edition	McGraw-Hill
Sudarshan			
R. Elmasri and S. Navathe	Fundamentals of Database Systems	5th Edition	Pearson Education
Reference Books:			
J. D. Ullman	Principles of Database and Knowledge – Base Systems		Computer Science Press
Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley	Foundations of Databases		
List of equipment/apparatus for laboratory experiments:			

Sl. No.	
1.	Computer/Laptop
2.	Oracle /Mysql

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 6**	**10**	**10**				**60**
B	**1 to 6**			**5**	**3**	**5**	
C	**1 to 6**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.sc in Information Technology (Artificial Intelligence)

Subject: Machine learning and Machine learning Lab

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Course Code: : BITAIC302 BITAIC392	**Semester: III**
Duration:36 hours	**Maximum Marks:200**
Teaching Scheme	**Examination Scheme**
Theory:3	End Semester Exam:70
Tutorial:0	End Semester Exam:70
Practical:4	Attendance : 5
Credit:3+2	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:	
Sl. No.	
1.	**Extract features that can be used for a particular machine learning approach in various AI applications.**
2.	**To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.**
3.	**To mathematically analyse various machine learning approaches and paradigms.**

Objective:	
Sl. No.	
1.	**To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various nodes.**
2.	**To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.**
3.	**Explore supervised and unsupervised learning paradigms of machine learning.**
4.	**To explore Deep learning technique and various feature extraction strategies.**

Pre-Requisite:	
Sl. No.	
1.	**Data Structure**
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Unit 1:** **Supervised Learning (Regression/Classification)** ● **Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Nave Bayes** • **Linear models: Linear Regression, Logistic Regression, Generalized Linear Models** • **Support Vector Machines, Nonlinearity and Kernel Methods** • **Beyond Binary Classification: Multi-class/Structured Outputs, Ranking**	**9**	**10**
02	**Unsupervised Learning** • **Clustering: K-means/Kernel K-means** • **Dimensionality Reduction: PCA and kernel PCA** • **Matrix Factorization and Matrix Completion** • **Generative Models (mixture models and latent factor models)**	**8**	**14**

03	**Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)**	**6**	**14**
04	**Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning**	**4**	**10**
05	**Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference**	**4**	**14**
06	**Recent trends classification applications.in various methods for learning techniques applications of machine learning.**	**5**	**8**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
Intellectual skills:

List of Practical

Based on Theory

Assignments: Based on Theory

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Reference Books:

1. Kevin Murphy	**Machine Learning: A Probabilistic Perspective**		**MIT Press, 2012**
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman,	**The Elements of Statistical Learning,**		**Springer 2009 (freely available online)**
3.Christopher Bishop,	**Pattern Recognition and Machine Learning,**		**Springer, 2007.**

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	**Computer**
2.	
3.	

4.	

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**ALL**						
C				**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Artificial Intelligence			
Course Code: BITAIC303		**Semester: III**	
Duration: 36		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory:5		End Semester Exam: 70	
Tutorial: 1		Attendance : 5	
Practical:0		Continuous Assessment:25	
Credit: 6			
Aim:			
Sl. No.			
1.	To enable computers to perform such intellectual tasks as decision making, problem solving, perception, understanding human communication		
Objective:			
Sl. No.			
1.	Understand the uses Artificial Intelligence in real life scenario.		
Pre-Requisite:			
Sl. No.			
1.	Elementary knowledge about Computer Programming		
2.	Data Structure & algorithm		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	**6**	**15**

02	Search techniques : Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.	**5**	**10**
03	Heuristic search strategies :Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.	**5**	**10**
04	Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening. Knowledge & reasoning Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	**6**	**10**
05	Using predicate logic Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.	**5**	**5**
06	Probabilistic reasoning :Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics. Planning [2] Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques. Natural Language processing :Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning : Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Expert Systems [2] Representing and using domain knowledge, expert system shells, knowledge acquisition.	**9**	**20**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Credit: 2

Skills to be developed:

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
Ritch & Knight	Artificial Intelligence,		TMH
Stuart Russel Peter Norvig Pearson	Artificial Intelligence A Modern Approach		

Reference Books:

Patterson,	Introduction to Artificial Intelligence & Expert Systems		PHI

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	Computer/Laptop
2.	Oracle /Mysql

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 6**	**10**	**10**				**60**
B	**1 to 6**			**5**	**3**	**5**	
C	**1 to 6**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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:

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

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	3	3

Name of the Course: B.sc in Information Technology (Artificial Intelligence)
Subject :Object Oriented Programming

Course Code: BITAIS381	**Semester: III**
Duration:12 hours	**Maximum Marks:100**
Teaching Scheme	**Examination Scheme**
Theory:1	Practical Sessional internal continuous evaluation:40
Tutorial:0	Practical Sessional external examination:60
Practical:4	
Credit:3	

Aim:

Sl. No.	
1.	To understand Object Oriented Programming concepts and basic characteristics of Java
2.	To know the principles of packages, inheritance and interfaces

Objective:

Sl. No.	
1.	To define exceptions and use I/O streams
2.	To develop a java application with threads and generics classes

Pre-Requisite:

Sl. No.	
1.	**Data Structure**
2.	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	• INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10 Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments.	**9**	**10**

02	• INHERITANCE AND INTERFACES 9 Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces - Object cloning -inner classes, ArrayLists - Strings	**8**	**14**
03	EXCEPTION HANDLING AND I/O 9 Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	**6**	**14**
04	MULTITHREADING AND GENERIC PROGRAMMING 8 Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.	**4**	**10**
05	EVENT DRIVEN PROGRAMMING 9 Graphics programming - Frame – Components - working with 2D shapes - Using color, fonts, and images - Basics of event handling - event handlers - adapter classes - actions - mouse events -	**4**	**14**
06	AWT event hierarchy - Introduction to Swing – layout management - Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows – Menus – Dialog Boxes	**5**	**8**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:
Skills to be developed:
Intellectual skills:

List of Practical

Based on Theory

Assignments: Based on Theory

List of Books
Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Reference Books:

1. Herbert Schildt	Java The complete reference		McGraw Hill Education, 2011.

2. Cay S. Horstmann, Gary cornel	—Core Java Volume –I Fundamentals		Prentice Hall, 2013

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	**Computer**
2.	
3.	
4.	

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**ALL**						
C				**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Computer Networks and Computer Networks Lab			
Course Code: BITAIC401 BITAIC491		**Semester: IV**	
Duration:36 hrs		**Maximum Marks: 200**	
Teaching Scheme		**Examination Scheme**	
Theory: 4		**End Semester Exam: 70**	
Tutorial: 0		**Attendance : 5**	
Practical: 4		**Continuous Assessment: 25**	
Credit: 4 + 2		**Practical Sessional internal continuous evaluation: 40**	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.	**Ability to** Learn the flow control and congestion control algorithms		
Objective:			
Sl. No.			
1.	Understand the division of network functionalities into layers.		
2.	Be familiar with the components required to build different types of networks Be exposed to the required functionality at each layer		
3.			
Pre-Requisite:			
Sl. No.			
1.	**Electrical, Electronics**		
2.			
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**FUNDAMENTALS & LINK LAYER 9L** Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance ; Link layer Services – Framing – Error Detection – Flow control	**7**	**14**

02	**MEDIA ACCESS & INTERNETWORKING 9L** Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP,ICMP)	**7**	**14**
03	**ROUTING 9L** Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM)	**7**	**14**
04	**TRANSPORT LAYER 9L** Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements	**7**	**14**
05	**APPLICATION LAYER 7L** Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

Based on theory

Assignments: Based on theory

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
James F. Kurose, Keith W. Ross,	"Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition,		Pearson Education

Nader. F. Mir	Computer and Communication Networks		Pearson Prentice Hall Publishers,
Reference Books:			
Ying-Dar Lin, Ren-Hung Hwang, Fred Baker	Computer Networks: An Open Source Approach",		McGraw Hill Publisher
Behrouz A. Forouzan	Data Communication and Networking		Tata McGraw – Hill.
List of equipment/apparatus for laboratory experiments:			
Sl. No.			
1.	**Computer**		

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**				**70**
B	**ALL**			**5**	**3**	**15**	
C	**ALL**			**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

Examination Scheme for Practical Sessional examination:			
Practical Internal Sessional Continuous Evaluation			
Internal Examination:			
Continuous evaluation			**40**
External Examination: Examiner-			
Signed Lab Assignments		**10**	
On Spot Experiment		**40**	
Viva voce		**10**	**60**

Name of the Course: BSc. in Information Technology (AI) **Subject:** Software Engineering	
Course Code: BITAIC402 BITAIC492	**Semester: IV**
Duration: 36 Hrs.	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 4	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4	**Continuous Assessment: 25**
Credit: 4+2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	Ability to learn how to implement Project.
2.	Ability to learn how to handle project in corporate level.

Objective:

Sl. No.	
1.	Understand different stage of project implementation.
2.	Understand how to estimate various project parameter.

Pre-Requisite:

Sl. No.	
1.	**Object Oriented Programming Concept.**

Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.	**10**	**14**
02	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.	**5**	**14**

03	Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.	**8**	**14**
04	Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.	**7**	**14**
05	Fundamentals of Object Oriented design in UML Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram.	**8**	**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**
Rajib Mall	Software Engineering		
Somerville	Software Engineering		**Pearson**

Reference Books:

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	1,2,3,4,5	10	10				
B	3, 4, 5			5	3	5	60
C	1,2,3,4,5			5	3	15	

- Only multiple choice type question (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

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL
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Department of Information Technology
Syllabus of B.Sc. in Information Technology (Artificial Intelligence)
Effective from academic session 2020-21

Name of the Course: B.sc in Information Technology (Artificial Intelligence) **Subject:** Data Visualization and Data Visualization Lab	
Course Code: BITAIC403, BITAIC493	
Duration:36 Hrs.	**Semester: IV**
Teaching Scheme	**Maximum Marks:200**
Theory:4	**Examination Scheme**
Tutorial:0	End Semester Exam:70
Practical:4	Attendance : 5
Credit:4+2	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

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**

Practical:

Skills to be developed:

1.Data interpretation skills using statistics
2.Data analysis skills from visualizations
3.Mathematical computation skills in Python
4.Visualization creation skills

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Write a Python program to create a 1D Numpy array having integers from 1 to 100, and extract all multiples of 7 from it.
2. Write a Python program to create a 1D Numpy array having 36 random elements fromthe standard normal distribution. From this array, create another array having 9 rows and 4 columns.
3. Write a Python program to create a matrix of order 4x5 having randomly selected integers in the range [1,100]. Compute the mean of the elements of this matrix without using the mean and sum functions of Numpy.
4. Write a Python program to create a zero matrix of order 10x10. From this matrix, create
   a) an identity matrix of order 10.
   b) a diagonal matrix with elements 4, 7, 2, 9, 1, -4, -7, -2, -9, -1 along theprincipal diagonal.
5. The sales for the years 2017, 2018 and 2019 are given in the 'Sales Data' file. Write a Python program to plot the data in a single line chart and comment regarding the general trendand the sales across different months.
6. The 'Heights' dataset contains the heights in inches for boys and girls in a class of 40 students. Write a Python program to construct box plots for heights of boys and girls on a singlescale.

   State which box plot has the wider spread for the middle 50% of the data, and which one is skewed.
7. Write a Python program to import the 'Pokemon' dataset, and plot a bar graph for the number of pokemon of each type having
   a) speed less than 50
   b) attack more than 90
8. Write a Python program to import the FIFA dataset. Plot histograms for the following attributes and comment regarding their distribution:
   a) Overall
   b) Age
   c) Shot Power
9. Write a Python program to Import the 'Housing Sales' dataset. Plot scatter plots between the following attributes and write down some conclusions regarding the correlation between them:
   a) 1stFlrSF and SalePrice
   b) 2ndFlrSF and SalePrice
   c) GarageArea and SalePrice

Assignments (based on theory classes):

1. Write a Python program to create a 1D numpy array having 30 distinct elements, and change it to a 5×6 matrix.
2. Write a Python program to create a 4×4 zero matrix and replace the entries along the principal diagonal by 9,8,-5,4.

3. What is numpy.random.rand() used for? Explain with an example.
4. Write a Python program to create a numpy array having 8 equi-spaced elements, starting at 4 and ending at 128.
5. Consider the following data:
   Heights (in inches) for boys:
   66; 66; 67; 67; 68; 68; 68; 68; 68; 69; 69; 69; 70; 71; 72; 72; 72; 73; 73; 74
   Heights (in inches) for girls:
   61; 61; 62; 62; 63; 63; 63; 65; 65; 65; 66; 66; 66; 67; 68; 68; 68; 69; 69; 69
   On a single scale, construct box plots for heights of boys and girls. State which box plot has the wider spread for the middle 50% of the data.
6. Explain broadcasting in Python with examples.
7. Consider a dataset named Banking, of csv format, having the following attributes:
   Customer ID, Age, Job, Marital Status, Education, Balance
   Write code to execute the following in Python:
   a) Import the dataset in pandas.
   b) Give a short statistical summary of the data. Does this summary include the mode of the attributes?
   c) Find the unique values of Education attribute.
   d) Plot a bar graph showing the counts of different Job categories.
   e) Plot a bar graph showing the counts of different Job categories for entries having Age between 30 and 50.
   f) Plot a histogram to show the distribution of the Balanceattribute.
   g) Plot a scatter plot between Age and Balance. Can you comment on the correlation between the variables by looking at this plot?

8. Explain, with the help of examples, how to improve plot aesthetics by changing colours, changing layout and adding annotations in matplotlib.pyplot.

List of Books
Text Books:

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

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	Computer

End Semester Examination Scheme.		**Maximum Marks-70.**	**Time allotted-3hrs.**
Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)	**Subjective Questions**

		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	ALL	10	10				
B	ALL			5	3	5	70
C	ALL			5	3	15	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation		**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (AI) **Subject:** Minor Project and Entrepreneurship II	
Course Code: BITAIS481	**Semester: IV**
Duration: 12Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

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Syllabus of B.Sc. in Information Technology (Artificial Intelligence)
Effective from academic session 2020-21

Name of the Course: *B. Sc. in Information Technology (Artificial Intelligence)* **Subject:** *Deep Learning*			
Course Code: BITAIC501 BITAIC591		**Semester:** V	
Duration: 36 Hrs.		**Maximum Marks:** 200	
Teaching Scheme		**Examination Scheme**	
Theory: 4		**End Semester Exam:** 70	
Tutorial: 0		**Attendance :** 5	
Practical: 4		**Continuous Assessment:** 25	
Credit: 4 + 2		**Practical Sessional internal continuous evaluation:** 40	
		Practical Sessional external examination: 60	
Aim:			
Sl. No.			
1.			
Objective:			
Sl. No.			
1.	*Apply deep learning approach to solve real life complex problem.*		
Pre-Requisite:			
Sl. No.			
1.	*Artificial Intelligence, Probability and Statistics, Linear Algebra*		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	*Introduction* *Feedforward Neural networks. Gradient descent and the backpropagation algorithm. Unit saturation, aka the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima. Heuristics for faster training. Nestors accelerated gradient descent. Regularization. Dropout.* *Convolutional Neural Networks* *Architectures, convolution / pooling layers Recurrent Neural Networks LSTM, GRU, Encoder Decoder architectures* *Deep Unsupervised Learning*	*6*	*14*
02	*Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM Attention and memory models,* *Dynamic memory networks*	*6*	*14*
03	*Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics*	*6*	*14*
04	*Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-ofWords model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning*	*6*	*14*
05	*Dialogue Generation with LSTMs* *Applications of Dynamic Memory Networks in NLP*	*6*	*10*
06	*Recent Reseearch in NLP using Deep Learning: Factoid Question Asnwering, similar question detection, Dialogue topic tracking, Neural Summarization, Smart Reply*	*6*	*4*
	Sub Total:	*36*	*70*
	Internal Assessment Examination & Preparation of Semester Examination	*4*	*30*
	Total:	*40*	*100*

Practical:

Skills to be developed:

List of Practical:

1. *Based on theory lectures.*

List of Books

Text Books:

Name of Author	*Title of the Book*	*Edition/ISSN/ISBN*	*Name of the Publisher*
Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville	*Deep learning."*		*MIT Press book*
Bengio, Yoshua.	*Learning deep architectures for AI." Foundations and trends in Machine Learning*		

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	*Computer*

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	**Total Marks**	**No of question to be set**	**To answer**	**Marks per question**	**Total Marks**
A	ALL	10	10				
B	ALL			5	3	5	70

C	ALL			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**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Image Processing **and** Image Processing **Lab**	
Course Code: BITAIC502,BITAI592	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 4	**End Semester Exam: 70**
Tutorial: 0	**Attendance : 5**
Practical: 4	**Continuous Assessment: 25**
Credit: 4 + 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	Review the fundamental concepts of a digital image processing system
2.	Evaluate the techniques for image enhancement and image restoration.
3.	Interpret image segmentation and representation techniques.
4.	Interpret Image compression standards.

Objective:

Sl. No.	
1.	To study the image fundamentals and mathematical transforms necessary for image processing.
2.	To study the image enhancement techniques.
3.	To study image restoration procedures. To study the image compression procedures.

Pre-Requisite:

Sl. No.	
1.	Mathematics
2.	Digital Electronics, Signals and systems.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction ,Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	**3**	**8**
02	Digital Image Formation [4L] A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform	**3**	**10**

03	Mathematical Preliminaries [9L] Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.	**8**	**16**
04	Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, Highboost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	**8**	**16**
05	Image Restoration [7L] Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	**7**	**10**
06	Image Segmentation [7L] Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	**7**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination		
	Total:		

Practical:

Skills to be developed:

Intellectual skills:

1. Skill to Analyze images in the frequency domain using various transforms.
2. Skill to Interpret image segmentation and representation techniques

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

1. Display an image to illustrate change in image quality with decreasing gray levels-128, 64, 32, 16 and 8.
2. Write a code in Matlab to perform the following operations on an image:
   a. Increase and decrease brightness of an image.
   b. Manipulate contrast of an image.
   c. Determine negative of an image.
3. Read an image and perform histogram equalization of the input image and analyse theresult.
4. Read a grayscale image and convert it to a binary image using hard thresholding. Make the threshold value a user defined parameter. Vary the threshold and observe theresult.
5. Read an image, convolve the image with the mask 1/9 x $\begin{matrix}1 & 1 & 1\\ 1 & 1 & 1\\ 1 & 1 & 1\end{matrix}$

   And show that it performs averaging operation which results in blurring of the image. Also analyse

the impact of increasing the size of the mask to 5x5, that is, mask is

$$1/9 \times \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{pmatrix}$$

6. Read an image and then corrupt the image by salt-and-pepper noise and Gaussian noise. Then apply an averaging filter of size 3 X 3 and 5 x 5 to this corrupted image. Comment on the result obtained.
7. Read an image and then corrupt the image by salt-and-pepper noise. Now apply a 3 x 3 box filter, a 5 x 5 box filter and a median filter to the corrupted image and comment on the result obtained.
8. Write a matlab program that performs a two-dimensional Butterworth low-pass and high-pass filter of the given image for two different cut-off frequencies.
9. Read an input image to perform the following operations:
    a. High-pass filtering in the frequency domain
    b. Low-pass filtering in the frequency domain
    c. Band-pass filter in the frequency domain
    d. Band-stop filter in the frequency domain
10. Read an image and degrade the image using motion blur.

Assignments: Based on 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
Gonzalves,	Digital Image Processing		Pearson
Jahne	Digital Image Processing,		Springer India
Reference Books:			
Chanda & Majumder	Digital Image Processing & Analysis		PHI
Jain	Fundamentals of Digital Image Processing		PHI
Sonka,	Image Processing, Analysis & Machine Vision,		VIKAS

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1.	**Computer**

2.	**Software : Matlab, Python**
3.	
4.	
5.	

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1,2,3,4,5,6**	**10**	**10**	**5**	**3**	**15**	**70**
B	**1,2,3,4,5,6**						
c				**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

Examination Scheme for Practical Sessional examination:		
Practical Internal Sessional Continuous Evaluation		
Internal Examination:		
Continuous evaluation		**40**
External Examination: Examiner-		
Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject: Pattern Recognition**	
Course Code: BITAID501A	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Skills to Design and construct a pattern recognition system
2.	Skills to Know the major approaches in statistical and syntactic pattern recognition.

Objective:

Sl. No.	
1.	To introduce the fundamental algorithms for pattern recognition
2.	To instigate the various classification and clustering techniques

Pre-Requisite:

Sl. No.	
1.	Statistics.,
2.	Mathematics
3.	Programming Basic knowledge

Contents		Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Basics of pattern recognition**	**2**	**5**

02	**Bayesian decision theory :** Classifiers, Discriminant functions, Decision surfaces ,Normal density and discriminant functions ,Discrete features	**8**	**6**
03	**Parameter estimation methods** Maximum-Likelihood estimation **,**Gaussian mixture models ,Expectation-maximization method , Bayesian estimation	**6**	**8**
04	**Hidden Markov models for sequential pattern classification** Discrete hidden Markov models , Continuous density hidden Markov models	**8**	**8**
05	**Dimension reduction methods** Fisher discriminant analysis, Principal component analysis, Parzen-window method ,. K-Nearest Neighbour method	**3**	**6**
06	**Non-parametric techniques for density estimation**	**2**	**6**
07	**Linear discriminant function based classifier** Perceptron , Support vector machines	**2**	**4**
08	**Non-metric methods for pattern classification** Non-numeric data or nominal data , Decision trees	**3**	**13**
09	**Unsupervised learning and clustering** Criterion functions for clustering ,Algorithms for clustering: K-means, Hierarchical and other methods	**2**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1. Will be able Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms.

2. Will be able to Understand and apply both supervised and unsupervised clasification methods to detect and characterize patterns in real-world data.

Assignments: : Assignment from theory

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
R. O. Duda, P. E. Hart and D. G. Stork	Pattern Classification		
S. Theodoridis and K. Koutroumbas	Pattern Recognition		Academic Press

Reference Books:

C. M. Bishop	Pattern Recognition and Machine Learning		Springer

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**ALL**					**45**	
c	**ALL**			**5**	**3**		

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject: Security & Authentication**	
Course Code:BITAID501B	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance : 5**
Practical 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Ability to Understand common attacks and how to prevent them.
2.	Ability to Understand how security is defined and proven at the cryptographic level.

Objective:

Sl. No.	
1.	Gain the ability to apply appropriate cryptographic techniques to a security engineering (and management) problem at hand.
2.	A strong grasp of the basic concepts underlying classical and modern cryptography, and the fundamentals.

Pre-Requisite:

Sl. No.	
1.	Basic Networking Knowledge,
2.	Basic Programming Knowledge
3.	computer organization, discrete mathematics

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to Information Security : Attacks, Vulnerability, Security Goals, Security Services and mechanisms	**2**	**5**
02	Conventional Cryptographic Techniques : Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher, Steganography	**8**	**6**

03	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms	**6**	**8**
04	Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos	**8**	**8**
05	Program Security : Nonmalicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels	**3**	**6**
06	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME	**2**	**6**
07	**Exploitation techniques and fuzzing, Secure system design, access control, and protection**	**2**	**4**
08	**Tools for writing robust application code, Dealing with bad (legacy) application code: sandboxing and isolation, Network security testing , Malware: Computer viruses, Spyware, and key-loggers , bot-nets: attacks and defenses .**	**3**	**13**
09	**Basic web security mode, User authentication and session management, Web application security, Security problems in network protocols: TCP, DNS, SMTP, and routing, Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters**	**2**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

Intellectual skills:

1. Able to Understand how security is defined and proven at the cryptographic level.

Assignments: : Assignment from theory

List of Books

Text Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Kevin Murphy	Machine Learning: A Probabilistic Perspective		MIT Press
Trevor Hastie, Robert Tibshirani, Jerome Friedman,	The Elements of Statistical Learning,		Springer
Reference Books:			
Christopher Bishop	Pattern Recognition and Machine Learning		Springer

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

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Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**All**	**10**	**10**	**5**	**3**	**15**	**70**
B	**All**			**5**	**3**	**45**	
C	**All**						

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

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Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Health Informatics	
Course Code:BITAID501C	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Ability to Understand and appreciate the role and value of information technologies in potentially revolutionizing healthcare delivery, administration, education, and research;
2.	Ability to distinguish the various types of healthcare information, including knowledge, data, sources, processes and standards;.

Objective:

Sl. No.	
1.	Identify major health informatics applications and develop basic familiarity with healthcare IT products;
2.	Analyze obstacles and success factors for implementation and integration of information, communication and decision technologies in healthcare;.

Pre-Requisite:

Sl. No.	
1.	Basic Data Analytic knowledge
2.	Basic Programming Knowledge

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Information technology including hardware, software, characteristics of systems, Spreadsheets and presentations	**5**	**10**
02	Databases, Administrative Decision Making Support Systems	**8**	**5**
03	Clinical Decision Making Support Systems , Healthcare Information Systems and Departments	**9**	**8**
04	Strategic Planning and Implementation of Healthcare Information Systems Networks	**8**	**18**

05	Life Cycle of Healthcare Information Systems to include budgeting, proposals, and project management Electronic Health Records	**2**	**10**
06	Human factors in Healthcare Information Systems Communication Technology	**2**	**10**
07	Imaging Technology Standards for Electronic Health Records, Protection and securityof healthcare information and systems	**2**	**9**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

skills:

1. Able to acquire hands-on experience in analyzing a problem arising from practice and implementing a solution using a health informatics approach

Assignments: : Assignment from theory

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Cecily Morrison, Matthew R. Jones, Julie Bracken	Clinical Information Systems in Critical Care		

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**

B **c**	**All** **All**			**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

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Department of Information Technology
Syllabus of B.Sc. in Information Technology (Artificial Intelligence)
Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Soft Computing	
Course Code:BITAID502A	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation:NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Cover the concepts of Fuzzy logic (FL), Artificial Neural Networks (ANNs) and Genetic Algorithm (GA).
2.	Ability to apply Soft Computing techniques to solve a number of real life problems.
3.	Provide exposure to theory as well as practical systems and software used in soft computing.

Objective:

Sl. No.	
1.	To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2.	To implement soft computing based solutions for real-world problems.
3.	To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.

Pre-Requisite:

Sl. No.	
1.	Understanding of basic mathematical logic.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**

01	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm.	**4**	**10**
02	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.	**18**	**30**
	Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting.		
03	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuo-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification .	**6**	**10**
04	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition.	**4**	**10**
05	Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	**4**	**10**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1. Able to apply Soft Computing techniques to solve a number of real life problems.

Assignments: : Assignment from theory

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Timothy J. Ross, John Wiley and Sons	Fuzzy logic with engineering applications		
S. Rajasekaran and G.A.V.Pai	Neural Networks, Fuzzy Logic and Genetic Algorithms		PHI
S N Sivanandam, S. Sumathi, John	Principles of Soft Computing		
Reference Books:			
George J. Klir and Bo Yuan	Fuzzy Sets and Fuzzy Logic: Theory and Applications		Prentice Hall
Simon Haykin	Neural Networks: A Comprehensive Foundation		Prentice Hall.

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**All**						
c	**All**			**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation		
Internal Examination:		
Continuous evaluation		**40**
External Examination: Examiner-		
Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence)
Subject: Network Security

Course Code: BITAID502B	**Semester: V**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Ability to Understand how security is defined and proven at the cryptographic level.

Objective:			
Sl. No.			
1.	A strong grasp of the basic concepts underlying classical and modern cryptography, and the fundamentals.		
2.	Understand how security is defined and proven at the cryptographic level.		
Pre-Requisite:			
Sl. No.			
1.	Fundamentals of Networking		
2.	Basic Programming Language		
Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Foundations of Network Security** Principles of Network Security, Network Security Terminologies , Network Security and Data Availability, Components of Network Security, Network Security Policies.	**2**	**3**
02	**Advanced TCP/IP** TCP/IP Concepts , Subnet Masks, Variable Length Subnet Masks,Unicast,Broadcast and Multiple Concepts ,The Three way Handshake,The Process of DHCP and APIPA,Internet Protocol version 6.	**3**	**4**
03	**Packet Structure and Analysis** Capture and Identify IP Datagrams, Capture and Identify ICMP	**3**	**7**
	Messages,Capture and Identify TCP Headers ,Capture and Identify UDP Headers ,Packet Fragmentation,The Three way Handshake		
04	**Routing and Access Control Lists** Arp Process , Cisco Routing Modes , Routing Process , Routing Tables, Access Control Lists ,Implement Access Control Lists, Limitations , DNS and Its Role .	**3**	**7**
05	**Securing Windows** Windows NT 4.0 Fundamental Security , Windows NT Resource Security,Windows 2000 Infrastructure,Windows 2000 Authentication,Windows 2000 User and Group Security ,Windows 2000 Resource Security ,Windows 2000 Network Security.	**3**	**7**
06	**Securing Linux** Key Concepts, Linux Administration and Security, Key Linux Network Files, Key Linux Network Process, Key Linux Network Commands,Hardening Linux,Network File System and Linux,Network Information Service and Linux .	**4**	**7**

07	**Security on the Internet and World Wide Web** Components of Internet , Weak Points of Internet, Techniques of Web Hacking, Methods of Attacking Users.	**5**	**7**
	Attack Techniques Network Reconnaissance , Mapping and sweeping the Network , Scanning the Network ,Viruses, Worms and Trojan Horses, Gaining Control on Systems,Record Keystrokes,Crack Encrypted Passwords,Reveal Hidden Passwords, Gain Unauthorised Access, Hide evidence of Attack ,Perform a Denial of Service attack		
08	**Network Defense Fundamentals** Concepts, & Key Issues , Identify Defensive Technologies, Objectives of Access Control , Identify Impact of Defense , Concepts of Network Auditing **Designing and Configuring Fire wall Systems** Firewall Components , Creating a FW Policy, Rule Sets and Packet Filters, Proxy Server ,Bastion Host and Honey pot , FW Implementation Practices , Installing and Configuring FW, Monitor FW ,Installing and configuring ISA Server 2000 ,Monitor ISA Server ,IP Chains Concepts,Implementing FW Technologies .	**5**	**7**
09	**Configuring VPNs** VPN Fundamentals ,IP Security Protocol,VPN Design and Architecture,VPN Security ,Configuring a VPN . **Cryptography Fundamentals** What is Cryptography? , History of Encryption , Symmetric versus Asymmetric, Combined Solutions, Private Key versus Public Key, Data Encryption Standard (DES) , Advanced Encryption Standard (AES), RSA, Diffie-Hellman , MD4, MD5, SHA-1	**4**	**7**
10	**Digital Signatures**	**2**	**7**
	Definition and Characteristics,How Digital Signatures function , Message Digest Functions, Digital Signatures with Message Digest , E-Signature Law and Legal Issues, Key Length (56, 112, and 128 bit) , RSA and DSS Signature Standards **Secure EMail Implementation** Secure use of Netscape Messenger, Secure use of Microsoft Outlook ,Secure use of Microsoft Outlook Express ,PGP Implementation,Sending Signed E-Mail Messages,E-Mail encryption and Decryption Methods **.**		

11	**Secure and resilient data aggregation** Key pre-distribution and management, Encryption and authentication, Security in group communication, Trust establishment and management, Denial-of-service attacks, Energy-aware security mechanisms **Internet Security** Denial-of-Service Attacks, Internet Worms, IP Trace back, BGP security.	**2**	**7**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

1. Able to apply techniques to solve a number of real life problems.

Assignments: : Assignment from theory

List of Books

Text Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Tyler Wrightson	Wireless Network Security A Beginner's Guide	ISBN: 9780071760942	McGraw-Hill

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

Group	**Unit**	**Objective Questions** (MCQ only with the correct answer)		**Subjective Questions**			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**	**5**	**3**	**15**	**70**
B	**All**						
c	**All**			**5**	**3**	**45**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**

Examination Scheme for Practical Sessional examination:		
Practical Internal Sessional Continuous Evaluation		
Internal Examination:		
Continuous evaluation		**40**
External Examination: Examiner-		
Signed Lab Assignments	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (AI) **Subject: Internet of Things**	
Course Code: BITAID502C	**Semester: II**
Duration: 36 Hrs	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	End Semester Exam: 70
Tutorial:1	Attendance: 5
Practical:0	Continuous Assessment: 25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1.	Describe what IoT is and how it works today.
2.	Recognize the factors that contributed to the emergence of IoT
3.	Design and program IoT devices

Objective:

Sl. No.	
1.	Use real IoT protocols for communication

2.	Secure the elements of an IoT device.
3.	Design an IoT device to work with a Cloud Computing infrastructure

Contents		**4 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Introduction to IoT, Sensing, Actuation, Basics of Networking, Basics of Networking, Communication Protocols	**3**	**10**
02	Communication Protocols, Sensor Networks. Sensor Networks,Machine-to-Machine Communications.	**7**	**10**
03	Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino., Introduction to Python programming, Introduction to Raspberry.	**6**	**15**
04	Implementation of IoT with Raspberry Pi, Introduction to SDN. SDN for IoT, Data Handling and Analytics, Cloud Computing.	**6**	**15**
05	Cloud Computing, Sensor-Cloud. Fog Computing, Smart Cities and Smart Homes.	**4**	**10**
06	Connected Vehicles, Smart Grid, Industrial IoT.	**5**	**5**
07	rial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.	**5**	**5**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
Jan Holler Vlasios Tsiatsis Catherine Mulligan Stamatis Karnouskos Stefan Avesand David Boyle	From Machine to machine Internet of Things		

Reference Books:

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

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

Name of the Course: B.Sc. in Information Technology (AI) **Subject:** Industrial Training and Internship	
Course Code: BITAIS581	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0	**End Semester Exam: 100**
Tutorial: 0	**Attendance: 0**
Practical: 4	**Continuous Assessment: 0**
Credit: 2	**Practical Sessional internal continuous evaluation: 40**
	Practical Sessional external examination: 60
Contents	
Students will do projects on application areas of latest technologies and current topics of societal relevance.	

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Cloud Computing and Cloud Computing Lab	
Course Code: BITAIC601& BITAIC691	**Semester: VI**
Duration: 36	**Maximum Marks: 200**
Teaching Scheme	**Examination Scheme**
Theory: 4	End Semester Exam: 70
Tutorial: 0	Attendance : 5
Practical:4	Continuous Assessment:25
Credit: 4+2	Practical Sessional internal continuous evaluation:40
	Practical Sessional external examination:60

Aim:

Sl. No.	
1.	Analyze the Cloud computing setup with it's vulnerabilities and applications using different architectures.
2.	Design different workflows according to requirements and apply map reduce programming model.
3.	Apply and design suitable Virtualization concept, Cloud Resource Management and design scheduling algorithms.
4.	Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds
5.	Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop cloud application
6.	Broadly educate to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.

Objective:

Sl. No.	
1.	To learn how to use Cloud Services.

2.	To implement Virtualization
3.	To implement Task Scheduling algorithms.
4.	Apply Map-Reduce concept to applications.
5.	To build Private Cloud.
6.	Broadly educate to know the impact of engineering on legal and societal issues involved.

Pre-Requisite:

Sl. No.	
1.	Knowledge on Operating System.
2.	Knowledge on Virtualization.
3.	Knowledge on Networking.

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**Definition of Cloud Computing and its Basics** 1. Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing 2. Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients 3. Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	**9**	**20**
02	**Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU,	**12**	**25**

	storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance 2. Concepts of Platform as a Service Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks 3. Use of Google Web Services Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service. 4. Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service Syllabus for B.Tech(Information Technology) Up to Fourth Year Revised Syllabus of B.Tech IT (for the students who were admitted in Academic Session 2010-2011) 55 5. Use of Microsoft Cloud Services Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services		
03	**Cloud Infrastructure** Types of services required in implementation – Consulting, Configuration, Customization and Support 1. Cloud Management An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle) 2. Concepts of Cloud Security Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	**7**	**10**
04	**Concepts of Services and Applications**		**15**

	Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs 2. Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs 3. Cloud-based Storage: Cloud storage definition – Manned and Unmanned 4. Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services	**8**	
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

Course Code: BITAIC691

Credit: 2

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)

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
Barrie Sosinsky,	Cloud Computing Bible		Wiley India Pvt. Ltd
Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi,	Mastering Cloud Computing		McGraw Hill Education (India) Private Limited
Anthony T. Velte,	Cloud computing: A practical approach		Tata Mcgraw-Hill.

Reference Books:

Dr. Kumar Saurabh,	Cloud Computing	Second Edition	Wiley India

List of equipment/apparatus for laboratory experiments:

Sl. No.	
1.	**Computer**
2.	**Linux/Ubantu operating system**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

NH-12 (Old NH-34), Simhat, Haringhata, Nadia -741249

Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**1 to 4**	**10**	**10**				**60**
B	**1 to 4**			**5**	**3**	**5**	
C	**1 to 4**			**5**	**3**	**15**	

- Only multiple choice type question (MCQ) with one correct answer are to be set in the objectivepart.
- 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**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

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Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course:	B.Sc. in Information Technology (Artificial Intelligence)
Subject: Introduction to Robotics and Introduction to Robotics Lab	
Course code: BITAIC602, BITAIC692	
Teaching Scheme	**Semester: VI**
Theory: 4	**Maximum Marks: 200**
Tutorial: 0	**Examination Scheme**
Practical: 4	**End Semester Exam: 70**
Credit: 3 + 2	**Attendance : 5**
	Continuous Assessment: 25
	Practical Sessional internal continuous evaluation: 40
	Practical Sessional external examination: 60

Aim:

Sl. No.	
1.	**Ability** to understand the limitations of Algorithmic power
2.	

Objective:

Sl. No.	
1.	To focus on topics in robotics that relate to modeling, dynamics, and control ofrobotic manipulators
2	To understand different algorithm design techniques.

Pre-Requisite:

Sl. No.	
1	**Mathematics, programming knowledge**
2	

Contents		**Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	Preliminaries, A glimpse on 2D planar position kinematics ,A glimpseon 2D planar velocity kinematics	**6**	**14**
02	Relative position ,The rotation matrix ,The anatomy of a rotationmatrix ,Composition of rotations, Parameterizations of rotation	**6**	**14**
03	The similarity transformation , Switching rotation parameterizations ,Rigid body motions ,Denavit Hartenbergparameters , DH-example	**6**	**14**

04	Inverse kinematics – theory ,Inverse kinematics – examples , Inversekinematics – more examples ,Forward kinematics on the Puma	**6**	**10**
05	Angular velocity.Representation of angular velocity ,The Jacobian , Jacobian examples , Singularities ,Singularity examples ,Jacobian withforces & accelerations	**6**	**4**
06	Newtonian Dynamics , Newtonian dynamics example , Lagrangian dynamics , Lagrangian dynamics example ,Independent joint control , Feedback linearization / computed torque control.	**6**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of SemesterExamination	**4**	**30**
	Total:	**40**	**100**

Practical:

Skills to be developed:

List of Practical: Sl. No. 1& 2 compulsory & at least three from the

rest)Based on theory

Assignments: Based on theory

List of

BooksText

Books:

Name of Author	**Title of the Book**	**Edition/ISSN/ISBN**	**Name of the Publisher**
McKinnon, Peter.Robotics	everything you Need to know about robotics from beginner to expert.		Peter McKinnon
Ghosal, Ashitava	Robotics: fundamental concepts and analysis.		Oxford university press

Reference Books:

Niku, Saeed B.	Introduction to robotics:analysis, control, applications		John Wiley & Sons,

List of equipment/apparatus for laboratory experiments:

Sl. No.	

1.	
2.	
3.	
4.	
5.	

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks
A	**ALL**	**10**	**10**				**70**
B	**ALL**			**5**	**3**	**15**	
C	**ALL**			**5**	**3**	**45**	

- Only multiple choice type question (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**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

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Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Intrusion Detection and Prevention	
Course Code: BITAD601A	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial: 1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit: 6	**Practical Sessional internal continuous evaluation: NA**
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1	Compare alternative tools and approaches for Intrusion Detection through quantitativeanalysis to determine the best tool or approach to reduce risk from intrusion.
2	Identify and describe the parts of all intrusion detection systems and characterize new andemerging IDS technologies according to the basic capabilities all intrusion detection systems share.

Objective:

Sl. No.	After completion of the course, students will be able to:
1	Possess a fundamental knowledge of Cyber Security. Understand what vulnerability is and how to address most common vulnerabilities.
2	Know basic and fundamental risk management principles as it relates to Cyber Security and Mobile Computing. Have the knowledge needed to practice safer computing and safeguardyour information using Digital Forensics.
3	Understand basic technical controls in use today, such as firewalls and Intrusion Detectionsystems. Understand legal perspectives of Cyber Crimes and Cyber Security.

Contents		**3 Hrs./week**	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	The state of threats against computers, and networked systems-	**7**	**14**
	Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of IntrusionDetection and Intrusion Prevention, Network and Host-based IDS		
02	Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers- Kids/hackers/sop Hesitated groups-Automated: Drones, Worms,Viruses	**7**	**14**
03	A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS	**8**	**14**
04	Anomaly Detection Systems and Algorithms-Network BehaviourBased Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology,Payload Anomaly Detection R16 B.TECH IT	**7**	**14**

05	Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware detectionObfuscation, polymorphism- Document vectors. Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero-day detection-Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception-Future: Collaborative Security	**7**	**14**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

List of BooksText Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Peter Szor	The Art of Computer Virus Research and Defense,	ISBN 0-321-30545-3.	Symantec Press
Markus Jakobsson and Zulfikar Ramzan,	Crimeware: Understanding New Attacks and Defenses	ISBN: 978-0321501950	Symantec Press
Reference Books:			
Ali A. Ghorbani, Wei Lu	Network Intrusion Detection]and Prevention: Concepts and Techniques		Springer
Paul E. Proctor	The Practical Intrusion Detection Handbook		Prentice Hall
AnkitFadia and MnuZacharia	Intrusiion Alert		Vikas Publishing house Pvt
Ankit Fadia,	Intrusion Alert: An Ethical HackingGuide to Intrusion Detection.	Second edition	Vikas Publication House Pvt Ltd

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

Group	Unit	Objective Questions (MCQ only with the correct answer)		Subjective Questions			
		No of question to be set	Total Marks	No of question to be set	To answer	Marks per question	Total Marks

A **B** **C**	**1 to 5** **1 to 5** **1 to 5**	**10**	**10**	 **5** **5**	 **3** **3**	 **5** **15**	 **60**

- Only multiple choice type questions (MCQ) with one correct answer are to be set inthe 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**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

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Department of Information Technology

Syllabus of B.Sc. in Information Technology (Artificial Intelligence)

Effective from academic session 2020-21

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Bioinformatics	
Course Code: BITAID601B	**Semester: VI**
Duration: 36 Hrs.	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 5	**End Semester Exam: 70**
Tutorial:1	**Attendance : 5**
Practical: 0	**Continuous Assessment: 25**
Credit:6	**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**

	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 BooksText Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Des Higgins (Editor),Willie Taylor.	Bioinformatics: Sequence, Structureand D	ISBN: 978-0199637904. 1st edition,	Oxford Univers ityPress.
David W. Mount.	Bioinformatics: Sequence and Genome Analysis	ISBN: 978-0879697129 2nd edition,	Cold spring harbor laboratory press.

Reference Books:

Teresa Attwood, David Parry-Smith	Introduction to	ISBN: 978-8178085074 1st edition	Pearson Education.
Andreas D. Baxevanis, B. F. Francis Ouellette.	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

		No of questi onto be set	Tot al Mar ks	No of questi onto be set	To answ er	Marks per questi on	Tot al Mar ks
A	**1 to 5**	**10**	**10**				
	1 to 5			**5**	**3**	**5**	**60**
B	**1 to 5**			**5**	**3**	**15**	
C							

- Only multiple choice type questions (MCQ) with one correct answer are to be set inthe 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**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Big Data Analytics	
Course Code: BITAID601C	**Semester: VI**
Duration: 36	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory:5	End Semester Exam: 70
Tutorial: 1	Attendance : 5
Practical:	Continuous Assessment:25
Credit: 6	Practical Sessional internal continuous evaluation: NA
	Practical Sessional external examination: NA

Aim:

Sl. No.	
1	Understand the Big Data Platform and its Use cases
2	Provide an overview of Apache Hadoop
3	Provide HDFS Concepts and Interfacing with HDFS
4	Understand Map Reduce Jobs
5	Provide hands on Hodoop Eco System
6	Apply analytics on Structured, Unstructured Data.

Objective:

Sl. No.	The students will be able to:
1	Identify Big Data and its Business Implications.
2	List the components of Hadoop and Hadoop Ecosystem
3	Access and Process Data on Distributed File System
4	Manage Job Execution in Hadoop Environment
5	Develop Big Data Solutions using Hadoop EcoSystem
6	Analyze Infosphere BigInsights Big Data Recommendations.

Pre-Requisite:

Sl. No.	

1.	
2.	

Contents		Hrs./week	
Chapter	**Name of the Topic**	**Hours**	**Marks**
01	**INTRODUCTION TO BIG DATA AND HADOOP** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools,Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.	**8**	**15**
02	**HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume andScoop and Hadoop archives, Hadoop I/O: Compression, Serialization,Avro and File-Based Data structures.	**10**	**20**
03	**Map Reduce** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffleand Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.	**8**	**15**
04	**Hadoop Eco System Pig :** Introduction to PIG, Execution Modes of Pig, Comparison of Pig withDatabases, Grunt, Pig Latin, User Defined Functions, Data Processingoperators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients,Example, Hbase Versus RDBMS.	**10**	**20**
	Sub Total:	**36**	**70**
	Internal Assessment Examination & Preparation of Semester Examination	**4**	**30**
	Total:	**40**	**100**

Practical:

List of Practical: Sl. No. 1& 2 compulsory & at least three from the rest)Assignments:

Based on the curriculum as covered by subject teacher.

List of BooksText Books:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher

Tom White	Hadoop: The Definitive Guide	3rd	O'reily Media,
Seema Acharya, Subhasini Chellappan,	Big Data Analytics		Wiley
Reference Books:			
Michael Berthold, David J. Hand	Intelligent Data Analysis		Springer
Jay Liebowitz,	Big Data and Business Analytics		Auerbach Publications,CRC press
Anand Rajaraman and Jef rey David Ulman,	Mining of Massive Datasets		Cambridge University Press
Bill Franks,	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics		John Wiley & sons
Tom Plunkett, MarkHornick	Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop		McGraw-Hill/OsborneMedia (2013), Oracle press

List of equipment/apparatus for laboratory experiments:	
Sl. No.	
1	**Computer**
2	**Linux/Ubantu operating system**
3	**Oracle/ Python**

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

Group	**Unit**	**Objective Questions** (MCQ only with thecorrect answer)		**Subjective Questions**			
		No of questi onto be set	Tot al Ma rks	No of question tobe set	To answer	Marks per questio n	Tot al Ma rks

A	**1 to 4**	**10**					
			10				**60**
B	**1 to 4**			**5**	**3**	**5**	
C	**1 to 4**			**5**	**3**	**15**	

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

Examination Scheme for end semester examination:

Group	Chapter	Marks of each question	Question to beset	Question to beanswered
A	**All**	**1**	**10**	**10**
B	**All**	**5**	**5**	**3**
C	**All**	**15**	**3**	**3**

Examination Scheme for Practical Sessional examination:

Practical Internal Sessional Continuous Evaluation

Internal Examination:

Continuous evaluation			**40**

External Examination: Examiner-

Signed Lab Note Book	**10**	
On Spot Experiment	**40**	
Viva voce	**10**	**60**

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence)
Subject: Grand Viva

Course Code: BITAIS681	**Semester: VI**
Duration: 36 Hrs.	**Practical Sessional internal continuous evaluation: 40**
Teaching Scheme	**Practical Sessional external examination: 60**
Theory: 0	
Tutorial: 0	
Practical:2	
Credit: 1	

Contents

Students will give a viva from all the subject that they have covered in the course.

Name of the Course: B.Sc. in Information Technology (Artificial Intelligence) **Subject:** Major Project and Entrepreneurship	
Course Code: BITAID682	**Semester: VI**
Duration: 36 Hrs.	**Practical Sessional internal continuous evaluation: 40**
Teaching Scheme	**Practical Sessional external examination: 60**
Theory: 0	
Tutorial: 0	
Practical: 8	
Credit: 4	

Contents

Students will do projects on application areas of latest technologies and current topics of societal relevance.