KANNUR UNIVERSITY

(Abstract)

B. Sc Artificial Intelligence and Machine Learning Programme at Don Bosco Arts & Science College, Angadikkadavu -Scheme & Syllabus, Pattern of Question Paper and Model Question Paper under Choice Based credit semester system in OBE (Outcome Based Education) -With effect from 2023 admission- Implemented - Orders issued

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ACADEMIC C SECTION

ACAD C/ACAD C5/19900/2023 Dated: 20.12.2023

Read:-1. U.O No. ACAD/ACAD A2/13767/2023 dated 21.09.2023

2. Lr. No DBASC/Syllabus/2023/B.Sc AI & ML dtd 24/08/2023
3. ACAD C/ ACAD C5/19900/2023(i), ACAD C/ACAD C511990012023 dtd 13/10/2023, ACAD C/ACAD C5/L9900/2023 Dtd 26/11/2023
4. Lr No. ACAD C/ACAD C5/19900/2023 dtd 06/12/2023
5. Syllabus Submitted by the Principal ,Don Bosco Arts & Science College , Angadikkadavu

ORDER

1. Provisional affiliation was granted for B.Sc. Artificial intelligence and Machine learning programme at Don Bosco Arts & Science College, Angadikadavu for the academic year 2023-24, vide paper read (1) above.
2. As Kannur University is not having the Syllabus of aforementioned programme and the Board of Studies is not functioning at present, considering the exigency of the matter, as ordered by the vice chancellor, the draft Scheme and Syllabus of Core Courses of B.Sc. Artificial intelligence and Machine learning and Complementary Elective Courses of Mathematics and statistics prepared and submitted by the Principal, Don Bosco Arts and Science College (paper read 2) has been forwarded to the Convener Ad hoc committee for computer science (PG), Former Chairperson Mathematics (UG) & Head, Dept.of Statistical Sciences, respectively for scrutiny.
3. After vetting the syllabus of core and complementary courses of B,.Sc Artificial Intelligence and Machine Learning programme, the experts put forth their suggestions vide paper read 3 above and the same has been forwarded to the Principal, Don Bosco Arts & Science college vide paper read 4 above, for incorporating in the syllabus.
4. The Principal Don Bosco Arts & Science College, vide paper read 5 above, resubmitted the draft scheme, syllabus, pattern of question paper and model question paper of B. Sc Artificial Intelligence and Machine Learning Programme, under CBCSS, OBE, after incorporating the suggestions put forth by subject experts and in accordance with the UG Regulations 2019 of Affiliated colleges.
5. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) Chapter III of Kannur University Act

1996 accorded sanction to implement the Scheme, Syllabus, Model Question paper and Pattern of Question paper of B.Sc. Artificial intelligence and Machine Learning programme (CBCSS-OBE), at Don Bosco Arts & Science College, Angadikadavu with effect from 2023 admission, subject to reporting to the Academic Council.

6. The Scheme, Syllabus, Model Question paper and Pattern of Question Papers of the B.Sc. Artificial intelligence and Machine Learning programme are uploaded on the University website. (www.kannuruniversity.ac.in)
7. Orders are issued accordingly

Sd/-

Narayanadas K

DEPUTY REGISTRAR (ACAD)

For REGISTRAR

To: 1)The Principal , Don Bosco Arts & Science College, Angadikadavu

Copy To: 1. The Examination Branch (through PA to CE)
2. AR III/ES Section (Exam)
3. EX C I, EG I
4. PS to VC/PA to PVC/PA to Registrar
5. DR/AR-1 Academic
5. The Computer Programmer, Web Manager
5. SF/DF/FC

Forwarded /By Order

SECTION OFFICER

KV

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

KANNUR UNIVERSITY

SYLLABUS FOR B. SC. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CORE, COMPLEMENTARY ELECTIVE COURSE AND GENERIC ELECTIVE COURSES

CHOICE BASED CREDIT AND SEMESTER SYSTEM

(OBE-Outcome Based Education System)

(2023 ADMISSION ONWARDS)

About the Programme

The BSc programme in Artificial Intelligence and Machine Learning addresses the current and future market needs by producing graduates with a good background of Computer Science, Mathematics, Modelling and Statistical skills. The relevance of Artificial Intelligence and Machine Learning is becoming more and more evident day by day. Some of the areas where Artificial Intelligence and Machine Learning techniques can be applied include data science, personal assistants, surveillance systems, financial services, cyber security, video games, self-driving cars, robotic manufacturing etc. Thus the area of application ranges from scientific research to social life, from medical field to economic theories, from sensitive robotic technology to games for entertainment. Along with traditional computer science courses, this programme focuses on courses in areas such as machine learning, deep learning, natural language processing, robotics and image processing.

Programme Specific Outcomes

PSO1: Understand the concepts of System Software and Application Software.

PSO2: Understand the concepts of Computer Networks and Operating Systems

PSO3: Design, develop, implement and test software systems to meet the given specifications, following the principles of Software Engineering.

PSO4: Gain knowledge and experience in major areas of Artificial Intelligence and Machine Learning such as Prediction, Classification, Clustering, and Information Retrieval.

PSO5: Learn to analyze large and complex datasets and create systems that adapt and improve over time using machine learning techniques.

Eligibility

Should have passed plus two or equivalent examination with Mathematics as one of the major subjects.

Ranking Criteria for Admission

Marks of the qualifying examination + Marks of Mathematics +20% of the marks for Computer Science/ Electronics

KANNUR UNIVERSITY

BSC ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

WORK AND CREDIT DISTRIBUTION STATEMENT

Credit Distribution		
Sl no	**Category of course**	**Credits**
1	English Common course	14
2	Additional Common course	8
3	General Awareness Course	16
4	Core course Discipline Specific Elective course	64
5	Complementary elective Course	16
6	Generic Elective Course	2
Total		**120**

Semester	Course Title	Credits	Hours per week	Total Credits	Total Hours
I	Common Course–English I	4	5	17	25
	Common Course–English II	3	4		
	Additional Common Course I	4	5		
	Core Course – I : Introduction to Computer Science	2	3		
	Complementary Elective – I (Mathematics)	2	4		
	Complementary Elective – I (Statistics)	2	4		
II	Common Course–English III	4	4	19	25
	Common Course–English IV	3	4		
	Additional Common Course II	4	4		
	Core Course –II :Programming in C	2	3		
	Core Course – III : Lab 1 – C Programming	2	2		
	Complementary Elective – II (Mathematics)	2	4		
	Complementary Elective – II (Statistics)	2	4		
III	Core Course – IV : Introduction to Artificial Intelligence and Machine Learning	3	3	15	25
	General Awareness Course – I : Operating System and Linux Shell Programming	4	3		
	General Awareness Course – II: Data Structures	4	4		
	General Awareness Course – I: Lab–1: Linux Shell Programming	0	2		
	General Awareness Course – II: Lab–2: Data Structures Using C	0	3		
	Complementary Elective – III (Mathematics)	2	5		
	Complementary Elective -III (Statistics)	2	5		

IV	Core Course – V :Digital Fundamentals and Computer Organization	3	3	26	25
	Core Course – VI :Python for Machine Learning	3	3		
	Core Course – VII : Data Base Management System	3	3		
	General Awareness Course – III: Lab–1: Linux Shell Programming	4	2		
	General Awareness Course – IV: Lab–2: Data Structures Using C	4	2		
	Core Course – VIII: Lab-3: Data Base Management System	3	2		
	Core Course – IX : Lab–4: Python for Machine Learning	2	2		
	Complementary – IV (Mathematics)	2	4		
	Complementary Elective -IV (Statistics)	2	4		
V	Core Course –X : Introduction to R Programming	4	4	16	25
	Core Course – XI :Software Engineering	3	4		
	Core Course – XII : Object Oriented Programming Using Java	4	4		
	Core Course –XIII Discipline Specific Elective Course I	3	4		
	Core Course – XIV : Lab–5: Introduction to R Programming	0	4		
	Core Course – XVI : Lab–6: Object Oriented Programming Using Java	0	3		
	Generic Elective Course	2	2		

VI	Core Course –XVII :Digital Image Processing	4	3	27	25
	Core Course –XVIII: Discipline Specific Elective Course II	3	3		
	Core Course –XIX: Computer Networks	3	3		
	Core Course – XX: Natural Language Processing	3	3		
	Core Course –XXI :Soft Computing	3	3		
	Core Course – XXII : Lab–7: Introduction to R Programming	2	3		
	Core Course – XXIII : Lab–8: Object Oriented Programming Using Java	2	3		
	Core Course – XXIV: Project	7	4		
Total				**120**	**150**

Total Marks of the Programme – 1850 Marks (Eng-200 Marks, Additional Common Course 100 Marks, Core 975 Marks, General Awareness Course 150 Marks, First Complementary Elective 200 Marks , Second Complementary Elective-200 Marks and Generic Elective Course 25 Marks)

PART A

BSC ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CORE COURSES

WORK AND CREDIT DISTRIBUTION

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS	MARKS (Internal + External)
1B01 AIML	Introduction to Computer Science	1	3	2	3	10+40
2B02 AIML	Programming in C	2	3	2	3	10+40
2B03 AIML	Lab 1 – C Programming*	2	2	2	3	5+20
3B04 AIML	Introduction to Artificial Intelligence and Machine Learning	3	3	3	3	10+40
4B05 AIML	Digital Fundamentals and Computer Organization	4	3	3	3	10+40
4B06 AIML	Python for Machine Learning	4	3	3	3	10+40
4B07 AIML	Data Base Management System	4	3	3	3	10+40
4B08 AIML	Lab-4: Data Base Management System**	4	2	3	3	5+20
4B09 AIML	Lab–5: Python for Machine Learning**	4	2	2	3	5+20
5B10 AIML	Introduction to R Programming	5	4	4	3	10+40
5B11 AIML	Software Engineering	5	4	3	3	10+40
5B12 AIML	Object Oriented Programming Using Java	5	4	4	3	10+40
DISCIPLINE SPECIFIC ELECTIVE I						
5B13A AIML	Data Mining	5	4	3	3	10+40
5B13B AIML	Pattern Recognition					
5B13C AIML	Data Science and Analytics					
5B14 AIML	Lab–6: Introduction to R Programming***	5	4	0	-	-
5B15 AIML	Lab–7: Object Oriented Programming Using Java***	5	3	0	-	-
6B16 AIML	Digital Image Processing	6	3	4	3	10+40

DISCIPLINE SPECIFIC ELECTIVE II						
6B17A AIML	Introduction to Deep Learning	6	3	3	3	10+40
6B17B AIML	Data Visualization					
6B17C AIML	Cloud Computing					
6B18 AIML	Computer Networks	6	3	3	3	10+40
6B19 AIML	Natural Language Processing	6	3	3	3	10+40
6B20 AIML	Soft Computing	6	3	3	3	10+40
6B21 AIML	Lab–6: Introduction to R Programming***	6	3	2	3	5+20
6B22 AIML	Lab–7: Object Oriented Programming Using Java***	6	3	2	3	5+20
6B23 AIML	Project	6	4	7	-	20+80

*External examination will be conducted at the end of second semester

**External examination will be conducted at the end of fourth semester

***External examination will be conducted at the end of sixth semester

EVALUATION

Assessment	Weightage
External	80%
Internal	20%

CONTINUOUS INTERNAL ASSESSMENT FOR THEORY

Component	Weightage	Remarks
Component 1: TEST	80%	Minimum of 2 tests should be conducted. Marks for the best component should be calculated as the average of the marks obtained in the tests conducted
Component 2: ASSIGNMENT/SEMINAR/VIVA	20%	Any one component

PATTERN OF QUESTION PAPER FOR END SEMESTER EVALUATION

Part A	**Short Answer**	**6 Questions x 1Mark =6Marks**
	Answer all questions	6 Questions x 1Mark=6Marks
Part B	**Short Essay**	**8 Questions x 2Marks=16Marks**
	Answer any 6 questions	6 Questions x 2Marks=12Marks
Part C	**Essay**	**6 Questions x 3Marks=18Marks**
	Answer any 4 questions	4 Questions x 3Marks=12Marks
Part D	**Long Essay**	**4 Questions x 5Marks=20Marks**
	Answer any 2 questions	2 Questions x 5Marks=10Marks
Total Marks Including Choice:60		
Maximum Marks for the Course:40		

CONTINUOUS EVALUATION FOR PRACTICAL

COMPONENT	WEIGHTAGE	REMARKS
Component 1:LAB SKILLS,OBSERVATION NOTE AND PUNCTUALITY	20% For Lab Skill 20% For Observation Note And Punctuality	Observation note is mandatory. Marks should be given considering observation note Lab skills and punctuality.
Component2: TEST	60%	Model examination should be conducted before external exam and considered for Internal mark.

END SEMESTER EVALUATION FOR PRACTICAL

COMPONENT	PART A	PART B
Code Writing	3	3
Output	3	3
Modification for Part A or Part B	3	
Record	2	
Viva	3	
Total Marks	**20**	

PATTERN OF QUESTION PAPER FOR END SEMESTER EVALUATION-PRACTICAL

Part A	**2 Questions x 10 Mark =20 Marks**	
	Answer any 1 question	1 Questions x 10 Mark=10 Marks
Part B	**2 Questions x 10 Mark =20 Marks**	
	Answer any 1 question	1 Questions x 10 Mark=10 Marks
Total Marks Including Choice:40		
Maximum Marks for the Course:20		

SEMINARS / ASSIGNMENTS / VIVA

These are part of the curriculum and are to be critically assessed for Internal Assessment. Marks should be awarded based on the content, presentation and the effort put in by the student. The course teacher may give the topics for seminars / assignments. The topics shall be related to the syllabus of the course and is not meant for evaluation in the End Semester Examination.

RECORDS

One rough record (Observation Note) and one fair record are compulsory for each practical course. The student will not be permitted to appear for practical examinations without certified practical records. The records are intended as observation records of the practical works done in the lab. The valuation of records, to be done internally, should be based on the effort and promptness of the student in practical works. Record mark is calculated at the time of End Semester Evaluation. Observation notes are compulsory in Lab hours. Students should get signature for each program done in the lab from the faculties and those programs are recommended for fair record.

PROJECTWORK

Every student shall have to work on a project of SEVEN credits under the supervision of a faculty member as per the curriculum. The duration of the project is one year, starting in the fifth semester and submission of the dissertation at the end of sixth semester. Individual projects are recommended but, inan instance, where the number of supervising teachers is less, the project may be done as group. The maximum number of students in a group shall be limited to THREE.

PROJECT EVALUATION

Evaluation of the Project Work shall be done under Mark System at two stages:

1. Internal Assessment (supervising teachers will assess the project and award internal Marks)
2. External evaluation (external examiner appointed by the University)

Marks secured for the project will be awarded to candidates, combining the internal and external Marks. Assessment of different components may be taken as below.

CONTINUOUS EVALUATION FOR PROJECT

COMPONENT	WEIGHTAGE
Punctuality	20%
RelevanceoftopicSystemstudy/Designoftables	20%
ProjectReport	30%
Presentation&Viva-voce	30%
Total	**100%**

END SEMESTER EVALUATION FOR PROJECT

COMPONENT	WEIGHTAGE
Written Synopsis/Abstract	12.5%
Content of the Project	12.5%
Quality of project work/ Use of software/tools	12.5%
Perfection of the work (Design soft tables /Input& Output forms)	25%
Live demo	12.5%
Viva-voce	25%
Total	**100%**

CORE COURSE I: 1B01 AIML INTRODUCTION TO COMPUTER SCIENCE

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
1	1B01 AIML	3	2	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the basic concepts and functional knowledge in the field of Informatics.

CO2: Evaluate students' ability in computer arithmetic.

CO3: Analyze the problem-solving skills using computers.

CO4: Study to use the Internet safely, legally, and responsibly.

Unit I:

Overview of the computer system- What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), Keyboard and Mouse, Other input/output Devices, Computer Memory; Storage Unit, Control Unit, Memory hierarchy, RAM, ROM, PROM and EPROM, cache memory and registers. Secondary storage devices. Storage capacity: bit, byte, nibble. Software-types of software.

Unit II:

Computer Arithmetic- Number systems, decimal number system, binary number system, addition of binary number, binary subtraction, Octal number system, hexa-decimal number system, conversions, CODES: BCD, ASCII, Excess-3, GRAY and UNICODE. Data Representation: Data types - Complements (1's and 2's)– Fixed Point representation –Floating Point representation.

Unit III:

Problem solving using computers- introduction, steps involved in problem solving using computers, algorithms- characteristics, flow charts, pseudocode-sequence, selection, iteration. Classification of programming language-machine level language, assembly level language, higher level languages, language processors- assembler, linker, loader, interpreter, compiler. Programming techniques- procedural programming, object-oriented programming.

Unit IV:

Connecting and Communicating Online and Online Security and Privacy: An introduction to internet, world wide web and its structure, ICT, Brief overview of web browser, websites-Types of Websites, webpages, as well as web server and web publishing. Threats to computer, Virus and its types, Anti-Virus software and Examples, Firewall and its use, Cyber-crime and Computer ethics, Cyber law and Importance.

Reference Books:

1. T. Jeyapoovan, “Fundamentals of Computing”, Vikas Publishing House
2. B. Ram, “Computer Fundamentals”, New Age International(P) Limited

CORE COURSE II: 2B02 AIML PROGRAMMING IN C

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2B02 AIML	3	2	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand about basics of programming.

CO2: Analyze the problem and develop simple programs using C.

CO3: Familiar with advanced concept of C program.

CO4: Develop C programs using structure union, pointers and files.

Unit I:

Introduction to C, Features of C , Basic structure of C program , Executing a c program, Character set, Tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of variables, Declaration of storage class, Assigning values to variables, Defining Symbolic constant, Arithmetic operators , Logical operators, Relational operators, Assignment operators, Increment and decrement operators, Conditional operators, Bitwise operators, Special operators, Arithmetic expressions, Evaluation of expressions Precedence of arithmetic operators, Type conversion in expression.

Unit II:

Managing Input output operation: Reading a character, Writing a character, Formatted input, Formatted output, Decision Making and Branching: if, if…Else, nested if...else, else...if ladder, Switch statement, GO TO statement. Decision Making and Looping: while statement, do...while statement, for statement. Break and continue statements. Arrays: One dimensional arrays, Two dimensional arrays, Initializing array elements, Multidimensional arrays, Character Arrays and Strings: Declaring and initializing string variables, Reading strings from terminal, Writing strings to screen. Arithmetic operations on characters, String handling functions.

Unit III:

User- Defined Functions: Need for user defined functions , Elements of user-defined functions, definition of function, Return values and their types, Function Declaration, Function calls, Parameter passing techniques, The Scope, visibility and life time of variables in function, Recursive functions, Passing arrays to functions, Passing strings to functions. Structure and union: Defining a structure, Declaring structure variables, Accessing structure Members, Structure initialization. Arrays of structures, Arrays within structures, Structures within structures, Unions.

Unit IV:

Pointers: Accessing the address of a variable, Declaration and initialization of pointer variables, Accessing a variable through its pointers, pointer expressions, pointers and arrays , Pointers and character string , Array of pointers, Pointers to functions. Dynamic memory allocation: malloc(), calloc(), free(),realloc(). File Management: Text and binary files, Defining and opening a file, Closing a file, Input and output operations on files, Error handling during I/O operations, Random access to files. Command line arguments.

Text Book :

1. E. Balagurusamy, Programming in ANSI C, 3rd edition McGraw-Hill Publication

Reference books:

1. M.T. Somashekara, Problem Solving with C, PHI, 2009
2. V. Rajaraman, Computer Basics and c Programming, PHI, 2008
3. Ashok N. Kamthane, Programming with ANSI and Turbo C, 1st edn, Pearson Education.
4. YeshvanthKanethkar, Let us C, 3rd Edn, BPB
5. Programming with C in Linux, NIIT, PHI.

Web Resources:

1. www.cprogramming.com
2. www.programmersheaven.com

CORE COURSE III: 2B03 AIML LAB1 - C PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2B03 AIML	2	2	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO 1: Understand and trace the execution of programs written in C language.

CO 2: Write the C code for a given algorithm.

CO 3: Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.

CO 4: Write programs that perform operations using derived data types.

Part A

Conditional operator

1. Write a program to print largest among three numbers

sizeof operator

2. Write a program to print the size of built in data types.

else if

3. Write a program to check whether the given number is odd or even
4. Write a program to find the roots of a quadratic equation

else if ladder

5. Write a program to print grade of students
6. Write a program to count number of vowels, consonants and spaces in a line of text.

switch

7. Write a program to accept two numbers and perform various arithmetic operations (+, -, *, /) based on the symbol entered.

while

8. Write a program to check whether the given number is Armstrong number or not.

9. Write a program to print Fibonacci series up to a given number.

do-while

10. Write a program to print multiplication table for the given number for

11. Write a program to print prime numbers within range.

12. Write a program to convert decimal number to its binary equivalent.

Part B

Array

13. Write a program to perform Matrix multiplication

String

14. Write a program to check whether the given string is palindrome or not

15. Write a program to implement 5 string handling functions

Function

16. Write a program to print transpose of a given matrix

Recursive function

17. Write a program to find the factorial of a given number.

Pointers

18. Write a program to swap two numbers using pointers

Structure

19. Write a program to calculate and display the Gross_salary and Net_salary of employees working in a retail medical shop if their Basic, DA, TA, other allowances and deductions are given.

File

20. Write a program to read a line of text from the keyboard and write it to a file.

CORE COURSE IV: 3B04 AIML INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3B04 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.

CO2: Understand knowledge representation using logic and rules.

CO3: Analyze various AI techniques in expert systems, artificial neural networks and other machine learning models.

CO4: Analyze the main approaches to natural language processing and expert systems.

CO5: Understand the basic concepts of Bayesian theory and normal densities.

UNIT – I Introduction to AI:

Problems, Problem Spaces and Search: Defining the Problem as a State space Search,Production Systems, Problem Characteristics, Production system characteristics, Issues in theDesign of Search Programs. Heuristic Search Techniques: Generate-and-test, Hill Climbing,Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

UNIT – II Knowledge Representation:

Using Predicate Logic, Representing Simple Facts in logic, Representing Instance and IsaRelationships, Computable Functions and Predicates, Resolution - Representing KnowledgeUsing Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.Semantic Nets, Frames,Scripts. Nonmonotonic Reasoning. Introduction to Expert Systems, Architecture ofexpert systems, Roles of expert systems - Knowledge Acquisition

UNIT –III Bayesian Decision Theory and Normal Distribution:

Machine perception -feature extraction -classification, clustering, linear and logistic regression -Types of learning -Bayesian decision theory -classifiers, discriminant functions, and decision surfaces -univariate and multivariate normal densities -Bayesian belief networks . Perceptron and backpropagation neural network -k-nearest-neighbor rule. Support vector machine: multicategory generalizations -Regression.

UNIT –IV Classification Algorithms :

Decision trees: classification and regression tree -random forest. Principal component analysis Linear discriminant analysis -Independent component analysis. k-means clustering -fuzzy k-means clustering Convolution neural network (CNN) -Layers in CNN -CNN architectures. Recurrent Neural Network -Applications: Speech-to-text conversion-image classification-time series prediction.

Text Books:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition,Pearson,2017.
2. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, PHI.,2015
3. Francois Chollet, Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.
4. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

Reference Books:

1. I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
2. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York,2018.

GENERAL AWARENESS COURSES

WORK AND CREDIT DISTRIBUTION

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS	MARKS (Internal + External)
3A01 AIML	Operating System and Linux Shell Programming	3	3	4	3	10+40
3A02 AIML	Data Structures	3	4	4	3	10+40
3A03 AIML	Lab–2: Linux Shell Programming*	3	2	0	-	-
3A04 AIML	Lab–3: Data Structures Using C*	3	3	0	-	-
4A05 AIML	Lab–2: Linux Shell Programming*	4	2	4	3	5+20
4A06 AIML	Lab–3: Data Structures Using C*	4	2	4	3	5+20

*External examination will be conducted at the end of fourth semester

GENERAL AWARENESS COURSE I: 3A01 AIML OPERATING SYSTEM AND LINUX SHELL PROGRAMMING

SEMESTER	COURSECODE	HOURSPERWEEK	CREDIT	EXAM HRS
III	**3A01 AIML**	**3**	**4**	**3**

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Identify the types, structure, functions and major concepts of Operating Systems.

CO2: Understand the concepts of process, process synchronization, CPU scheduling, deadlocks and file system concepts.

CO3: Understand LINUX file system concepts and simple commands

CO 4: Understand LINUX shell programming concepts

CO 5: Understand AWK scripting concepts

Unit I:

Introduction: Types of OS - Batch Processing System – Multi programming system - Time Sharing System – Real Time System. Operating System Concepts, System Calls – Operating-System Operations -Process management, Memory management, Storage management, Operating system structures - System components, Operating systems services, System calls, Types of system calls. Processes: Process concept, Process scheduling, Operations on processes, Inter-process communication. Overview of threads. Process Synchronization: Critical-Section Problem, Semaphores.

Unit II:

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms - First come First Served, Shortest Job First, Priority scheduling, Round robin scheduling. Deadlocks: System Model, Necessary conditions, Methods for Handling Deadlocks, Deadlock prevention, Deadlock avoidance - Banker's algorithms, Deadlock detection, Recovery from deadlock. Memory Management: Concept of address spaces, Swapping, Contiguous memory allocation, Segmentation, Paging. Virtual memory, Demand paging, Page replacement algorithms.

Unit III:

File System: File concept, Access methods, Tree-structured directories, File system mounting, Protection. File System Implementation: File System structure, implementation.

Unix : History of Unix OS, Open Source Software - Issues, Portability, Documentation, Best Practices for Working with Open Source Developers, Varieties of Open Source Licenses, Free Software vs Open Source software. Understanding File system, File Ownership and Permission. Shell - Types, Responsibilities. Basic Commands - cd, mkdir, echo, ls, pwd, rm, who, date, cp, mv, cat, ps. Working with Directories, Standard Input/Output, and I/O Redirection, pipes.

Unit IV:

Job Control. Regular Expressions - grep. Text editors - vim, emacs. Shell Programming - variables, quotes, comments, command substitution, arguments, decisions, loops, reading and printing data, functions. Awk - Invoking and Basic Concepts, Patterns, Actions, Variables, Printing, Operators, BEGIN and END, for, while, if, break, continue, next, exit.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2013). Operating System Concepts, 9th edition, John Wiley & Sons.
2. Wood, P., Kochan, S. G. (2016), Shell Programming in Unix, Linux and OS X, 4th edition, Pearson Education.
3. The GNU Awk User's Guide - https://www.gnu.org/software/gawk/manual/gawk.html

Reference Books:

1. Andrew S. Tanenbaum, Herbert Bos (2016). Modern Operating Systems, 4th edition, Pearson Education India
2. William Stallings (2018), Operating systems - Internals and Design Principles, 9th Edition, Pearson Education, PHI.
3. Raymond, E. S. (2009). The Art of UNIX Programming, 3rd Edition, Pearson Education.
4. Kanetkar, Y. P. (2003), UNIX Shell Programming, 1st Edition, BPB Publications.
5. Forouzan, B. A., Gilberg, R. F. (2003), UNIX and Shell Programming, 1st Edition, Cengage Learning India

GENERAL AWARENESS COURSE II: 3A02 AIML DATA STRUCTURES

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A02 AIML	4	4	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the concepts of Arrays and Linked Lists.

CO2: Understand linear data structures such as stacks, queues and their applications.

CO3: Understand non-linear data structures such as trees, graphs and their applications.

CO4: Familiarize with various sorting, searching and hashing techniques.

Unit I:

Overview of Data Structures, Basic data structures – Arrays and its operations, Linked lists - Singly linked list, Doubly linked list, Circular linked list, Operations on linked list, Applications of linked lists.

Unit II:

Stacks - Representation of stacks using arrays and linked lists, Operations on stacks, Applications of stacks - Evaluation of arithmetic expressions. Queues - Representation of queues using arrays and linked lists, Circular Queue, Priority Queue.

Unit III:

Trees- Binary Trees – level and height of the tree, complete-binary tree, representation using array, tree traversals (Recursive only), applications. Binary search tree – creation, insertion and deletion and search operations, applications. Graphs – representation of graphs, BFS and DFS, applications. Minimum Spanning Trees – Prim's and Kruskal's algorithms. Shortest path algorithms – Dijkstra's algorithm.

Unit IV:

Sorting techniques – Bubble sort, Selection Sort, Insertion sort, Merge sort, Quick sort, Searching algorithms - Linear searching with arrays and linked lists, Binary search, Hash Tables – Hashing functions – Mid square, division, folding.

Text Books:

1. Asoke N Kamthane, C and Data Structures, Pearson, 2009-10 Revised Edition
2. Yashvant Kanetkar, Data Structures Through C, BPB Publications

Reference Books:

1. Algorithms, Part I MOOC Course (https://www.coursera.org/learn/algorithms-part1)
2. Aho A. V., Hopcroft J. E. and Ullman J. D. (1983), Data Structures and Algorithms, Pearson Publication.
3. Gilberg, R., &Forouzan, B. (2004). Data Structures: A Pseudocode Approach with C. Cengage Learning.
4. Sedgewick, R. (2002). Algorithms In C: Fundamentals, Data Structures, Sorting, Searching, Parts 1-4, 3/E. Pearson Education.
5. Langsam, Y., Augenstein, M., Tenenbaum, A. M. (2019). Data Structures Using C. 1/E. Pearson Education.

GENERAL AWARENESS COURSE III: 3A03 AIML LAB 2: LINUX SHELL PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A03 AIML	2	-	-

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO 1: Understand basic LINUX commands.

CO 2: Understand commands for file system organization, grep and handling files/users.

CO 3: Apply shell programming concepts for solving simple problems.

CO 4: Apply awk scripting for simple text processing tasks.

Exercises

1. Getting started with basic commands.
2. Familiarisation of commands for understanding file system organisation.
3. Familiarisation of commands for operations such as redirection, pipes, filters, job control, changing ownership/permissions.
4. Familiarization of commands for comparing files.
5. Familiarise usage of grep command.
6. Write a shell script to show various system configurations like Home directory, current shell, Operating system information, Kernel information, current working directory, PATH variable contents.
7. Simple programs making use of shell conditional statements.
8. Simple programs making use of shell looping constructs.
9. Write a shell script to implement a menu-driven calculator.
10. Simple text processing programs using Awk.

A command-line text editor should be used for writing programs. Students should be taught the usage of git. They should be encouraged to use online services like Gitlab/Github for uploading the programs written in the lab.

Reference Books:

1. Raymond, E. S. (2009). The Art of UNIX Programming, 3rd Edition, Pearson Education.
2. Wood, P., Kochan, S. G. (2016), Shell Programming in Unix, Linux and OS X, 4th edition, Pearson Education.
3. The GNU Awk User's Guide - https://www.gnu.org/software/gawk/manual/gawk.html
4. Kanetkar, Y. P. (2003), UNIX Shell Programming, 1st Edition, BPB Publications.
5. Forouzan, B. A., Gilberg, R. F. (2003), UNIX and Shell Programming, 1st Edition, Cengage Learning India
6. Das, S. (2017), UNIX : Concepts and Applications, 4th Edition, McGraw Hill Education.

GENERAL AWARENESS COURSE IV: 3A04 AIML LAB 3: DATA STRUCTURES USING C

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3A04 AIML	3	-	-

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Implement basic linear and non-linear data structures and their major operations.

CO2: Implement applications which uses these data structures.

CO3: Implement algorithms for various sorting, searching and hashing techniques.

List of Programs

1. Write a program to implement stack operations
2. Write a program to evaluate postfix expression using stack
3. Write a program to implement Queue Operations
4. Write a program to implement Circular Queue Operations
5. Write a program to implement various linked list operations.
6. Write a program to implement binary search trees – creation, insertion, deletion, search
7. Write a program to implement linear search algorithm and print number of comparisons
8. Write a program to implement binary search algorithm and print number of comparisons
9. Write a program to implement Insertion sort algorithm and print number of comparisons
10. Write a program to implement Bubble sort algorithm and print number of comparisons

CORE COURSE V: 4B05 AIML DIGITAL FUNDAMENTALS AND COMPUTER ORGANIZATION

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B05 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the basics of digital electronics to design simple combinational logic and sequential logic circuits

CO2: Understand the different design features of computer architecture

CO3: Understand Processor logic design conventions and data path, pipelining and hazards, I/O organization, Interrupts and direct memory access

CO4: Understand different types of memory and design techniques

Unit I:

Logic Gates - AND, OR, NOT, NAND, NOR, XOR, Boolean Algebra - Basic Theorem and Properties, Boolean Functions, Standard Forms of Boolean Expressions - Sum of Products and Product of Sums, Boolean Expressions and Truth Tables, Minimization of Boolean Functions using Karnaugh Map Method - Basic Combinational Logic Circuits, Implementing Combinational Logic, Functions of Combinational Logic - Half Adder, Full Adder, Decoder, Encoder, Multiplexer, Demultiplexer.

Unit II:

Sequential Circuit - Clocking, Flip Flops - SR, JK, D, T flip flops, Counters - Synchronous and Asynchronous counters, Up/Down Synchronous Counters, Registers - Serial in Serial Out, Serial in Parallel Out, Parallel In Serial Out and Parallel In Parallel Out Registers.

Unit III:

Computer abstractions and technology - Introduction, Computer architecture -Design features, Application program - layers of abstraction, five key components of a computer, Technologies for building processors and memory, Performance, Instruction set principles – Introduction, classifying instruction set architectures, Memory addressing, encoding an instruction set. The Processor - Introduction, Logic design conventions, Building a data path, A simple implementation scheme, An overview of pipelining - Pipelined data path and control - Structural hazards - Data hazards - Control hazards

Unit IV:

I/O Organization - Accessing I/O Devices, Interrupts - Handling Multiple Devices, Direct Memory Access, The Memory System – Basic concepts, Semiconductor RAM Memories - Internal Organization, SRAM, DRAM, Structure of Larger Memories, ROM Memories, Speed, Size and Cost, Cache Memory - Mapping Functions, Replacement Algorithms (LRU).

Text Books :

1. Floyd, T. L. (2017). Digital Fundamentals, 11 th Edition. Pearson Education. (Unit I & II)
2. Hennessy, J. L., Patterson, D. A. (2017). Computer Organization and Design MIPS Edition:The Hardware/Software Interface, 5 th Edition. Elsevier Science. (Unit III)
3. Patterson, D. A., Hennessy, J. L. (2017). Computer Architecture: A Quantitative Approach 6 th Edition. Elsevier Science. (Unit III)
4. Zaky, S., Hamacher, C., Vranesic, Z. (2017). Computer Organization, 5 th Edition. McGraw-Hill. (Unit IV)

Reference Books:

1. Stallings, W. (2016). Computer Organization and Architecture: Designing for Performance, 10 th Edition. Pearson.

2. Mano, M. M. (2016). Digital Logic and Computer Design. Pearson Education.

CORE COURSE VI: 4B06 AIML PYTHON FOR MACHINE LEARNING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B06 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understanding the basic building blocks of Python programs and develop programs by utilizing the Lists, Tuples, Sets and Dictionaries in python.

CO2: Develop programs using functions and modules

CO3: Understand the usage of file handling and exception handling in Python

CO4: Write programs in Python to process data stored in files by utilizing the modules NumPy and Pandas

Unit I:

Features of Python, Different methods to run Python, Basic elements (Objects, Expressions, Numerical Types, Strings, Variables), Comments, Indentation in Python, Input and Output in Python, import function, Operators in Python, Tuples, Lists, Sets, Dictionaries, Built-in methods of lists, sets and dictionaries, Mutable and Immutable Objects.

Unit II:

Control flow statements - Branching (if, else, elif), Iteration (while, for), range and enumerate functions, break and continue statements. Functions -functions definition, function calling, function arguments (Required, Keyword, Default), Lambda functions, Recursion.

Unit III :

File Handling (Opening, Closing, Writing, Reading), Exceptions: Exception Handling, Built-in Exceptions (Index Error, Overflow Error, Zero Division Error, Runtime Error), Modules - Built-in Modules (os, sys).

Unit IV:

NumPy - ndarray, Creating Arrays (array, zeros, ones, empty, linspace, arange, random), 2D Array, Indexing, Slicing, Iterating, Copying, Splitting, Shape Manipulation (reshape, transpose, resize), Arithmetic Operations on Arrays, Broadcasting. Pandas - Series, dataframe, Index objects, Essential basic functionality - head and tail, indexing, selection and filtering, arithmetic and data alignment, sorting and ranking, descriptive statistics, reading and writing csv files using pandas, plotting basics.

Reference Books:

1. The Python Tutorial (https://docs.python.org/3/tutorial/index.html)
2. NumPy quick start (https://www.numpy.org/devdocs/user/quickstart.html).
3. Pandas User Guide (https://pandas.pydata.org/pandasdocs/stable/user_guide/index.html).
4. Mark Pilgrim., Dive In to Python3, Apress (Freely available a https://diveintopython3.net/)
5. Wes McKinney (2017), Python for Data Analysis: Data Wrangling with Pandas, NumPy,andIPython, O'Reilly Media.
6. John V. Guttag (2016), Introduction to Computation and Programming Using Python withApplication to Understanding Data, PHI.

CORE COURSE VII: 4B07 AIML DATABASE MANAGEMENT SYSTEM

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B07 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Familiar with organized data collection.

CO2: Design data bases.

CO3: Normalize the data bases.

CO4: Frame queries for various purposes

Unit I:

Introduction – Purpose of Database systems. View of Data, Data Models, transaction management, database structure, DBA, Data Base Users.

Unit II:

E-R model, Basic concepts; design issues; Mapping Constraints; Keys; Primary, Foreign, candidate, E-R diagram; Weak entity set; Extended E-R features. Normal forms – 1NF, 2NF, 3NF and BCNF; functional dependency, Normalization.

Unit III:

SQL: database languages; DDL- create, alter, drop; DML- Insert, Select, update, Delete; DCL, SQL Functions, Data types in SQL; Creation and deletion of database and user.

Unit IV:

Developing queries and sub queries; Join operations in Detail, set operation, Integrity constraints, views, Trigger and Sequences, Relational model – Structure of Relational database. Relational Algebra; Fundamental operations; Relational calculus; Tuple and domain calculus.

Text books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, 6th Ed, TMH.
2. Narain Gehani, The Database Book Principles and Practice Using MySQL, University Press.

Reference Book:

1. Elmasri Ramez and Navathe Shamkant, Fundamentals of Database System, 7th Ed, Pearson

GENERAL AWARENESS COURSE IV: 4A05 AIML LAB 2: LINUX SHELL PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A05 AIML	2	4	3

GENERAL AWARENESS COURSE IV: 4A06 AIML LAB 3: DATA STRUCTURES USING C

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4A06 AIML	2	4	3

CORE COURSE XIII: 4B08 AIML LAB 4: DATA BASE MANAGEMENT SYSTEM

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B08 AIML	2	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Ability to design and implement a database schema for given problem.

CO2: Apply the normalization techniques for development of application software to realistic problems.

CO3: Ability to formulate queries using SQL DML/DDL/DCL commands.

List of Exercises

SQL -1

Create table students with fieldssno, sname, sex, mark with sno as primary keyand assign suitable constraints for each attribute.Insert five records into the table.

1. Alter the table by adding one more field rank.

2. Display all boy students with their name.

3. Find the Average mark

4. Create a query to display the sno and sname for all students who got More than the

5. Average mark. Sorts the results in descending order of mark.

6. Display all girl student names for those who have marks greater than 20 and less than 40.

SQL -2

Create a table department with fieldsename, salary, dno, dname, place with dnoasprimarykey.Insert five records into the table.

1. Rename the field ‘place’ with ‘city’

2. Display the employees who got salary more than Rs.6000 and less than10000 /-

3. Display total salary of the organization

4. Display ename for those who are getting salary in between 5000 and 10000.

5. Create a view named ‘Star’ with field ename, salary & place

6. Display ename and salary with salary rounded with 10 digits’*’

SQL -3

Create a table department with fieldsdno, dname, dmanager and place with dnoasprimary key. Create a table emp with fields eno, ename, job, dno, salary, with eno as primary key.Setdno as foreign key. Insert five records into each table.

1. Display the ename and salary, salary with ascending order

2. Display ename and salary for eno=20,

3. Display the manager for the accounting Department

4. Display the name,salary and manager of all employees who are getting salary > 5000

5. Write the queries using various group functions.

6. Write the queries using various Number functions.

SQL -4

Create a table emp with fields eno,ename, job, manager and salary, with eno as primary key. Insert values into the table.

1. Display ename, salary from emp who are getting salary more than average salary of the organization.

3. ADD 20% DA as extra salary to all employees. Label the coloumn as 'New Salary'

4. Create a query to display the eno and ename for all employees who earn more thanthe average salary. Sort the results in descending order of salary.

5. Create a view called emp_view based on the eno, ename from emp table change theheading for the ename to 'EMPLOY'.

6. Write a query that will display the eno and ename for all employees whose namecontains a 'T'.

SQL -5

Create a table department with fieldsdno, ename, salary, Designation, dname and place with dno as primary key. Insert values into the table.

1. Write the queries using various Character functions in ename field.

2. Create a query to display the employee number and name for all employees who earnmore than the average salary. Sort the results in descending order of salary.

3. Display all employees who got salary between 5000 &10000

4. Display ename, salary, Designation for those who got salary more than 5000 or his Designation is 'clerk'.

5. Display ename and designation those who are not a clerk or manager.

6. Display the names of all employees where the third letter of their name is an 'A'

SQL -6

Create a table Customer with fieldscid, cname, date_of_birth and place Create table loan with fieldsloanno, cid and bname assigning suitable constraints. Create table depositor with fields accno, cid, balance and bname assigning suitable constraints. Insert 5 Records into each table.

1. Add one more field amount to loan table. Update each record. Display cnameforcid=2.

2. Calculate Rs 150 extra for all customers having loan.The added loan amount will display in a new coloumn.

4. Display loanno, cname and place of a customer who is residing in Kannur city.

5. Display all information from loan table for loanno 2,8,10.

6. Display all customers who have both loan and deposit.

CORE COURSE IX: 4B09 AIML LAB 5: PYTHON FOR MACHINE LEARNING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B09 AIML	2	2	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Implement programs to familiarize the usage of data structures in python.

CO2: Develop programs using functions and modules

CO3: Understand the usage of file handling and exception handling in python

CO4: Write programs in Python to process data stored in files by utilizing the modules NumPy and Pandas

List of Programs

1.Write a python program to find the square root of a number using Newton Raphson and bisection search methods.

2.Write a python program to check whether a string is palindrome or not using recursion.

3.Write a program to create a dictionary in which keys are the words in a given input sentence and values are the frequency of each word. (Use loop)

4.Write a program to find the frequency of each word in a text file.

5.Write a python program using lambda function to separate the odd numbers and even numbers in a given list.

6.Write a Python program to iterate over a root level path and print all its sub-directories and files, also loop over specified dirs and files.

7.Write a python program using NumPy to compute the multiplication of two given matrices

8.Write a python program using NumPy to compute the determinant, eigenvalues and right eigenvectors of a given square matrix.

9.Given an input csv file with 4 attributes of a student (id, name, programme, marks), write a program using pandas to get the details of students (name, programme, marks) with marks between 60 and 80.

10.Given an input csv file with details of each over of a 1-day cricket match with 50 overs (over, bowler name, runs scored, wickets fallen), write a program using pandas to create a bar plot showing the score in each over.

CORE COURSE X: 5B10 AIML INTRODUCTION TO R PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B10 AIML	4	4	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the basics in R programming in terms of constructs, control statements, string functions.

CO2: Understand the use of R for Big Data analytics.

CO3: Apply R programming for Text processing.

CO4: Appreciate and apply the R programming from a statistical perspective.

Unit I:

Introducing to R – R Data Structures – Help Functions in R – Vectors – Scalars – Declarations – Recycling – Common Vector Operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Victorised if-then else – Vector Element names.

Unit II:

Creating matrices – Matrix Operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns - Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists.

Unit III:

Creating Data Frames – Matrix-like operations in frames – merging Data frames – Applying functions to Data Frames – Factors and Tables – Factors and levels – Common Functions used with factors – Working with tables – Other factors and table related functions – Control statements – Arithmetic and Boolean operators and values – Default Values for arguments – Returning Boolean Values – Functions are objects – Environment and scope issues – Writing Upstairs – Recursion – Replacement functions – Tools for Composing function code – Math and Simulation in R.

Unit IV:

S3 Classes – S4 Classes – Managing your objects – Input/output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving Graphs to files – Creating Three-Dimensional plots. Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear Models – Time Series and Auto-Correlation – Clustering.

Text Books:

1. Norman Matloff, ―The Art of R Programming: A Tour of Statistical Software Design‖, No Starch Press, 2011.
2. Jared P. Lander, ―R for Everyone: Advanced Analytics and Graphics‖, Addison-Wesley Data &Analytics Series, 2013.

Reference Books:

1. Mark Gardner, ―Beginning R – The Statistical Programming Language‖, Wiley, 2013.
2. Robert Knell, ―Introductory R: A Beginner‘s Guide to Data Visualisation, Statistical Analysis and programming in R‖, Amazon Digital South Asia Services Inc, 2013. Richard Cotton(2013). Learning R, O‘Reilly Media.
3. Garret Grolemund (2014). Hands-on Programming with R. O‘Reilly Media, Inc.
4. Roger D.Peng (2018). R Programming for Data Science. Lean Publishing.

Web Resources:

1. https://onlinecourses.swayam2.ac.in/aic20_sp06/preview
2. https://onlinecourses.swayam2.ac.in/arp19_ap79/preview

CORE COURSE XI: 5B11 AIML SOFTWARE ENGINEERING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B11 AIML	4	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO 1: Understand what software engineering is and why it is important.

CO 2: Understand the importance of different software engineering techniques.

CO 3: Understand the software design and development stages .

CO 4: Understand the stages of testing a software.

Unit I :

Introduction to Software Engineering - Professional Software Development, Software Engineering, Software Engineering Diversity, Internet Software Engineering, Software Engineering Ethics. Case Study - Weather Station, A patient Information System.

Unit II:

Software Processes - Software Process Models – Waterfall Model, Incremental Development, Reuse oriented software Engineering.Process Activities- Software Specification, Software Design and Implementation, Software Validation, Software Evolution. Coping with Change – Prototyping, Incremental Delivery, Spiral Model, Rational Unified Process.

Unit III:

Introduction to Agile methods - Agile development techniques. Extreme Programming, Testing in XP, Pair Programming, Agile Project Management, Scaling Agile Methods. Requirements Engineering - - Functional and non-functional requirements, Software Requirements Document, Requirements Specification, Requirements engineering processes, Requirements elicitation and analysis. Requirements Validation and Management. Architectural design decisions. Architectural views.

Unit IV:

Object-oriented design using the UML, Implementation issues, Open-source development. Configuration Management - Version Management. Software Testing – Development Testing, Test Driven Development, Release Testing, User Testing.

Text Book:

1. Sommerville, I. Software Engineering, 9th Edition. Pearson Education.

Reference Books:

1. R., Pressman, R. S. (2014). Software Engineering: A Practitioner's Approach, 8th Edition. McGraw-Hill Education.
2. Sommerville, I. (2019). Engineering Software Products: An Introduction to Modern Software Engineering. Pearson Education.
3. Jalote, P. (2013). An Integrated Approach to Software Engineering. Springer.
4. https://git-scm.com/doc

CORE COURSE XII: 5B12 AIML OBJECT ORIENTED PROGRAMMING USING JAVA

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B12 AIML	4	4	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO 1: Understand the concepts of object-oriented programming
CO 2: Know the overall structure and concept of logic building activity of Java programming language
CO 3: Identify the real-world things as well as the relationship between them and understand transforming them into their corresponding computer representations.
CO 4: Realise how to achieve code reusability using inheritance, interfaces and packages and expedite application development activities.
CO 5: Familiarise simple and robust way of handling multitasking and runtime error as well as such kinds of abnormal situations within a program.

Unit I:

Introduction to Java - History, Features of Java, Byte Code, Java Language Fundamentals - Data Types, Variables, Arrays, Operators - Arithmetic, Bitwise, Relational, Boolean Logical, Assignment, Control Statements - if, else, else if, switch, while, do-while, for, break, continue, return.

Unit II:

Object Oriented Programming Concepts - Abstraction, Data Hiding, Encapsulation, Polymorphism, Inheritance, Concepts of Class and Objects, Methods, Constructors, Garbage Collection, Method Overloading, Access Control, static members, Nested and Inner Classes, Exploring String Class, Inheritance - Basics, Member Access and Inheritance, Multi-level Inheritance, Method Overriding, Dynamic Method Dispatching, Abstract Class, Object Class

Unit III:

Packages - Introduction, creating a Package, CLASSPATH, Packages and Member Access, Simple Programs using Package, Importing Packages, Interfaces - definition and implementation, Simple programs using Interface, Default interface methods. Exception handling- Basics, try, catch, finally, multiple catch, nested try, throw, throws, finally, User Defined exception, Chained Exception.

Unit IV:

Multi-threaded Programming - Basics of threading, Creating threads, Thread Life Cycle, Thread Priorities, Synchronization. I/O Basics, Reading Console Input, Writing Console Output, The PrintWriter Class, Applet Fundamentals.

Text Book:

1. Schildt, H. (2020). Java: The Complete Reference, 11 th Edition. McGraw-Hill Education

Reference Books:

1. Schildt, H. (2020). Java: A Beginner's Guide, 8 th Edition. McGraw-Hill Education.
2. Bloch, J. (2016). Effective Java, 3 rd Edition. Pearson Education.
3. Horstmann, C. (2016). Core Java Volume I-Fundamentals, 10 th Edition. Pearson Education.
4. Horstmann, C. (2020). Core Java Volume II-Advanced Features, 11 th Edition. PearsonEducation.
5. Sierra, K., Bates, B. (2005). Head First Java: A Brain-Friendly Guide, 2 nd Edition. O'Reilly Media.

DISCIPLINE SPECIFIC ELECTIVE I: 5B13A AIML DATA MINING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B13A AIML	4	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1. Understand the concept of Data Mining.

CO2. Discover various association rules.

CO3. Understand various Clustering Techniques.

CO4. Understand the concepts of Web Mining.

Unit I:

Data Mining –Introduction, what is mining? Definitions, KDD Vs Data Mining, DBMS Vs DM, DM Techniques, Other Mining Problems, Issues and Challenges in DM, DM Application Areas.

Unit II:

Association Rules – Introduction, Association Rule, Methods to Discover association rules, Apriori Algorithm, Partition Algorithm, Dynamic Item Set Counting Algorithm, Border Algorithm.

Unit III:

Clustering Techniques – Introduction, Clustering Paradigms, Partitioning Algorithms, k – Medoid Algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, CURE, Categorical Clustering Algorithms, STIRR, CACTUS.

Unit IV:

Decision Trees – Introduction, Decision Tree, Tree Construction Principle, Best Split, Splitting Criteria, CART, ID3, C4.5, CHAID. Web Mining –Introduction, Web Content mining, Web Structure mining, Web Usage Mining, Text Mining, Unstructured Text, Text Clustering. Temporal Data Mining – What is Temporal Data Mining.

Text Books:

1. Arun K Pujari, Data Mining Techniques, Universities Press, 3rd Edition

Reference Books:

1. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3. Margaret H Dunham, Data Mining, Pearson, 12th Impression, 2012

DISCIPLINE SPECIFIC ELECTIVE I: 5B13B AIML PATTERN RECOGNITION

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B13B AIML	4	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Differentiate between supervised and unsupervised classifiers
CO2: Classify the data and identify statistical estimation theory.
CO3: Extract feature set and select the features from given data set.
CO4: Analyze the main approaches to unsupervised Learning and Clustering.

.

UNIT – I Introduction to pattern recognition:

Introduction: -Definition of pattern recognition, Applications, Dataset for pattern recognition, Pattern Recognition Systems- Sensing, Segmentation and Grouping, Feature Extraction, Classification, Post Processing. The Design Cycle- Data Collection, Feature Choice. Model Choice- Training, Evaluation, Computational Complexity. Learning and Adaptation- Supervised Learning, Unsupervised Learning, Reinforcement Learning.

UNIT – II Bayesian Decision Theory:

Continuous Features, Two-Category Classification. The bayes decision rule for Minimum Error-Rate Classification- Minimax Criterion, Neyman-Pearson Criterion. Classifiers, Discriminant Functions, and Decision Surfaces, The Normal Density, Discriminant Functions for the Normal Density. Posterior Probability Form, Likelihood Ratio Form, Discriminant Function Form.

UNIT –III Algorithm-Independent Machine Learning:

Lack of Inherent Superiority of Any Classifier, Bias and Variance, Resampling for Estimating Statistics, Resampling for Classifier Design, Estimating and Comparing Classifiers.

UNIT –IV Unsupervised Learning and Clustering:

Mixture Densities and Identifiability, Maximum Likelihood Estimates, Application to Normal Mixtures, Unsupervised Bayesian Learning, Data Description and Clustering, Criterion Functions for Clustering, Iterative Optimization, Hierarchical Clustering, On-line clustering, Graph-Theoretic Methods, Component Analysis, Low-Dimensional Representations and Multidimensional Scaling (MDS).

Text Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification”, John Wiley,2nd Edition,2012.
2. K. Fukunaga, “Statistical pattern Recognition”,Academic Press,2nd Edition 2013.
3. Devi V.S., Murty, M.N., “Pattern Recognition: An Introduction”, Universities Press, Hyderabad, 2011
4. S.Theodoridis and K.Koutroumbas, “Pattern Recognition”,Academic Press, 4th Edition, 2009.

Reference Books:

1.C.M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

DISCIPLINE SPECIFIC ELECTIVE I : 5B13C AIML DATA SCIENCE AND ANALYTICS

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B13C AIML	3	3	3

Course Outcomes:

After the completion of course, the student will be able to:

CO1: Describe the Data Science process and how its components interact.

CO2: Classify Data Science problems.

CO3: Understand the concept of Bigdata.

CO4: Understand NoSQL databases, HDFS and MapReduce.

Unit I

Introduction to Data Analytics: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics.

Unit II

Data Analytics Lifecycle: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization. Data Pre-processing and Feature selection: Data cleaning - Data integration - Data Reduction- Data Transformation and Data Discretization, Feature Generation and Feature Selection, Feature Selection algorithms.

Unit III

Application: Exploratory Data Analysis (EDA), statistical measures, Basic tools (plots, graphs and summary statistics) of EDA, Data Analytics Lifecycle, Discovery, EDA case study, Web scraping, Text data and Natural Language Processing. Data Visualization, Data Science and Ethical Issues, Discussions on privacy, security, ethics. Bigdata – Concepts, Types and sources of Bigdata, Characteristics, Challenges of bigdata, Bigdata applications, Hadoop Distributors.

Unit IV

NoSQL databases – Types of NoSQL databases, SQL vs NoSQL. Introduction to Hadoop, Features of Hadoop, Hadoop core components – HDFS, MapReduce, YARN. Hadoop Distributed File System (HDFS)- HDFS architecture, Applicability of HDFS, Processing data with Hadoop – MapReduce, MapReduce Examples. Hadoop ecosystem technologies – Data Ingestion: Sqoop, Flume, Data processing: Spark, MapReduce, Data Analysis: Pig, Hive, Impala.

TEXT BOOKS

1. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”,1st Edition, 2022.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", Wiley 2015.
3. Vijay Kotu, Bala Deshpande, “Data Science: Concepts and Practices”, Morgan Kaufmann Publishers, Second edition, 2019.

REFERENCES

1. Vijay Kotu, Bala Deshpande, “Data Science: Concepts and Practices”, Morgan Kaufmann Publishers, Second edition, 2019.
2. Tom White ,“Hadoop: The Definitive Guide” Third Edition, O’reily Media, 2012.
3. Sinan Ozdemir, Principles of Data Science, Packt Publishing, December 2016.
4. Jiawei Han, Micheline Kamber and Jian Pei, “Data Mining: Concepts and Techniques”, Third Edition, ISBN 0123814790, (2011).
5. “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph” ,

CORE COURSE XIV: 5B14 AIML LAB -6: INTRODUCTION TO R PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B14 AIML	4	-	-

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Apply OOP concepts in R programming.

CO2: Understand and apply the use of data structure and loop functions.

CO3: Analyse data and generate reports based on the data.

CO4: Apply various concepts to write programs in R.

1. R Expressions and Data Structures
2. Manipulation of vectors and matrix
3. Operators on Factors in R
4. Data Frames in R
5. Lists and Operators
6. Working with looping statements.
7. Graphs in R
8. 3D plots in R

CORE COURSE XV: 5B15 AIML LAB - 7: OBJECT ORIENTED PROGRAMMING USING JAVA

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B15 AIML	3	-	-

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the concepts of object-oriented programming

CO2: Know the overall structure and concept of logic building activity of Java programming language CO 3: Identify the real-world things as well as the relationship between them and understand transforming them into their corresponding computer representations.

CO4: Realise how to achieve code reusability using inheritance, interfaces and packages and expedite application development activities.

CO5: Familiarise simple and robust way of handling multitasking and runtime error as well as such kinds of abnormal situations within a program.

List of Programs

1. Write a Java program to show method overloading.
2. Write a Java program to show the implementation of inheritance.
3. Write Java Program to show method overriding. (Exercise to understand Polymorphism)
4. Write a java program to implement interface.
5. Write a java program that handles various exceptions. Use try, catch and finallystatements.
6. Write a java program to demonstrate threads using runnable interface
7. Write a java program that creates three threads. First thread displays “Good Morning” every one second, the second thread displays “Hello” every two seconds and the third thread displays “Welcome” every three seconds.
8. Write a program to show an implementation of Packages.
9. Write a java program to implement abstract classes.

Text Books:

1. Schildt, H. (2020). Java: The Complete Reference, 11 th Edition. McGraw-Hill Education.

References Books:

1. Schildt, H. (2020). Java: A Beginner's Guide, 8 th Edition. McGraw-Hill Education.
2. Bloch, J. (2016). Effective Java, 3 rd Edition. Pearson Education.
3. Horstmann, C. (2016). Core Java Volume I-Fundamentals, 10 th Edition. PearsonEducation.
4. Horstmann, C. (2020). Core Java Volume II-Advanced Features, 11 th Edition. Pearson Education.

CORE COURSE XVI: 6B16 AIML DIGITAL IMAGE PROCESSING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B16 AIML	3	4	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Review the fundamental concepts of a digital image processing system.

CO2: Analyze images in the frequency domain using various transforms.

CO3: Evaluate the techniques for image enhancement and image restoration.

CO4: Categorize various compression techniques.

Unit I:

Steps in Digital image Processing, Elements of Visual perception, Image Sensing and Acquisition, Image sampling and quantization, Basic pixel relationships, Basic Intensity Transformation functions – Negatives, Log transforms, Power law transformations, Piecewise Linear Transformation functions.

Unit II:

Histogram processing, Fundamentals of spatial filtering, Smoothing spatial filters, sharpening spatial filters. Filtering in the Frequency domain: DFT of one and two variables, Properties of 2-D DFT, Basics of filtering in the Frequency domain. Image smoothing filters (Ideal Low pass, Gaussian Low pass), Image sharpening filters (ideal High pass, Gaussian High pass, Laplacian in the Frequency domain. Selective filtering – Notch filters.

Unit III:

Image restoration and reconstruction: Model, noise models, restoration in the presence of noise only – spatial filtering, Periodic noise reduction by frequency domain filtering. Linear, Position – invariant degradation. Color models – RGB and HIS. – Basics of color image processing.

Unit IV:

Image compression: Fundamentals, Compression methods (Huffman, Arithmetic coding, LZWCoding, run Length coding, Wavelet coding). Digital watermarking. Morphological Image Processing: Erosion and dilation, opening and closing, Hit-or-miss transformation, Morphological algorithms (Boundary extraction, Thinning, thickening, skeletons, pruning). Image segmentation: Fundamentals, Point and line and edge detection, Thresholding, Region-based thresholding.

Text Book:

1. Rafael C, Gonzalez, and Richard E. Woods. "Digital image processing [M]."Pearson Fourth Edition 2018

Reference Books:

1. Anil K. Jain, Fundamentals of Digital image Processing, Prentice Hall, US Ed., 1989.
2. William K. Pratt, Digital Image Processing: PIKS Scientific Inside, Wiley Interscience, 4thEd., 2007.
3. Bernd Jahne, Digital Image Processing, Springer, 6th Ed., 1997.
4. Sonka, Hlavac, Boyle, Digital Image Processing and Compurter Vision, Cengage, 2008

DISCIPLINE SPECIFIC ELECTIVE II: : 6B17A AIML INTRODUCTION TO DEEP LEARNING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B17A AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Describe the feed forward and deep networks.

CO2: Design single and multi-layer feed-forward deep networks and tune various hyper

parameters.

CO3: Analyse performance of deep networks.

Unit I:

Introduction: Historical context and motivation for deep learning; basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method. Neural Networks: Feed-forward neural networks, deep networks, regularizing a deep network, model exploration, and hyper-parameter tuning.

Unit II:

Convolution Neural Networks: Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification.

Unit III:

Sequence Modeling, Recurrent Nets, Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks. Autoencoders:Undercompleteautoencoders, regularized autoencoders, sparse autoencoders, denoisingautoencoders, representational power, layer, size, and depth of autoencoders, stochastic encoders and decoders.

Unit IV:

Structuring Machine Learning Projects:Orthogonalization, evaluation metrics, train/dev/test distributions, size of the dev and test sets, cleaning up incorrectly labeled data, bias and variance with mismatched data distributions, transfer learning, multi-task learning.

Text Book:

1. Ian Goodfellow, Deep Learning, MIT Press, 2016.

Reference Books:

1. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
2. Mindy L Hall, Deep Learning, VDM Verlag, 2011
3. Li Deng (Author), Dong Yu, Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing), Now Publishers Inc, 2009.

DISCIPLINE SPECIFIC ELECTIVE II: 6B17B AIML DATA VISUALIZATION

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B17B AIML	3	3	3

COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1: To understand the fundamentals of data visualization

CO2: To acquire knowledge about the issues in data representation

CO3: To design real time interactive information visualization system.

CO4: To apply the visualization techniques in practical applications

UNIT I:

Introduction –Visualization Stages –Computational Support –Issues –Different Types of Tasks –Data representation –Limitation: Display Space, Rendering Time, Navigation Link.

UNIT II:

Human Factors –Foundation for a Science of Data Visualization –Environment-Optics – Optimal Display – Overview about Lightness, Brightness, Contrast, Constancy, Color –Visual Attention that Pops Out –Types of Data –Data Complexity –The Encoding of Values – Encoding of Relation –Relation and Connection – Alternative Canvass.

UNIT III:

Human Vision –Space Limitation –Time Limitations –Design –Exploration of Complex Information Space – Figure Caption in Visual Interface –Visual Objects and Data Objects – Space Perception and Data in Space – Images, Narrative and Gestures for Explanation.

UNIT IV:

Norman's Action Cycle –Interacting with Visualization –Interaction for Information Visualization –Interaction for Navigation –Interaction with Models –Interacting with Visualization –Interactive 3D Illustrations with Images and Text –Personal View –Attitude – user perspective –Convergence –Sketching –Evaluation. Design – Virtual Reality: Interactive Medical Application –Tactile Maps for visually challenged People.

TEXT BOOKS

1. Robert Spence, “Information Visualization: An Introduction”, Third Edition, Pearson Education, 2014.
2. Colin Ware, “Information Visualization Perception for Design”, Third Edition, Morgan Kaufmann, 2012.

REFERENCE BOOKS:

1. Joerg Osarek, “Virtual Reality Analytics”, Gordo‟s Arcade, 2016.
2. Matthew O. Ward, George Grinstein, Daniel Keim, “Interactive Data Visualization: Foundation, Techniques and Applications”, Second Edition, A.K. Peters /CRC Press,2015.

DISCIPLINE SPECIFIC ELECTIVE II: 6B17C AIML CLOUD COMPUTING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B17C AIML	3	3	3

Course Outcomes:

After the completion of course, the student will be able to:

CO1: Explain the various cloud computing models and services.

CO2: Demonstrate the significance of implementing virtualization techniques.

CO3: Describe SAAS and PAAS.

CO4: Understand the concept of IAAS and Cloud Data Storage.

Unit I

CLOUD COMPUTING BASICS: Cloud computing components- Infrastructure-services- storage applications database services – Deployment models of Cloud- Services offered by Cloud- Benefits and Limitations of Cloud Computing – Issues in Cloud security- Cloud security services and design principles.

Unit II

VIRTUALIZATION FUNDAMENTALS: Virtualization – Enabling technology for cloud computing-Types of Virtualization- Server Virtualization- Desktop Virtualization – Memory Virtualization –Application and Storage Virtualization- Tools and Products available for Virtualization.

Unit 3

SAAS AND PAAS: Getting started with SaaS- Understanding the multitenant nature of SaaS solutions- Understanding Open SaaS Solutions- Understanding Service Oriented Architecture- PaaS-Benefits and Limitations of PaaS. Security as a Service.

Unit 4

IAAS AND CLOUD DATA STORAGE: Understanding IaaS- Improving performance through Load balancing- Server Types within IaaS solutions- Utilizing cloud-based NAS devices – Understanding Cloud based data storage- Cloud based backup devices- Cloud based database solutions- Cloud based block storage. Fundamentals of big data and Hadoop.

References:-

1. Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing: A Practical Approach, Tata McGraw Hill Edition, Fourth Reprint, 2010

2. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, "Virtualization, Business Models, Mobile, Security and more, Jones & Bartlett Learning Company, 2013

3. Ronald L.Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing Inc., 2010.

4. Kumar Saurabh, Cloud Computing, Wiley India

5. Gautam, Enterprise Cloud Computing Technology Architecture Applications, Shroff.

CORE COURSE XVIII: 6B18 AIML COMPUTER NETWORKS

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B18 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand state-of-the-art in network protocols, architectures and application.

CO2: To acquire knowledge about different computer networks

CO3: To understand the use of layer architecture for networking systems.

Unit I:

Introduction to data communication, important elements /components of data communication. Transmission media- Guided media, Unguided media. Synchronous /Asynchronous data transmission.Line configuration – Simplex, Half duplex,Duplex.Network topologies – star, Bus, ring, Mesh. Computer networks, Use, network hardware, network structure- point to point connection, multicast, broadcast, classification of networks-LAN, WAN, MAN.

Unit II:

Reference models, the OSI reference model, TCP / IP reference model. Comparison between OSI and TCP / Ip models. Data Link Layer, Design issues, Services to network layer, Framing- character count, character stuffing, bit stuffing, physical layer coding violation. Error control, flow control, Elementary data link protocols- unrestricted simplex protocol, simplex stop and wait protocol, simplex protocol for a noisy channel.

Unit III:

Network layer, design issues, services to the transport layer, routing algorithms- adaptive, non-adaptive algorithms, optimality principle, Dijkstra's shortest path routing algorithm, flow-based routing, hierarchical routing, congestion control algorithms–the leaky bucket algorithm, the token bucket algorithm.

Unit IV:

Transport layer, design issues, connection management-addressing, establishing and releasing connection, transport layer protocols- TCP, UDP, Application layer – Basic Idea of telnet, ftp, http, smtp, pop3.

Text Book:

1. Andrew S. Tanenbaum& David J. Wetherall, Computer Networks, Pearson.

Reference Books:

1. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill Education.
2. Achyut S. Godbole and AtulKahate, Data communication and Networks, 2nd Ed, McGraw Hill
3. Kurose James F. and Ross Keith W., Computer Networking: A Top-Down Approach, Pearson.
4. R. S. Rajesh, K. S. Easwara Kumar and R. Balasubramanian, Computer Networks – Fundamentals and Applications, Vikas Publishing House.

CORE COURSE XIX: 6B19 AIML NATURAL LANGUAGE PROCESSING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B19 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand the fundamental concepts of Natural Language Processing.

CO2: Design algorithms for NLP tasks.

CO3: Understand useful systems for language processing and related tasks involving text processing

Unit I:

Introduction to Language: Linguistic Knowledge, Grammar, Language and Thought, computational linguistics vs NLP, why NLP is hard, why NLP is useful, classical problems. Words of Language, Content Words and Function Words, Lexical categories, Regular expressions and automata. Morphology: Morphemes, Rules of Word Formation, Morphological parsing and Finite state transducers.

Unit II:

N-grams: simple N-grams, Applications, language modelling. Word classes and POS tagging: tag sets, techniques: rule based, stochastic and transformation based. Introduction to Natural Language Understanding- Levels of language analysis- Syntax, Semantics, Pragmatics.

Unit III:

Grammars and Parsing- Grammars for Natural Language: CFG, Probabilistic Context Free Grammar, Parsing methods-top down and bottom up parsing and Efficient Parsing, statistical parsing, Ambiguity Resolution- Statistical Methods. Features and Unification: Feature structures and Unification of feature structures. Lexical semantics, formal semantics and discourse, WSD.

Unit IV:

Knowledge Representation and Reasoning- FOPC, Elements of FOPC. Discourse processing: monologue, dialogue, reference resolution. Text coherence. Dialogue acts: Interpretation of dialogue acts, plan inference model, clue-based model. Semantics: Representing meaning, Semantic analysis. Applications: Natural Language Generation: surface realization and discourse planning. Machine translation.

Text Book:

1. Jurafsky and Martin, Speech and Language Processing, Pearson, 2013

Reference Books:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press
4. Kao, Natural Language Processing and Text Mining, Springer

CORE COURSE XX: 6B20 AIML SOFT COMPUTING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B20 AIML	3	3	3

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Identify and describe soft computing techniques and their roles in building intelligent machines.

CO2: Recognize the feasibility of applying a soft computing methodology for a particular problem.

CO3: Apply fuzzy logic and reasoning to handle uncertainty and solve problems.

CO4: Understand the concepts of genetic algorithm.

Unit I:

Introduction, Soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Basic tools of soft computing- Fuzzy logic, Neural network, Evolutionary computing. Neural networks, Application scope of neural networks, Fuzzy logic, Genetic algorithm, Hybrid systems.

UnitII:

Fuzzy Logic Introduction, Basic concepts of fuzzy logic, Crisp sets, Operations and properties of Crisp set, Fuzzy sets, Operations and properties of fuzzy sets, Crisp and fuzzy relations, Fuzzy to crisp conversion. Membership functions, Interference in fuzzy logic, Fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications&Defuzzificataion.

Unit III:

Fuzzy Controller, Fuzzy rule base and approximate reasoning: truth values and tables in fuzzy logic, fuzzy propositions, decomposition of compound rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference system, fuzzy expert systems

Unit IV:

Genetic Algorithm(GA) Basic concepts, simple GA, working principle, procedures of GA, flow chart of GA, Genetic representations, , operations in GA, stopping conditions for genetic algorithm flow, constraints in GA, classification of GA, advantages and disadvantages of GA , applications of GA.

Text Books:

1. S.N.Sivanandam ,S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
2. S.Rajasekaran, G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

Reference Books:

1. SimanHaykin,"NeuralNetowrks"Prentice Hall of India
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
3. Kumar Satish, "Neural Networks" Tata Mc Graw Hill.

CORE COURSE XXI: 6B21 AIML LAB -6: INTRODUCTION TO R PROGRAMMING

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B21 AIML	3	2	3

CORE COURSE XXII: 6B22 AIML LAB -7: OBJECT ORIENTED PROGRAMMING USING JAVA

SEMESTER	COURSECODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B21 AIML	3	2	3

PART B

B.SC. ARTIFICIAL INTELLIGENCE COMPLEMENTARY ELECTIVE COURSES

Complementary Elective I (Mathematics)

WORK AND CREDIT DISTRIBUTION

(2023 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS (INTERNAL +EXTERNAL)
1C01MAT - AIML	Differentiation and Matrix Theory	1	4	2	3	10+40
2C02MAT- AIML	Integration and Linear Algebra	2	4	2	3	10+40
3C03MAT- AIML	Differential Equations and Fourier Series	3	5	2	3	10+40
4C04MAT - AIML	Linear Programming and Game Theory	4	5	2	3	10+40

EVALUATION

Assessment	Weightage
External	80%
Internal	20%

CONTINUOUS INTERNAL ASSESSMENT FOR THEORY

Component	Weightage	Remarks
Component 1: TEST	80%	Minimum of 2 tests should be conducted. Marks for the best component should be calculated as the average of the marks obtained in the tests conducted
Component 2: ASSIGNMENT/SEMINAR/VIVA	20%	Any one component

PATTERN OF QUESTION PAPER FOR END SEMESTER EVALUATION

Part A	**Short Answer**	**6 Questions x 1 Mark =6 Marks**
	Answer all questions	6 Questions x 1 Mark=6 Marks
Part B	**Short Essay**	**8 Questions x 2 Marks=16 Marks**
	Answer any 6 questions	6 Questions x 2 Marks=12 Marks
Part C	**Essay**	**6 Questions x 3 Marks=18 Marks**
	Answer any 4 questions	4 Questions x 3 Marks=12 Marks
Part D	**Long Essay**	**4 Questions x 5 Marks=20 Marks**
	Answer any 2 questions	2 Questions x 5 Marks=10 Marks
Total Marks Including Choice:60		
Maximum Marks for the Course:40		

Complementary Elective I (Mathematics)

1C01MAT – AIML Differentiation and Matrix Theory

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
1	1C01MAT – AIML	4	2	3

CO 1
Understand differentiation, derivative of functions namely constant, Successive differentiation and Leibnitz's theorem for tenth derivative of the product of two functions.

CO 2
Understand different types of Relations and Functions, Composition of functions and invertible functions

CO 3
Understand Rank of a matrix, quivalent matrices, elementary matrices, Gauss-Jordan method of finding the inverse, normal form of a matrix and partition method of finding the inverse.

CO 4
Understand solution of linear system of equations, Cramer's rule, matrix inversion method, consistency of linear system of equations, Rouche's theorem, procedure to test the consistency of a system of equations in n unknowns, system of linear homogeneous equations.

Unit I- Differentiation and Successive Differentiation

Quick reviewof basics of differentiation – Derivatives of standard functions, rules of differentiation, parametric differentiation. *(Questions should not beasked in the End Semester Examinations from the above sections for quickreview)*
Successive differentiation, standard results, preliminary transformations, use ofpartial fractions, Leibnitz's theorem for the nth derivative of the product of two functions.

Unit II-Relations and Functions

Relations, Types of relations, Partitions, Equivalence relation, Partial order in relation, Functions, Composition of functions, One-to-one, onto and invertible functions.

Unit III-Matrices

Rank of a matrix, elementary transformation of a matrix, equivalent matrix, elementary matrices, Gauss-Jordan method of finding the inverse, normal form of a matrix.

Unit IV-System of Equations

System of linear equations, consistency of linear system of equations, solution of linear system of equations – method of determinants – Cramer's rule, Rouche's theorem ,procedure to test the consistency of a system of equations in n unknowns, system of linear homogeneous equations.

Text1 : Differential Calculus, Shanti Narayan and P.K. Mittal
Text2 : Higher Engineering Mathemaics (41stedition), B.S. Grewal,
Text3 :S. Lipschutz, Set Theory and Related Topics (2nd edition), Schaum'sSeries

References

1. Differential and Integral Calculus, S. Narayanan and T.K.M. Pillay, S.Viswanathan Printers and Publishers, Chennai
2. Textbook of Matrices, Shanti Narayan and P.K. Mittal, S. Chand & Co.
3. Theory of and Problems of Matrices, Frank Ayres JR, Schaum'sOutlineSeries, McGraw- Hill Book Company
4. Advanced Engineering Mathematics (10th edition), E. Kreyszig, Wiley
5. Calculus (10th edition), Anton, Bivens, Davis, Wiley-India
6. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor,Sultan Chand.

2C02MAT - AIML Integration and Linear Algebra

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
2	2C02MAT – AIML	4	2	3

CO1
Understand Functions of two or more variables, limits and Continuity, partial derivatives, homogeneous functions, Euler 'stheorem on homogeneous functions, total derivative, differentiation of implicit functions

CO2
Understand basics of integration, Integration by parts, trigonometric integrals, Understand Reduction formulae for trigonometric functions and evaluation of definite integrals $\int_0^{\pi/2} sin^n x\, dx$, $\int_0^{\pi/2} cos^n x\, dx$, Integration of $sin^p x cos^q x$ and $\int_0^{\pi/2} sin^p x cos^q x\, dx$

CO3
Understand Vector spaces, Linear Dependence and Linear Independence, Bases and Dimension, Linear transformations.

CO4
Understand Eigen values, Eigen vectors, properties of Eigen values,C ayley- Hamilton theorem, reduction to diagonal form, similarity ofmatrices, powers of a matrix, reduction of quadratic form to canonical form and nature of a quadratic form.

Unit I - Partial Differentiation

Functions of two or more variables, limits, continuity, partial derivatives, homogeneous functions, Euler's theorem on homogeneous functions, total derivative, differentiation of implicit functions, change of variables.

Unit II - Integration and Integration by Successive Reduction

Quick review of basics of Integration **(***Questions should **not** be asked in the End Semester Examinations from the above sections for quick review***)**
Integration of Trigonometric Functions**:** Integration of$sin^n x$, where *n* is a positive integer, evaluation of the definite integral$\int_0^{\pi/2} sin^n x\, dx$, Integration of$cos^n x$, evaluation of the definite integral$\int_0^{\pi/2} cos^n x\, dx$,Integration of$sin^p x cos^q x$, evaluation of the definite integral$\int_0^{\pi/2} sin^p x cos^q x\, dx$, integration of $tan^n x$.

Unit III-Vector Spaces

Introduction, Vector spaces, Subspaces, Linear Dependence and Linear Independence, Bases and Dimension, Linear transformations. (Omit proofs of all theorems in this section)

Unit IV Linear Algebra - Eigen Values and Cayley-Hamilton Theorem

Eigen values, eigen vectors, properties of eigen values, Cayley- Hamilton theorem (without proof), reduction to diagonal form, similarity of matrices, powers of a matrix, reduction of quadratic form to canonical form, nature of aquadratic form.

Text 1: Differential Calculus, Higher Engineering Mathematics (41stedition), B.S. Grewal, Khanna Pub.
Text 2: Integral Calculus, Santhi Narayanan and P.K. Mittal, S. Chand andCo.
Text 3: Higher Engineering Mathematics (41st edition), B.S. Grewal
Text 4: S.H Friedberg A.J. Insel and L.E Spence, Linear Algebra (4th edn), P.H Inc

References
1. Differential and Integral Calculus, S. Narayanan and T.K.M. Pillay, S.Viswanathan Printers and Publishers, Chennai
2. Textbook of Matrices, Shanti Narayan and P.K. Mittal, S. Chand & Co.
3. Theory of and Problems of Matrices, Frank Ayres JR, Schaum's OutlineSeries, McGraw- Hill Book Company
4. Advanced Engineering Mathematics (10th edition), E. Kreyszig, Wiley
5. Calculus (10th edition), Anton, Bivens, Davis, Wiley-India

6. S. Narayan and Mittal A textbook of Matrices (Revised edn S. Chnd)

3C03MAT – AIML Differential Equations and Fourier Series

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
3	3C03MAT – AIML	5	2	3

CO1
Understand Ordinary differential equations, Geometrical meaning of $y'=f(x, y)$ and Direction Fields, Understand Methods of solving Differential Equations, Linear ODEs and Bernoulli Equation.

CO2
Understand Second order ODEs, Homogeneous Linear ODEs of second order, Homogeneous Linear ODEs with constant coefficients

CO3
Differential Operators, Euler-Cauchy Equation, Existence and Uniqueness of Solutions – Wronskian and Non homogeneous ODEs.

CO4
Understand Fourier series, arbitrary period and Even and Odd Functions, Half range series.

Unit I - First Order Ordinary Differential Equations

Basic concepts, Geometrical meaning of $y'=f(x, y)$. Direction Fields(numerical method by Euler excluded), Separable ODEs (modelling excluded)Exact ODEs, Integrating Factors, Linear ODEs, Bernoulli Equation (population dynamics excluded)

Unit II - Second Order Ordinary Differential Equations

Homogeneous Linear ODEs of second order, Homogeneous Linear ODEs with constant coefficients, Differential Operators, Euler-Cauchy Equation, Existence and Uniqueness of Solutions – Wronskian (statement of theorems only, proof omitted), Non homogeneous ODEs.

Unit III Fourier Series

Fourier series, arbitrary period, Even and Odd functions.(Proofs omitted)

Unit IV Fourier Series

Half range series- Half range Fourier sine series, Half range Fouriercosine series

Texts 1: S.H. Friedberg, A. J. Insel and L.E. Spence, Linear Algebra (4thedition), PH Inc
Text 2: Advanced Engineering Mathematics (10th edition), E. Kreyszig, Wiley, 2015

References

1. Higher Engineering Mathematics (41st edition), B.S. Grewal, KhannaPub.
2. Elementary Differential Equations and Boundary Value Problems, W.E.Boyce and R.C. Deprima, Wiley141
3. Differential Equations, S.L. Ross, Wiley
4. An Introduction to Ordinary Differential Eqution, E.A. Coddington,Printice Hall
5. A Textbook of Engineering Mathematics, N.P. Bali and Manish Goyal,Laxmi Pub.

4C04MAT - AIML Linear Programming and Game Theory

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
4	4C04MAT – AIML	5	2	3

CO1

Understand LPP, formulate and solve using graphical method, Understand General LPP, canonical and standard forms of LPP, Solve LPP by Simplex Method

CO2
Understand formulation of transportation problem and its solution, transportation table, loops, transportation algorithm.

CO3
Understand problem of sequencing, Processing 'n' jobs through '2'machines, Processing 'n' jobs through 'k' machines

CO4
Understand basic terms in Game theory, The Maximin- Minimax Principle, Solution of game with saddle point, Solution of 2x2 game without saddle point, Graphic solution of 2xn and mx2 games and Arithmetic method for nxn Games.

Unit I- Linear Programming

Mathematical formulation of daily life situations – simple cases only(Questions should be avoided for end semester examination from this topic)Canonical and standard form, Graphical solution method and Simplex Method.

Unit II Linear programming

Transportation problem – introduction, transportation table, loops, solution to a Transportation Problem, finding an initial basic feasible solution, transportation algorithm (MODI method)(Proofs of theorems excluded)

Unit III Sequencing Problem

Problem of sequencing, Basic terms used in sequencing, Processing 'n' jobs through '2' machines, Processing 'n' jobs through 'k' machines, Maintenance Crew Scheduling.

Unit IV - Games and Strategies

Two-person Zero-sum Games, Basic terms in Game theory, The Maximin-Minimax Principle, Solution of game with saddle point, Solution of 2x2 game without saddle point, Graphic solution of 2xn and mx2 games, Dominance Property, Modified Dominance Property, Arithmetic Method for nxn Games.(Proofs of all theorems in this unit are omitted).

Text 1: Operations Research (18th thoroughly revised edition),
Kantiswaroop, P.K. Gupta and Manmohan, Sultan Chand & Sons.

References

1. Linear Programming, G. Hadley, Oxford & IBH Publishing Company,New Delhi.
2. Operations Research, S. Kalavathy, Vikas Pub.
3. Mathematical Methods, S. R. K. Iyengar and R. K. Jain, Narosa Pub.

B.SC. ARTIFICIAL INTELLIGENCE COMPLEMENTARY ELECTIVE COURSES

Complementary Elective II (Statistics)

WORK AND CREDIT DISTRIBUTION

(2023 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS (INTERNAL +EXTERNAL)
1C01STA - AIML	Descriptive Statistics	1	4	2	3	10+40
2C02STA- AIML	Statistical Methods	2	4	2	3	10+40
3C03STA- AIML	Probability and Distribution Theory	3	5	2	3	10+40
4C04STA - AIML	Inferential Statistics	4	5	2	3	10+40

1C01STA – AIML: DESCRIPTIVE STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
1	1C01STA – AIML	4 (Theory 3 + Practical 1)	2	3

COURSE OUTCOME

Student should be able to

CO1: understand the elementary concept in statistics.
CO2: compute various measures of central tendency and dispersion
CO3: acquire knowledge in sampling theory
CO4: understand the practical use of R

Unit I: Data Presentation: Collection of data, primary and secondary data; Numerical presentation – raw data, discrete frequency distribution and continuous frequency distribution; Diagrammatic representation of data- line diagram, bar diagram, sub divided bar diagram, histogram, frequency curve, frequency polygon and Pie diagram

(20 Hrs)

Unit II: Measures of central tendency: Basic concepts, various measures –mean, median, mode, geometric mean, harmonic mean, weighted mean, quartiles and simple numerical problems.

(16 Hrs)

Unit III: Measures of dispersion and moments- Absolute and relative measures of dispersion, range, mean deviation quartile deviation, standard deviation, coefficient of variation, Moments- Raw moments, central moments (Definition only); Skewness and Kurtosis-Definition and various measures with simple numerical problems.

(20 Hrs)

Unit IV: Elementary sampling procedures: Concept of population, sample, census and sample surveys, advantages of sampling and limitations; Sampling methods - sampling unit, sampling frame, sampling and non-sampling errors, probability sampling and judgment sampling, basic concepts of simple random sampling, systematic and stratified sampling, situations where they are used.

(16 Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. Rogger Till: Statistical methods for the earth scientists- An Introduction: Mc Millan.
2. John Silk: Statistical concepts in Geography, George Allan and Unwin
3. Prem S Mann : Introductory Statistics 5th Edition, Wiley
4. S. C Gupta and V.K Kapoor: Fundamental of Mathematical Statistics, Sulthan Chand and sons, 11^{th} edition.

2C02STA – AIML: STATISTICAL METHODS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2C02STA – AIML	4 (Theory 3 + Practical 1)	2	3

COURSE OUTCOME

Student should be able to
CO1: analyze the relation between two real life data.
CO2: compute various index numbers and understand their importance in real life.
CO3: acquire knowledge in time series data.
CO4: understand the practical use of R

Unit I: Correlation analysis - concept of correlation, method of studying correlation, scatter diagram, Karl Pearson correlation coefficient, Spearman rank correlation coefficient (with and without ties). Definitions of partial and multiple correlation coefficients (trivariate case only).

(22 Hrs)

Unit II: Regression analysis - Fitting of curves of the form linear, linear regression, relation between correlation and regression coefficients.
Regression Equations - Regression Equation of Y on X, Regression Equation of X on Y, Deviations Taken from Arithmetic Means of X and Y, Deviations Taken from Assumed Means, Graphing Regression Lines

(20 Hrs)

Unit III: Index numbers - Meaning and use of index numbers, simple and weighted index numbers, Laspeyer's, Paache's and Fisher's index numbers, Test for good index number, cost of living index number.
Tests of Adequacy of Index Number Formulae - Unit Test, Time Reversal, Factor Reversal, Circular Test

(20 Hrs)

Unit IV: Time Series - Definition and use of time series, Components of time series, measurement of secular trend semi average, moving average and least square method.

(10 Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. Rogger Till: Statistical methods for the earth scientists- An Introduction: Mc Millan.
2. John Silk: Statistical concepts in Geography, George Allan and Unwin
3. Prem S Mann : Introductory Statistics 5th Edition, Wiley
4. Roxy Peck, Chris Olsen, Jay Devore: Introduction to Statistics and Data Analysis, 3rd edition

3C03STA – AIML: PROBABILITY AND DISTRIBUTION THEORY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3C03STA – AIML	5	2	3

COURSE OUTCOME

Students should be able to

CO1: evaluate the probability of events
CO2: understand the concept of random variable with examples in real life.
CO3: familiarize with different discrete probability distributions
CO4: understand the characteristics of different continuous distribution.

Unit I : Probability theory - Random experiment, Sample space, events, classical definition, frequency and axiomatic approaches to probability, Addition theorem, conditional probability, multiplication theorem, independence of events, Baye's theorem and its practical applications.

(25 Hrs)

Unit II: Random Variable and Probability distribution: Random variable - discrete and continuous types, probability mass function, probability density function, distribution function, mathematical expectation.

(20 Hrs)

Unit III: Standard discrete and continuous theoretical distributions: Binomial and Poisson distributions – different characteristics and fitting of binomial and Poisson distributions, Features and properties of Normal distribution and Exponential distributions**.**

(25 Hrs)

Unit IV: Sampling distributions: Statistic, standard error, distribution of sample mean, chi square, student's t and F-distributions-definition, mean and variance, interrelation between them.

(20Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons

Books for Reference:

1. John E Freund, Roanld E Walpole: *Mathematical Statistics* 4th Edition, Prentice HallIndia Pvt Ltd.

2. David Ebdon, Basil Blackwell: *Statistics in Geography*-A practical approach, Oxford.
3. Murrau R Spiegel: *Theory and problems of statistics*, Schaums Outline series
4. Roxy Peck, Chris Olsen, Jay Devore: Introduction to Statistics and Data Analysis, 3rd edition

4C04STA – AIML: INFERENTIAL STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	**4C04STA – AIML**	5	2	3

COURSE OUTCOME

Student should be able to

CO1: estimate the parameters
CO2: understand the concept of statistical hypotheses.
CO3: apply parametric and nonparametric tests.
CO4: apply ANOVA

Unit I: Estimation theory: Point estimation, Desirable properties of a good estimator, Cramer-Rao inequality (statement only), Methods of estimation - method of MLE and method of moments. Interval estimation - Confidence interval for mean, proportion, variance, difference of means, difference of proportions.

(25 Hrs)

Unit II : Testing of hypotheses: Statistical hypotheses, Simple and composite hypotheses, Null and alternative hypotheses, Types of errors, Critical region, Size and power of test – Definition and problems, most powerful test, Neyman - Pearson lemma (without proof).

(20 Hrs)

Unit III: Large and small sample tests: Definition, Test for mean, proportion and variance, difference of means and proportions, chi square test for goodness of fit and independence of attributes, F-test, Non parametric test: Mann - Whiteney U test.

(25 Hrs)

Unit IV: Analysis of variance: One way and two way classification, linear hypothesis, total, between and within sum of squares, ANOVA table, solution of problems using ANOVA tables. Kruskal -Wallis test.

(20 Hrs)

Books for Study:

1. S.P Gupta: Statistical Methods, Sultan Chand and Sons
2. S.C Gupta and V.K . Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons

Books for Reference:

1. John Silk: Statistical concepts in Geography, George Allan and Unwin
2. Prem S Mann : Introductory Statistics 5th Edition, Wiley
3. Roxy Peck, Chris Olsen, Jay Devore: Introduction to Statistics and Data Analysis, 3rd edition

B.SC. ARTIFICIAL INTELLIGENCE GENERIC ELECTIVE COURSES

WORK AND CREDIT DISTRIBUTION

(2023 ADMISSION ONWARDS)

Students of other departments can choose **anyone of the generic elective courses from the pool of Three Courses**

COURSECODE	COURSETITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS	MARKS (INTERNAL +EXTERNAL)
5D01 AIML	Artificial Intelligence and Machine Learning	5	2	2	2	5+20
5D02 AIML	Data Mining	5	2	2	2	5+20
5D03 AIML	Programming in Python	5	2	2	2	5+20

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

CONTINUOUS INTERNAL ASSESSMENT FOR THEORY

Component	Weightage	Remarks
Component 1: TEST	80%	Minimum of 2 tests should be conducted. Marks for the best component should be calculated as the average of the marks obtained in the tests conducted
Component 2: ASSIGNMENT/SEMINAR/VIVA	20%	Any one component

PATTERN OF QUESTION PAPER FOR END SEMESTER ASSESSMENT

Part A	**Short Answer**	**6 Questions x 1Mark =6 Marks**
	Answer all questions	6 Questions x 1Mark=6 Marks
Part B	**Short Essay**	**6 Questions x 2 Marks=12 Marks**
	Answer any 4 questions	4 Questions x 2 Marks=8 Marks
Part C	**Essay**	**2 Questions x 6 Marks=12 Marks**
	Answer any 3 questions	1 Question x 6 Marks=6 Marks
Total Marks Including Choice:30		
Maximum Marks for the Course:20		

5D01 AIML: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understand basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.

CO2: Understand knowledge representation using logic and rules.

CO3: Analyze various AI techniques in expert systems, artificial neural networks and other machine learning models.

CO4:Analyze the main approaches to natural language processing and expert systems.

UNIT – I Introduction to AI:

Problems, Problem Spaces and Search: Defining the Problem as a State space Search,Production Systems, Problem Characteristics, Production system characteristics. Heuristic Search Techniques: Generate-and-test, Hill Climbing,Best-First Search, Problem Reduction, Constraint Satisfaction.

UNIT – II Knowledge Representation:

Using Predicate Logic, Representing Simple Facts in logic, Representing Instance and IsaRelationships, Computable Functions and Predicates, Resolution - Representing KnowledgeUsing Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching.Semantic Nets, Frames,Scripts. Introduction to Expert Systems, Architecture ofexpert systems, Roles of expert systems - Knowledge Acquisition.

UNIT –III Machine Perception:

Machine perception -feature extraction -classification, clustering, linear and logistic regression -Types of learning. Perceptron and backpropagation neural network. Support vector machine: multicategory generalizations -Regression.

UNIT –IV Classification Algorithms :

Decision trees: classification and regression tree -random forest. Principal component analysis Linear discriminant analysis -Independent component analysis. k-means clustering -fuzzy k-means clustering. Convolution neural network (CNN) -Layers in CNN -CNN architectures. Recurrent Neural Network - Applications: Speech-to-text conversion-image classification-time series prediction.

Text Books:

5. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition,Pearson,2017.
6. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, PHI.,2015
7. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

Reference Books:

2. I. Bratko, ―Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

5D02 AIML: DATA MINING

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1. Understand the concept of Data Mining.

CO2. Discover various association rules.

CO3. Understand various Clustering Techniques.

CO4. Understand the concepts of Web Mining.

Unit I:

Data Mining –Introduction, what is mining? Definitions, KDD Vs Data Mining, DBMS Vs DM, DM Techniques, Other Mining Problems, Issues and Challenges in DM, DM Application Areas.

Unit II:

Association Rules – Introduction, Association Rule, Methods to Discover association rules, Apriori Algorithm, Partition Algorithm, Dynamic Item Set Counting Algorithm, Border Algorithm.

Unit III:

Clustering Techniques – Introduction, Clustering Paradigms, Partitioning Algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, Categorical Clustering Algorithms, CACTUS.

Unit IV:

Decision Trees – Introduction, Decision Tree, Tree Construction Principle, Web Mining – Introduction, Web Content mining, Web Structure mining, Web Usage Mining, Text Mining, Unstructured Text, Text Clustering. Temporal Data Mining – What is Temporal Data Mining.

Text Books:

2. Arun K Pujari, Data Mining Techniques, Universities Press, 3rd Edition

Reference Books:

4. Alex Berson and Stephen J.Smith, ―Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
5. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
6. Margaret H Dunham, Data Mining, Pearson, 12th Impression, 2012

5D03 AIML: PROGRAMMING IN PYTHON

COURSE OUTCOMES

After the completion of course, the student will be able to:

CO1: Understanding the basic building blocks of Python programs and develop programs by utilizing the Lists, Tuples, Sets and Dictionaries in python.

CO2: Develop programs using functions and modules

CO3: Understand the usage of file handling and exception handling in Python

CO4: Write programs in Python to process data stored in files by utilizing the module NumPy.

Unit I:

Features of Python, Different methods to run Python, Basic elements (Objects, Expressions, Numerical Types, Strings, Variables), Comments, Indentation in Python, Input and Output in Python, import function, Operators in Python, Tuples, Lists, Sets, Dictionaries, Built-in methods of lists, sets and dictionaries, Mutable and Immutable Objects.

Unit II:

Control flow statements - Branching (if, else, elif), Iteration (while, for), range and enumerate functions, break and continue statements. Functions -functions definition, function calling, function arguments (Required, Keyword, Default), Lambda functions, Recursion.

Unit III :

File Handling (Opening, Closing, Writing, Reading), Exceptions: Exception Handling, Built-in Exceptions (Index Error, Overflow Error, ZeroDivisionError, Runtime Error)

Unit IV:

NumPy - ndarray, Creating Arrays (array, zeros, ones, empty, linspace, arange, random), 2D Array, Indexing, Slicing, Iterating, Copying, Splitting, Shape Manipulation (reshape, transpose, resize), Arithmetic Operations on Arrays.

Reference Books:

7. The Python Tutorial (https://docs.python.org/3/tutorial/index.html)
8. NumPy quick start (https://www.numpy.org/devdocs/user/quickstart.html).
9. Pandas User Guide (https://pandas.pydata.org/pandasdocs/stable/user_guide/index.html).
10. John V. Guttag (2016), Introduction to Computation and Programming Using Python withApplication to Understanding Data, PHI.

Model Question Papers

BSc (AI & ML) Degree Regular Examination

1B01 AIML INTRODUCTION TO COMPUTER SCIENCE

Time: 3 hours **Maximum Mark: 40**

PART – A

(Short Answer)

Answer All questions. Each question carries 1 mark. **(6x1=6)**

1. List any two characteristics of a good program.
2. Find 2 s Complement of 1101100.
3. What is Linker?
4. Define ASCII.
5. What is Unicode?
6. What is Internet?

PART – B

(Short Essay)

Answer any six questions. Each question carries 2 marks. (6 x 2 =12)

7. Give two differences between compiler and interpreter.
8. Explain floating point representation of data.
9. Discuss the steps involved in developing a program.
10. a)Add 1101 and 1111 b)Subtract 0111 from 1110.
11. What is meant by Object Oriented Programming?
12. Note on GRAY Code.
13. What is computer virus and its types?
14. Explain firewall and its use.

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks. **(4x3=12)**

15. Explain any three input devices.
16. Convert the following numbers
    a)34.4674 from base 10 to base 2.
    b)C15 from base 16 to base 10
    c)1110101100110 to Octal
17. Explain algorithm and flowchart.
18. Write a note on cyber ethics.
19. Explain the steps involved in problem solving using computers.
20. Explain ROM and its types.

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks. **(2x5=10)**

21. Explain secondary storage devices.
22. Explain Types of Software's.
23. Explain various number systems with example.
24. Explain Types of Computer Languages.

BSc (AI & ML) Degree Regular Examination

2B02 AIML PROGRAMMING IN C

Time: 3 hours **Maximum Mark: 40**

PART – A

(Short Answer)

Answer **all** questions. Each question carries 1 mark. **(6x1=6)**

1. List the importance of a C program.
2. Who developed C programming?
3. Define variable.
4. Define keyword.
5. Write file modes.
6. What is union?

PART – B

(Short Essay)

Answer **any six** questions. Each question carries 2 marks. **(6x2=12)**

7. What is nested if statements in C? Explain with an example.
8. What do you mean by two dimensional arrays? Give an example.
9. Explain switch statement with example.
10. Explain the basic structure of C program with an example.
11. Explain break, continue statements with suitable examples.
12. Differentiate between actual Parameters and formal parameters.
13. What is pointer? Explain with syntax.
14. Write a program to print all prime numbers between given limits.

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks. **(4x3=12)**

15. Explain formatted and unformatted functions in C programming with example.
16. Explain different primitive data types in C with example.
17. Write a program to read and display n elements in an array.
18. Differentiate between structure and union.
19. Explain the dynamic memory allocation technique.
20. Explain storage classes in C.

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks. **(2x5=10)**

21. Explain different type of looping structures in C with example.
22. Explain different type of operators in C with example.
23. Explain C tokens in detail.
24. Write a program to create a file and store some records in it. Display the content of the same.

BSc (AI & ML) Degree Regular Examination

3B04 AIML INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is a State Space?
2. What is best first search?
3. What are predicates?
4. Give the name of a knowledge representation method.
5. What is learning?
6. Expand CNN. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. What is a production system?
8. Write a note on heuristic search.
9. Represent the statement "All men are mortal" in predicate logic.
10. What is clustering?
11. Write a note on perceptron.
12. What is an expert system?
13. What is a decision tree?
14. Write a note on neural networks. (6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Write a note on Means Ends Analysis.
16. Write a note on Constraint Satisfaction.
17. Differentiate forward and backward reasoning.
18. Explain the procedure of knowledge acquisition in expert systems.
19. Explain different types of learning.
20. Write a note on time series prediction. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe the characteristics of production systems.
22. Describe the architecture of expert systems.
23. Explain Bayesian belief networks.
24. Explain the architecture of CNN.

BSc (AI & ML) Degree Regular Examination

3A01 AIML OPERATING SYSTEM AND UNIX SHELL PROGRAMMING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is Operating System?
2. Define System calls.
3. What is Scheduling?
4. What is Open source software?
5. Define Shell.
6. What is Deadlock?

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Compare Free software and Open source software.
8. What is cat command?
9. What is vim editor.
10. What is thread?
11. Compare cp and mv command.
12. Define Swapping.
13. What is AWK?
14. What is mkdir command

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Explain different types of system calls.
16. Explain variables in shell programming
17. Explain Round robin scheduling.
18. Explain Process scheduling?
19. Explain different page replacement algorithms.
20. What are shell scripts? (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. List and explain different types of Operating system.
22. Explain necessary conditions for deadlock.
23. Explain Banker's Algorithm
24. Explain different control statements in shell programming

(2 X 5 = 10 Marks)

BSc (AI & ML) Degree Regular Examination

3A02 AIML DATA STRUCTURES USING C

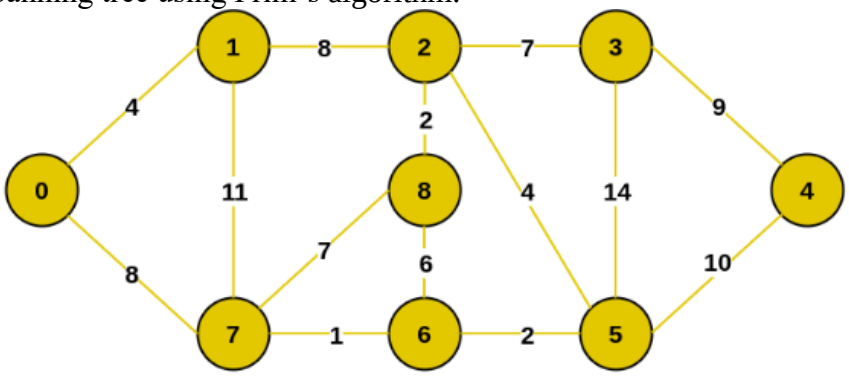
Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What are the basic data structures?
2. Define tree.
3. What is sorting?
4. Define array.
5. How to calculate height and level of a tree?
6. Note on information storage. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Find minimum spanning tree using Prim's algorithm.



8. What is the difference between queue and circular queue?
9. Evaluate the expression (A+B/C*D-(E/F))-G*H
10. Write algorithm for BFS.
11. Note on hexadecimal representation of numbers.
12. How to perform bubble sort?
13. Explain any two hashing functions.
14. Explain Boolean algebra laws. (6 X 2 = 12 Marks)

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks.

15. Explain stack operations.
16. Explain binary search with example.
17. Explain Dijkstra's algorithm with example.
18. Discuss heaps.
19. Write a program to insert and delete elements from beginning in linked list.
20. Explain addressing and byte ordering. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe Binary Search tree in detail.
22. Write a detailed note on quick sort algorithm and explain with example.
23. Explain IEEE Floating point representation.
24. Write in detail about Queue Data Structure. (2 X 5 = 10 Marks)

BSc (AI & ML) Degree Regular Examination

4B05 AIML DIGITAL FUNDAMENTALS AND COMPUTER ORGANIZATION

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer **All** questions. Each question carries 1 mark.

1. Define logic gates.
2. What is flipflop?
3. Define cache memory.
4. Define DMA.
5. Write the format of an instruction.
6. Define pipeline. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Explain logic gates.
8. Explain combinational logic circuit.
9. Compare SRAM and DRAM.
10. What is ROM?
11. What is interrupts?
12. Which are the layers of abstraction?
13. Explain structural hazards.
14. Explain instruction categories.

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Explain key components of a computer.

16. Explain DMA.

17. Explain counters.

18. Explain instruction set principles.

19. Explain registers.

20. Explain the use of Karnaugh map through example. (4 X 3 = 12 Marks)

PART – D
(Long Essay)
Answer **any two** questions. Each question carries 5 marks.

21. Explain theorems an properties of Boolean algebra with example.

22. Explain different flipflops.

23. Explain instruction set architecture.

24. Explain cache memory mapping mechanisms. (2 X 5 = 10 Marks)

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4B06 AIML PYTHON FOR MACHINE LEARNING

Time: 3 hours **Maximum Mark: 40**

PART – A

(Short Answer)

Answer **all** questions. Each question carries 1 mark. **(6x1=6)**

1. Give an example for a mutable data types.
2. How to remove and rename a directory in Python?
3. Write if….else syntax.
4. What type of language is python?
5. What is exception?
6. What is array?

PART – B

(Short Essay)

Answer **any six** questions. Each question carries 2 marks. **(6x2=12)**

7. What are local and global variables in python?
8. Explain any three features of Python.
9. Define pandas dataframe.How to add a new column to pandas dataframe?
10. What is pass in python? Explain with an example.
11. Differentiate between break, continue statements.
12. What is PYTHONPATH in python?
13. What are some of the most commonly used built-in modules in python?
14. Write a python script to sort a dictionary by value.

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks. **(4x3=12)**

15. What is the difference between python arrays and lists?
16. Explain numpy arrays in detail.
17. Write a program to read and display n elements in an array.
18. What are the steps to create 1D, 2D and 3D arrays?
19. What are lambda functions? What are the characteristics of lambda functions?
20. Discuss the different argument passing mechanism in python with suitable example.

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks. **(2x5=10)**

21. Explain control structure inpython with example.
22. Explain exception handling.
23. Write a program to count the frequencies of each word from a file.
24. Discuss the relation between tuples and lists, tuples and dictionaries in detail.

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4B07 AIML DATABASE MANAGEMENT SYSTEMS

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is a Data Base System?
2. Define Schema.
3. Define Primary Key.
4. Give the syntax for creating a table in SQL.
5. Define Weak Entity.
6. How is 2NF different from 1 NF? (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Who is a database administrator?
8. What is the difference between logical physical data independence?
9. What is a sub query?
10. Explain sequences.
11. What is cardinality and degree of a table?
12. What is drop table?
13. Can you change the structure of a table? If so, how?
14. Give any two data types in SQL. (6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Compare different levels of abstraction in DBMS.
16. Explain integrity constraints.
17. Discuss hierarchical data model.
18. Discuss TCL.
19. Explain any three SQL functions.
20. Explain the categories of database users. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Explain the purpose of DBMS.
22. Draw an ER Diagram for Library Management System.
23. Explain Relational Calculus.
24. Create table Student with rollno, name, sex and marks as attributes. (Rollno is the Primary Key). Write queries for
    1) Insert Records
    2) Sort students based on marks
    3) Display the highest mark.

(2 X 5 = 10 Marks)

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5B10 AIML INTRODUCTION TO R PROGRAMMING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. Define R programming.
2. List out any five features of R.
3. Explain RStudio.
4. What are the different values that can be assigned to a numeric datatype in R?
5. Write R program to create a blank matrix.
6. Write the syntax to obtain the following matrix, A =[-8 3 0 4 -1 2 -5 7 3] .

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Write a R program to find the maximum and the minimum value of a given vector. Explain the functions with syntax
8. Define operators in R.
9. Describe the function cat() in R. How is it different from print() for output?
10. Write an if-else statement to check whether a given number is even or odd.
11. Write R code to calculate the sum of all elements in a matrix M.
12. Create a vector v and convert it into a matrix with 3 rows and 4 columns.
13. What are the different data types in R?
14. Summarize the advantages and disadvantages (6) Remembering BTL-1 of R?

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Explain the difference between a matrix and a data frame in R. Give an example of when you would use each.
16. Write a function that checks if a given string contains the substring "R programming". The function should return a Boolean value.
17. Explain any 4 graphs in R with syntax.
18. Create two matrixes in R and perform matrix multiplication.
19. List out the properties of the following:
    i) Matrix subtraction
    ii) Matrix Division
    iii) Matrix addition
    iv) Matrix multiplication

20. Write a program to add two matrices. How do you access the elements in the 2nd column and 4th row of a matrix? (4 X 3 = 12 Marks)

PART – D
(Long Essay)
Answer **any two** questions. Each question carries 5 marks.

21. Explain Different operators in R Programming with example.
22. Explain decision making statements in R.
23.
    i) Provide an example of how to create a numeric vector containing the elements 5, 10, 15, ..., 50 using the seq() function.
    ii) Explain the process of subsetting a vector using logical indexing.
    iii) Illustrate the use of the rep() function to create a vector repeating the elements "A", "B", and "C" three times each.

24.
    i) Create a data frame named "student_data" with columns "Name", "Age", and "Grade".
    ii) How can you access the second row of the data frame "student_data"?
    iii) Write code to calculate the mean age of students in the "student_data" data frame.

(2 X 5 = 10 Marks)

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5B 11AIML SOFTWARE ENGINEERING

Time: 3 hours **Maximum Mark: 40**

PART – A

(Short Answer)

Answer All questions. Each question carries 1 mark. **(6*1=6)**

1. What are the attributes and objectives of design?
2. Expansion of FAST is.....
3. What is Function oriented design
4. What is Feasibility study?
5. Define SRS.
6. What is software process?

PART – B

(Short Essay)

Answer **any six** questions. Each question carries 2 marks.**(6x2=12)**

7. What are the advantages of developing prototypes?
8. Define Black Box testing/Functional testing?
9. Explain Types of requirements.
10. What is the difference between verification and validation?
11. Briefly explain the steps of requirement engineering.
12. What are DFDs? Explain the various symbols used in DFDs
13. Differentiate conceptual and technical design
14. Explain the term modularity, write any two properties of modular system.

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks. (**4x3=12)**

15. What is structural Testing? Explain various approaches to structural testing.
16. Explain the different strategies/techniques for performing system design.
17. Explain the characteristics of SRS.
18. Explain different types of coupling.
19. Briefly explain object oriented design.
20. Explain use case approach with example.

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.**(2x5=10)**

21. Explain different levels of testing.
22. Explain waterfall model.
23. Explain agile development techniques.
24. Explain various steps of requirement analysis (With suitable diagrams).

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5B12 AIML OBJECT ORIENTED PROGRAMMING USING JAVA

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer **All** questions. Each question carries 1 mark.

1. What is a byte code?
2. What is type wrapper?
3. Define exception.
4. Define package.
5. Define abstract class.
6. Define garbage collection. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Explain the history of java.
8. Explain array.
9. Compare String and StringBuffer class.
10. What is dynamic method dispatching?
11. Differentiate between throw and throws.
12. How to create user define exceptions?
13. Explain synchronization.
14. Explain collection. (6 X 2 = 12 Marks)

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks.

15. Explain features of java.

16. Explain thread life cycles.

17. Explain the creation of packages through example.

18. Explain the operators in java.

19. Compare method overloading and overriding with example.

20. Write a program that implement interface. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Explain exception handling with example.

22. Explain control structures with example.

23. Explain multi-threading. Write a program that implement the concept of multithreading.

24. Explain object-oriented concepts. (2 X 5 = 10 Marks)

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5B13A AIML DATA MINING

Time: 3 hours **Maximum Mark: 40**

PART – A

(Short Answer)

Answer All questions. Each question carries 1 mark. **(6*1=6)**

1. What is Data Mart?
2. What is mean by promoted border set?
3. Explain ETL.
4. Define Association rule.
5. What is spatial data mining?
6. What are data cubes?

PART – B

(Short Essay)

Answer **any six** questions. Each question carries 2 marks.**(6*2=12)**

7. Differentiate DBMS vs Data mining.
8. Explain web mining.
9. Explain logistic regression model.
10. Explain temporal data bases.
11. Explain Partition algorithm.
12. Write a short note on Spatial databases.
13. Compare OLTP and OLAP.
14. Explain Machine Learning and its types.

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks. **(4*3=12)**

15. Explain KDD and its steps.
16. Explain model based clustering methods.
17. Explain clustering paradigms.
18. Explain DBSCAN Clustering Algorithm.
19. Explain Data preprocessing Steps.
20. Write a note on Data Mining Application Areas.

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.**(2*5=10)**

21. Explain Hierarchical Methods.
22. Explain Data warehousing Architecture.
23. Explain issues and challenges of Data Mining.
24. Explain Different Types of Schemas.

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5B13B AIML PATTERN RECOGNITION

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer **All** questions. Each question carries 1 mark.

1. Which learning approach involves training models using labeled data in pattern recognition?
2. What comparison is made to determine classification in the likelihood ratio form of decision making?
3. Which type of density function is often used for modeling continuous features in classification?
4. Which algorithm is used for solving temporal probabilistic reasoning?
5. What is the primary purpose of resampling in classifier design?
6. What is the primary purpose of Multidimensional Scaling?

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. **What are the common applications of pattern recognition?**
8. What is feature extraction in pattern recognition? Give an example.
9. Describe the significance of the likelihood ratio form in decision-making processes.
10. Outline the key principle behind the Neyman-Pearson Criterion in hypothesis testing.
11. Discuss the role of cross-validation in refining classifier performance.
12. Describe the fundamental principle behind using resampling techniques for estimating statistics.
13. Explain the fundamental concept of applying Graph-Theoretic Methods in data analysis.
14. Explain the role of criterion functions in the context of clustering algorithms.

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Compare and contrast supervised, unsupervised, and semi-supervised learning methods in the context of pattern recognition.
16. Describe the stages involved in the design cycle of a pattern recognition system. Highlight the significance of each stage.
17. Explain the fundamental principles of Bayesian learning and its significance in machine learning.
18. Discuss the concept of identifiability in mixture densities. Provide examples to illustrate the challenges and potential solutions in addressing identifiability problems.
19. Explain the role of maximum likelihood estimation in modeling normal mixtures.
20. Discuss the differences between Classical MDS and Non-Metric MDS techniques.

(4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe the design cycle of pattern recognition.
22. Explain the following
    a) Posterior Probability Form
    b) Likelihood Ratio Form
    c)Discriminant Function Form
23. Describe the Challenges in Classifier Evaluation.
24. Describe advancements and challenges in Statistical Modeling and Data Analysis.

(2 X 5 = 10 Marks)

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5B13C AIML DATA SCIENCE AND ANALYTICS

Time: 3 hours **Max. Marks: 40**

PART – A

(Short Answer)

Answer **all** questions. Each question carries 1 mark.

1. What are the primary sources of data in the context of data analytics?
2. State one significant need for data analytics in modern contexts.
3. Define Data Pre-processing.
4. Define Exploratory Data Analysis (EDA).
5. Define Big Data.
6. What is Hadoop Distributed File System (HDFS)? **(6x1=6 Marks)**

PART – B

(Short Essay)

Answer **Any Six** questions. Each question carries 2 marks.

7. Distinguish between analysis and reporting in data analytics.
8. Briefly describe the characteristics of data in analytics.
9. Differentiate Feature Generation and Feature Selection in data analytics.
10. Explain the steps involved in Data Cleaning in data analytics.
11. What is Web scraping in the context of data collection?
12. State the significance of the Discovery Phase in the Data Analytics Lifecycle.
13. Explain two sources of Big Data and their significance in analytics.
14. Explain two examples illustrating the use of MapReduce for data processing tasks.

(6x2=12 Marks)

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks.

15. Explain the classification of data and provide examples of each.
16. What are feature selection algorithms? Explain their importance in model building with examples.
17. Explain the role of Data Visualization in interpreting complex datasets.
18. Explain the steps involved in Data Cleaning in data analytics.
19. Explain the types of NoSQL databases and compare SQL with NoSQL databases.
20. Explain the role of Pig and Hive in data analysis within the Hadoop ecosystem.

(4x3=12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. List and explain modern data analytics tools with examples of their applications.
22. Explain in detail the various phases of the data analytics lifecycle and their significance.
23. Define Exploratory Data Analysis (EDA) and discuss its importance in the initial phases of the data analytics lifecycle.
24. Explain the significance of Hadoop in handling Big Data and its applications.

(2x5=10 Marks)

BSc (AI & ML) Degree Regular Examination

6B16 AIML DIGITAL IMAGE PROCESSING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is image enhancement?
2. What are image negatives?
3. What is histogram matching?
4. Write the objective of sharpening.
5. What is noise in digital images?
6. Expand GIF. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Give the general form of log transformation.
8. What is contrast stretching?
9. What is a histogram?
10. What are averaging filters?
11. Write a note on image reconstruction.
12. What are periodic noises?
13. What is digital water marking?
14. What are skeletons? (6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Write a note on power law transformations.
16. How do you sharpen images?
17. Write a note on Notch filters.
18. How can you reduce noise in images?
19. Write a note on image segmentation.
20. Explain region bound thresholding. (4 X 3 = 12 Marks)

PART – D
(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe the steps in digital image processing.
22. Discuss image smoothing filters.
23. Explain color image processing.
24. Explain any two image compression methods. (2 X 5 = 10 Marks)

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6B17A AIML INTRODUCTION TO DEEP LEARNING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is deep learning?
2. What is feed forward neural networks?
3. What is convolutional neural network?
4. What do you mean by recurrent nets?
5. Define deep recurrent networks.
6. Define transfer learning. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Differentiate between deep learning and machine learning.
8. Write a note on hyper parameter tuning.
9. Explain briefly about stacking in CNN.
10. What are the applications of CNN?
11. Write a note on bidirectional RNNs.
12. What do you mean by sparse encoders?
13. Explain briefly about the size of the dev and test sets.
14. Differentiate transfer learning and multi-task learning.

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Explain briefly about basic supervised classification task.
16. Write a note on optimization of logistic classifier using gradient descent.
17. Write a note on striding in CNN.
18. Write a note on recurrent neural networks.
19. Explain briefly about encoder-decoder sequence to sequence architectures.
20. Explain briefly about multi-task learning (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Explain stochastic gradient descent in detail.
22. Explain in detail about convolution neural networks.
23. Explain unfolding computational graphs in detail.
24. Explain in detail about structuring machine learning projects.

(2 X 5 = 10 Marks)

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6B17B AIML DATA VISULIZATION

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

25. What is display space?
26. What is rendering time?
27. What is lightness?
28. What do you mean by contrast?
29. What is space perception?
30. What is a tactile map? (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

31. Write a note on data visualization.
32. Write a note on the computational support for data visualization.
33. What is constancy?
34. What is encoding of values?
35. Write an example for complex information space.
36. Write a note on visual interface.
37. What is information visualization?
38. What is sketching?

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

39. Describe various visualization stages.
40. Describe different types of data.
41. Differentiate visual and data objects.
42. Explain the space and time limitations in human vision.
43. Write a note on 3D interactive illustrations of data.
44. Write a note on Virtual Reality. (4 X 3 = 12 Marks)

PART – D
(Long Essay)
Answer **any two** questions. Each question carries 5 marks.

45. Explain different types of tasks in data visualization.

46. Explain encoding of relations and connections.
47. Describe narratives and gestures for explanation.
48. Explain Norman’s action cycle.

(2 X 5 = 10 Marks)

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6B17C AIML CLOUD COMPUTING

Time: 3 hours **Max. Marks: 40**

PART – A

(Short Answer)

Answer **all** questions. Each question carries 1 mark.

1. Define cloud computing.
2. What is full virtualization?
3. Define SOA.
4. What is Big Data?
5. What are the deployment models of cloud?
6. What is SaaS?

(6x1=6 Marks)

PART – B

(Short Essay)

Answer **any six** questions. Each question carries 2 marks.

7. What are the benefits of cloud computing?
8. Write a note on DaaS.
9. What are the Server Types within IaaS solutions?
10. Write a note on desktop virtualization.
11. Compare private and public cloud.
12. Write the role of Open SaaS.
13. What is memory virtualization?
14. Write a note on Security as a Service.

(6x2=12 Marks)

PART – C

(Essay)

Answer **any four** questions. Each question carries 3 marks.

15. What are the Tools and Products available for Virtualization?
16. What are the services offered by cloud?
17. Define and describe SaaS.
18. Describe virtualization in detail.
19. Explain Hadoop.
20. Define and describe IaaS.

(4x3=12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. What are the three components of cloud solutions? Explain.
22. What are the different types of virtualization? Explain.
23. What is PaaS? Explain the benefits and disadvantages of PaaS solutions.
24. What are the advantages and disadvantages of cloud-based data storage?

(2x5=10 Marks)

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6B18 AIML COMPUTER NETWORKS

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. ISO OSI stands for**…….**
2. The set of rules a computer must follow on a network is called……..
3. What is datagram in network communication?
4. Algorithms that change routing decisions based on changes in topology and traffic is called**…….**
5. Write any four application of internet.
6. What is Flow control?

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Define Optimality principle.
8. What is meant by congestion?
9. What is Asynchronous data transmission?
10. What are design issues of datalink layer?
11. Compare Analog and Digital signal.
12. What are the components of data communication?
13. What is Flooding?
14. What are design issues of network layer?

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. Explain different network topologies.
16. Explain Framing techniques.
17. Explain Dijkstra's shortest path routing algorithm.
18. Explain congestion control algorithms?
19. Explain different classification of Networks.
20. What are the merits computer networks?

(4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. List and explain elementary protocols used in DataLink Layer.
22. With a neat diagram explain OSI reference model.
23. Explain TCP/IP layers with neat diagram.
24. Explain Guided media with neat diagram.

(2 X 5 = 10 Marks)

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6B19 AIML NATURAL LANGUAGE PROCESSING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is Natural Language Processing?
2. What is Morphology?
3. What is parsing?
4. What are the applications of N-grams?
5. What is semantic analysis?
6. What is clue-based model? (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. What do you mean by ambiguity in NL?
8. What are the rules of word formation?
9. Define Morphemes and give examples.
10. Differentiate between top down parsing and bottom up parsing.
11. What is meant by statistical parsing?
12. Differentiate between lexical semantics and formal semantics.
13. Write a note on text coherence.
14. Explain briefly about discourse processing.

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. List various applications of NLP and explain any two applications.
16. Explain types word classes in English NL.
17. Write a note on Unification of feature structures.
18. Write a note on N-Gram language model.
19. Explain the use of CFG in NLP with suitable example.
20. Explain various elements of FOPC. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Explain various stages involved in NLP process with suitable example.
22. Explain various approaches to perform POS tagging.
23. Write FOPC for the following sentences:
    All cats and dogs hate each other
    I arrived in New York.
24. Explain various approaches to semantic analysis and different semantic relationships between the words.

(2 X 5 = 10 Marks)

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6B20 AIML SOFT COMPUTING

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is soft computing?
2. Give an example for a fuzzy statement.
3. What are crisp sets?
4. What is membership function?
5. Write an example for a fuzzy rule.
6. Give an example for a GA operator. (6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Write two advantages of neural networks.
8. What neuro fuzzy hybrid system?
9. What are the properties of fuzzy sets?
10. What are fuzzy if then rules?
11. Write a note on fuzzy controller.
12. What are compound rules?
13. Mention the classification of genetic algorithm.
14. Give two applications of genetic algorithm. (6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. What is the role of hybrid systems?
16. What are the tools for soft computing?
17. Explain inference in fuzzy logic.
18. Explain fuzzy to crisp conversion.
19. Write a note on fuzzy expert systems.
20. Discuss various operations in GA. (4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe the application scope of neural networks.
22. Explain fuzzification and defuzzification.
23. Describe different types of fuzzy reasoning.
24. Explain various genetic representations. (2 X 5 = 10 Marks)

Complementary Elective I (Mathematics)

IC01MAT – AIML Differentiation and Matrix Theory

Part A (Short Answer)

Answer all questions **(6 x 1 = 6)**

1. Define equivalence relation
2. Find the derivative of $y = 5x^4 - 3x^2 + 1$
3. State Rouche's Theorem.
4. State Leibnitz's theorem for n^{th} derivatives
5. Find the derivative of $\sqrt{\sec(2x+3)}$
6. Define one-one and onto functions.

Part B (Short Essay)

Answer any 6 questions **(6 x 2 = 12)**

7. Find the n^{th}derivative of $\frac{x}{x^2-1}$
8. Find the n^{th} derivative of sin(ax+b)
9. If $y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$. Find $\frac{dy}{dx}$
10. Find the rank of the matrix $\begin{bmatrix} 1 & -1 & -1 \\ 1 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$.
11. Find the derivative of $\left(\frac{e^x-1}{e^x+1}\right)$
12. Check whether the function $f(x) = x^2$ is one-one or not.
13. Define a function. Give an example.
14. Explain partially ordered set and give an example.

Part C (Essay)

Answer any 4 questions **(4 x 3 = 12)**

15. Solve the following system of equations using Crammer's rule.
    $2x + 3y = 8$
    $4x - y = 5$
16. Use Rouche's theorem to determine the number of solutions of the equations
    $3x - 2y = 6$
    $6x - 4y = 12$
17. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$ using partial fraction.
18. If $y = \tan^{-1}(\frac{1+x}{1-x})$, Find $\frac{dy}{dx}$.

19. Define composition of functions. If $f(x) = 2x + 3, g(x) = x^2$, find $f \circ g(x)$.
20. Define invertible functions. Determine whether the function is invertible $f(x) = 3x + 1$.

Part D (Long Essay)

Answer any 2 questions **(2x 5 = 10)**

21. If (1-x^2)y_2-xy_1-a^2y=0, Prove that (1-x^2)y_{n+2} - (2n+1)xy_{n+1}-($n^2 + a^2$)$y_n = 0$
22. Find the inverse of the matrix $\begin{bmatrix} 2 & -2 & 0 \\ 1 & 1 & 3 \\ 3 & 0 & 1 \end{bmatrix}$ using Gauss-Jordan method.
23. Check the consistency of the system and solve.

$$x + 2y - z = 0$$
$$x - y - z = 0$$
$$2x + y + 3z = 0$$

24. Solve the system using Cramer's rule.

$$2x + y - z = 1$$
$$x + y + z = 2$$
$$2x + y + 3z = 3$$

2C02MAT - AIML Integration and Linear Algebra

Part A (Short Answer)

Answer all questions **(6 x 1 = 6)**

1. If $z=x^3+y^3-3axy$ find $\frac{\partial z}{\partial x}$.
2. State Cayley-Hamilton theorem.
3. Define Linear Dependence and Linear Independence
4. State Euler's theorem on homogeneous functions
5. Define vector space and give an example
6. Define eigen values and eigen vectors.

Part B (Short Essay)

Answer any 6 questions **(6 x 2 = 12)**

7. Find the first order partial derivatives of $z=x^2y-xsinxy$
8. What is meant by similarity of matrices.
9. Show that $\int_0^{\frac{\pi}{2}} cos^7\, x\, dx = \frac{16}{35}$
10. Evaluate $\int_0^{\frac{\pi}{2}} cos^4 x\, dx$
11. Find the eigen values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$
12. Define Basis of a vector space and give an example.
13. Define linear transformation. Give an example of a linear transformation from $\mathbb{R}^2$ to $\mathbb{R}^3$
14. Define a quadratic form. Find the matrix corresponding to the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$

Part C (Essay)

Answer any 4 questions **(4 x 3 = 12)**

15. Find the value of $\lim_{\substack{x\to 1 \\ y\to 2}} \frac{3x^2y}{x^2+2y^2+4}$
16. If u=$sin^{-1}(\frac{x^2+y^2}{x+y})$. Prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$=tan u.
17. Give a set of three vectors in $\mathbb{R}^3$ that are linearly dependent, and justify your answer.
18. Verify Cayley-Hamilton theorem for the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$, and find the inverse.
19. Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 5 \\ -1 & 4 \end{bmatrix}$

20. If $y = \tan^{-1}(\frac{1+x}{1-x})$, Find $\frac{dy}{dx}$

Part D (Long Essay)

Answer any 2 questions **(2x 5 = 10)**

21. Find the characteristic equation of the matrix A = $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ Andhence compute A^{-1} using Cayley- Hamilton theorem. Also express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomials in A.

22. Find the characteristic equation of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ .And hence compute A^{-1} using Cayley-Hamilton theorem

23. Evaluate $\int sin^2 x cos^4 x \, dx$

24. Evaluate $\int \frac{x^2+x+1}{(x+1)^2(x+2)}$ dx.

3C03MAT – AIML Differential Equations and Fourier Series

Part A (Short Answer)

Answer all questions **(6 x 1 = 6)**

1. Determine the order and degree of the differential equation $x\frac{dy}{dx} + 3x + y = 0$
2. Solve $y' = ky$
3. Define Bernoulli Equation
4. When do we say a second order ODE is linear?
5. Write the characteristic equation of $y" + 3y' - 4y = 0$.
6. Define an even function and odd function in the context of Fourier series

Part B (Short Essay)

Answer any 6 questions **(6 x 2 = 12)**

7. Solve $\frac{dy}{dx} + 2xy = 0$
8. Verify that the functions $y = e^{3x}$, $y = e^{-2x}$ are solution of the homogenous linear differential equation $y'' - y' - 6y = 0$
9. Find the Fourier series of f given by $f(x) = x, where \ -\pi < x < \pi \ and$
10. $f(x) = f(x + 2\pi) \ \forall \ x \in \mathbb{R}$
11. Find the general solution of $y'= (y - x)^2$
12. Check whether the equation $\cos(x + y)\, dx + (y^2 + 2y + \cos(x + y)\, dy = 0$ is exact or not.
13. Apply the given operator to the given function (D+5I)(D-I)(e^{5x}).

Find the Wronskian of $e^x \ and \ xe^x$

Part C (Essay)

Answer any 4 questions **(4 x 3 = 12)**

14. Test for exactness and solve $(y - 1)dx + (x - 3)dy = 0$.
15. Find the solution of the initial value problem $y'' - 2y' + y = 0, \quad y(0) = 1, \ y'(0) = 2$
16. Express the function f(x) = x^2 ,when $-\pi < x < \pi$ as a Fourier series with period 2π.
17. Solve $y' = -2xy$, $y(0) = 2$.
18. solve $x^2D^2 + xD - y = 0$
19. Solve $y" + 5y' + 6y = e^{-3x}$.

Part D (Long Essay)

Answer any 2 questions **(2x 5 = 10)**

20. Make the following equation exact and hence solve $ydx + (x^2y - x)dy = 0$

21. Find the Fourier series of the function

$$f(x) = \begin{cases} 0 & when \ -2 < x < -1 \\ k & when \ -1 < x < 1 \\ 0 & when \ 1 < x < 2 \end{cases}$$ with period 4

22. Solve $(x^2 + 1)\frac{dy}{dx} + 2xy = x^2$.
23. Find the general solution of $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$.

4C04MAT – AIML Linear Programming and Game Theory

Part A (Short Answer)

Answer all questions **(6 x 1 = 6)**

1. Define the transportation problem in linear programming.
2. What is a saddle point in game theory?
3. Define the term feasible solution of a linear programming problem.
4. What is an unbalanced transportation problem?
5. Define slack variable in a linear programming problem.
6. Explain two-person zero-sum game.

Part B (Short Essay)

Answer any 6 questions **(6 x 2 = 12)**

7. Define pure strategy and mixed strategy for a game.
8. Explain the concept of sequencing 'n' jobs through '2' machines.
9. Obtain an initial basic feasible solution to the following transportation problem using the north-west corner rule.

	D_1	D_2	D_3	D_4	Availability
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	34
Demand	16	18	31	25	

10. How is the dominance property used in solving games?
11. State the general LPP in the canonical form.
12. Explain loops in transportation problems.
13. Explain the dominance property in game theory.
14. Explain the characteristics of a standard linear programming problem

Part C (Essay)

Answer any 4 questions **(4 x 3 = 12)**

15. Find an initial basic feasible solution to the following transportation problem.

	I	II	III	IV	V	Availability
A	20	28	32	55	70	50
B	48	36	40	44	25	100
C	35	55	22	45	48	150
Requirement	100	70	50	40	40	

16. Consider the 2×2 game: $\begin{pmatrix} 4 & 7 \\ 6 & 5 \end{pmatrix}$

a) Does it have a saddle point?
b) Determine the frequency of optimum strategies by matrix oddment method and find the value of the game.

17. Solve the following linear programming problem graphically.
Minimize $z = 4x_1 + 2x_2$ subject to the constraints

$$x_1 + 2x_2 \geq 2$$
$$3x_1 + x_2 \geq 3$$
$$4x_1 + 3x_2 \geq 6$$
$$x_1 \geq 0, x_2 \geq 0$$

18. Write the optimum sequence algorithm for processing *n* jobs through two machines.
19. Write a short note on maintenance crew scheduling.
20. Explain the Maximin-Minimax principle in game theory.

Part D (Long Essay)

Answer any 2 questions **(2x 5 = 10)**

21. Solve the following 2×3 game graphically.

Player B

Player A $\begin{pmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{pmatrix}$

22. Briefly explain the MODI method used in solving transportation problems.

23. Determine the optimal sequence of jobs that minimizes the total elapsed time based on the following information processing time on machines is given in hours and passing is not allowed:

Jobs	A	B	C	D	E	F	G
***Machine*M_1**	3	8	7	4	9	8	7
***Machine*M_2**	4	3	2	5	1	4	3
***Machine*M_3**	6	7	5	11	5	6	12

24. Explain maximin-minimax principle for solving games.

25. Solve the following LPP by Simplex method:

Maximize Z= $x_1 + x_2$

Subject to $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 0, x_1, x_2 \geq 0$

Complementary Elective II (Statistics)

BSc (AI & ML) Degree Regular Examination

1C01STA – AIML: Descriptive Statistics

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. What is the difference between primary data and secondary data?
2. What type of diagram is used to represent categorical data?
3. Define kurtosis.
4. Write down the equation for finding the correlation in the case of equal ranks
5. Write a short note on Quartiles.
6. Define sampling units.

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Define sampling and non-sampling errors
8. Explain relative measures of dispersion
9. Calculate the harmonic mean of the following data
   12, 10, 8, 13, 18, 15, 9, 17, 20
10. Write merits and demerits of geometric mean.
11. Find the average speed of an object moving along 4 sides of a square at speed 200,300,400 and 500km/hr?
12. Give any measures of skewness. Also give its formula
13. Write a short note on Quartiles, Percentiles and Deciles.
14. Calculate standard deviation for the following data.

Class :	0-10	10-20	20-30	30-40	40-50
Freq:	30	12	5	11	7

(6 X 2 = 12 Marks)

PART – C
(Essay)

Answer **any four** questions. Each question carries 3 marks.

15. For any two positive numbers x and y ; $AM \geq GM \geq HM$

16. Explain simple random sampling and systematic random sampling.

17. What is mean by cumulative frequency curve. How can it be used to obtain media.
18. Compute Q1 and Q3 from the following data.

X:	5	20	24	29	35
F :	2	3	4	3	5

19. Calculate geometric mean for the following data.

Class	0-10	10-20	20-30	30-40
Frequency	10	5	8	3

20. Represent the following data by a histogram

Mark in English	0-10	10-20	20-30	30-40	40-50
No. of students	3	20	20	15	6

(4 X 3 = 12 Marks)

PART – D
(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. Describe censes and sample. Specify their merits and demerits
22. Find the mean, median and mode for the following data.

Class	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

23. The following table shows the numbers of hours spent by a child on different events on a working day. Represent the data on a pie chart.

Activity	School	Sleep	Playing	Study	TV	Others
No. of Hours	6	8	2	4	1	3

24. Explain the following sampling schemes. Give the situations where they are used.
    i) Simple random sampling
    ii) Systematic sampling
    iii) Stratified sampling

(2 X 5 = 10 Marks)

BSc (AI & ML) Degree Regular Examination

2C02STA – AIML Statistical Methods

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. Define Index Number
2. Define Scatter diagram
3. Define time series
4. What do you mean by vital statistics
5. What do you mean by regression
6. The correlation between two variables is zero. How will you interpret it?

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. The lines of regression concerning x and y are $y = 32 – x$ and $x = 13 – 0.25y$. Obtain their means.
8. Calculate Karl Pearson's Correlation coefficient for the following data and interpret its values.

Marks (English) :	48	35	17	23	47
Marks (Maths) :	45	20	40	25	45

9. What are the components of time series
10. Write merits and demerits of scatter diagram
11. Write down any two limitations of index numbers
12. Obtain Fisher's index number
13. Explain time reversal test of index number
14. Why there are two regression lines?

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. What is the effect of change of scale on correlation coefficient?
16. The equations of two regression lines obtained are 25x-6y-7=0 and 9x-4y+15=0
    i. Identify the regression lines
    ii. Obtain the mean of x and mean of y
    iii. Find $\mathbf{r_{xy}}$
17. From the following data, calculate the rank correlation coefficient

A		60	34	40	50	45	41	22	43	42	66	64	46
B		75	32	34	40	45	33	12	30	36	72	41	57

18. What do you mean by cost of living index number? What are its uses?
19. Explain moving average method for measuring trend of a time series
20. Explain the importance of time series analysis

(4 X 3 = 12 Marks)

PART – D
(Long Essay)
Answer **any two** questions. Each question carries 5 marks.

21. Obtain the trend values for 3 year moving average for the following data.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Profit	40	42	40	48	52	49	50	54	55	52

22. Calculate Laspeyer's and Paasche's price index number for the following data:

Commodity	Price in base year	Price in current year	Quantity in base year	Quantity in current year
A	0.80	0.70	10	11
B	0.85	0.90	8	9
C	1.30	0.80	5	5.5

23. Illustrate with the help of an example to calculate 7 years moving average by taking your own artificial data from 2006 and 2022
24. From the following data obtain the two regression equation.

X	6	2	10	4	8
Y	9	11	5	8	7

(2 X 5 = 10 Marks)

BSc (AI & ML) Degree Regular Examination

3C03STA – AIML Probability and Distribution Theory

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. Give the frequency definition of probability.
2. What do you mean by a random experiment.
3. Define statistic
4. Write the pdf of Normal distribution.
5. What do you mean by sample space?
6. Define independence of events.

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. Write any four properties of normal distribution
8. Write down the properties of Probability Density Function.
9. Write a short note on Expectation of a random variable
10. Distinguish between continuous and discrete random variables with the suitable examples
11. If P(A)=3/5, P(B)=3/10, P(AB)=1/5 . Are A and B are independent event?
12. Write the limitations of classical definition of probability.
13. Write the pdf of t and F distribution
14. Obtain the mean of Poisson distribution.

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. If two events are independent, show that their compliments are also independent.
16. State and prove multiplication theorem for probability.
17. Define mathematical expectation of a random variable. Show that E(cX) = cE(X) where c is a real constant
18. A, B, C are any three arbitrary events such that P(A) = P(B) = P(C) = 0.25, P(A∩B) = P(B∩C) = 0 and P(C∩A) = 0.125. Find the probability that at least one of the event in AB and C occurs.
19. Explain the relationship between χ^2, t and F distribution
20. Using axiomatic approach prove that $P(A^c) = 1 – P(A)$.

(4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21.

i) State and prove Baye's theorem.

ii) Show that if A and B are independent events A^c and B^c are independent events.

22. A, B and C are three arbitrary events. Find expression for the event noted below, in the context of A, B and C.

i) Only A occurs

ii) Both A and B, but not C occurs

iii) All three events occurs

iv) At least one occurs

v) At least two occurs

23. Derive Poisson distribution as a limiting case of binomial distribution.

24. Derive the distribution of sample mean.

(2 X 5 = 10 Marks)

BSc (AI & ML) Degree Regular Examination

4C04STA– AIML Inferential Statistics

Time: 3 Hours Max. Marks: 40

PART – A
(Short Answer)
Answer All questions. Each question carries 1 mark.

1. Define convergence in distribution
2. Define a consistent estimator
3. What do you mean by confidence interval estimation?
4. Define a null hypothesis
5. What do you mean by critical region in testing procedure?
6. Define the term ANOVA

(6 X 1 = 6 Marks)

PART – B
(Short Essay)
Answer **any six** questions. Each question carries 2 marks.

7. State Weak Law of large numbers.
8. Obtain the two types of errors associate with statistical hypothesis.
9. Distinguish between one-tail and two tailed tests
10. State Weak Law of large numbers.
11. Differentiate between simple and composite hypothesis
12. What is paired t-test ? Give an example
13. Define efficiency of an estimator. Give example
14. Explain the technique of one-way classified ANOVA

(6 X 2 = 12 Marks)

PART – C
(Essay)
Answer **any four** questions. Each question carries 3 marks.

15. State central limit theorem for iid random variable.
16. Explain goodness of fit
17. State Neymann Pearson lemma
18. What are the assumptions of one way ANOVA
19. A coin is tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased.
20. Obtain the 95% confidence interval for the difference of the mean of two population.

(4 X 3 = 12 Marks)

PART – D

(Long Essay)

Answer **any two** questions. Each question carries 5 marks.

21. State Chebychev's inequality and write about its applications
22. Explain the two methods of estimation .
23. If $Y \geq 1$ is the critical region for testing H_0: $\theta=2$ against H_1: $\theta=1$ on the basis of single observation from a population $F(Y,\theta)= \theta e^{-\theta y}$, $Y \geq 0$. Obtain probabilities of type 1 and type 2 error.
24. The 3 samples below have obtained from normal population with equal variances. Test the hypothesis that the sample means are equal by using ANOVA

SAMPLE 1	**SAMPLE 2**	**SAMPLE 3**
8	7	12
10	5	9
7	10	13
14	9	12
11	9	14

(2 X 5 = 10 Marks)

GENERIC ELECTIVE COURSE

Fifth Semester Degree (CBCSS-OBE- Regular / Supplementary /Improvement) Examination

5D01 AIML Artificial Intelligence And Machine Learning

Time : 2 Hours Max. Marks: 20

Part A
(Answer All Questions)

1. What is a state space?
2. What are heuristics?
3. What is predicate?
4. What is knowledge?
5. What is a neural network?
6. What is a decision tree? (6X1=6 Marks)

Part B
(Answer Any Four Questions)

7. What is a production system?
8. Write a note on constraint satisfaction?
9. Differentiate forward and backward reasoning.
10. What is an expert system?
11. What is a back propagation network?
12. Write a note on time series prediction. (4X2=8 Marks)

Part C
(Answer Any One Question)

13. Describe the architecture of expert systems.
14. Describe the architecture of Convolution Neural Networks.

(1X6=6 Marks)

Fifth Semester Degree (CBCSS-OBE- Regular / Supplementary /Improvement) Examination

5D02 AIML Data Mining

Time : 2 Hours Max. Marks: 20

Part A
(Answer All Questions)

1. What is data mining?
2. Give an application area of mining.
3. What is an association rule?
4. What is a cluster?
5. What is a decision tree?
6. What is temporal mining? (6X1=6 Marks)

Part B
(Answer Any Four Questions)

7. Differentiate DBMS and DM.
8. Write a note on apriori algorithm.
9. Explain dynamic item set counting.
10. Write a note on CLARANS.
11. What is Web content mining?
12. Write a note on text clustering. (4X2=8 Marks)

Part C
(Answer Any One Question)

13. Explain methods to discover association rules.
14. Explain Web Mining. (1X6=6 Marks)

Fifth Semester Degree (CBCSS-OBE- Regular / Supplementary /Improvement) Examination

5D03 AIML: Programming in Python

Time : 2 Hours Max. Marks: 20

Part A
(Answer All Questions)

1. What is a variable?
2. What are comments?
3. What is run time error?
4. What are function arguments?
5. What is an array?
6. What is splitting? (6X1=6 Marks)

Part B
(Answer Any Four Questions)

7. List the features of Python.
8. Differentiate break and continue statements.
9. Write a note on recursion.
10. Write a note on Dictionaries.
11. Explain exception handling.
12. Describe various operations on arrays. (4X2=8 Marks)

Part C
(Answer Any One Question)

13. Describe various operators in Python.
14. Explain the file handling in Python. (1X6=6 Marks)