KANNUR UNIVERSITY

(Abstract)

New Generation Courses - Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme under the CBCSS, offered at NAS College, Kanhangad- Scheme of 1 to 10 Semesters, Syllabus of 1st and 2nd Semester with pattern of Question papers-- - Implemented w.e.f 2020 admission onwards- orders issued

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ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 (I) Dated: 30.07.2021

Read:-1.GO (Ms) No. 389/2020/HEDN dated 05/11/2020

2. Minutes of the meeting of the Syndicate held on 17/11/2020 Vide Item No. 2020.550

3. U.O No. Acad/A3/389/NEW COURSE/2020-21 dated 23/12/2020

4. Minutes of the meeting of CSMC held on 20/11/2020

5. U.O No. Acad/C2/2408/2020 dated 27.11.2020

6. U.O No. Acad/C2/16586/NGCI/2021 dated 31.05.2021

7.Full Scheme and Syllabus of Core course (1st & 2nd semesters) , QP Pattern submitted by the convener CSMC on 24.06.2021

8. Order of the Vice-Chancellor dated 20.07.2021

ORDER

1. As per paper read (1) above, sanction was accorded by the Government to start New Generation UG/PG courses in 15 Govt/Aided Colleges under Kannur University, during the academic year 2020-21.
2. Subsequently, the meeting of the Syndicate as per paper read (2) resolved to start the newly sanctioned UG/PG Programmes in Govt/Aided Colleges under Kannur University, during the academic year 2020-21.
3. Accordingly, provisional affiliation was granted for conducting the Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme [New Generation Course] at Nehru Arts & Science College, Kanhangad, in the academic year 2020-21, as per paper read (3).
4. Further, the Curriculum Syllabus Monitoring Committee, as per the paper read (4) was entrusted with preparing the draft regulations for the Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme. An Expert Committee was also constituted as per paper read (5), for preparing the draft Curriculum Syllabus of the New Generation Courses, by conducting two day Workshop.
5. Subsequently, Regulations for the Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence & Machine Learning programme was implemented, as per paper read (6) above,
6. As per paper read (7) the Convener, Curriculum Syllabus Monitoring Committee submitted the Scheme of 1 to 10 Semesters, Syllabus of 1st and 2nd semester Core Courses and Pattern of Question paper of the Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence & Machine Learning

Programme, prepared by the Expert Committee.

7. The Vice Chancellor, after considering the matter in detail and in exercise of the power of Academic Council conferred under section 11(1) Chapter III of Kannur University Act 1996, accorded sanction to implement the Scheme of 1 to 10 semesters, Syllabus of the 1st and 2nd Semester Core courses and the Pattern of Question Papers of the Integrated M.Sc.Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme (CBCSS), offered at Nehru Arts & Science College Kanhangad, with effect from 2020 admission, subject to reporting to the Academic Council.
8. The Scheme of 1 to 10 Semesters, Syllabus of 1st and 2nd Semester Core Courses and pattern of Question Papers for the Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence & Machine Learning Programme (CBCSS) w.e.f 2020 admission are uploaded in the university website (www.kannuruniversity.ac.in).

Orders are issued accordingly.

sd/-

BALACHANDRAN V K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: The Principal
Nehru Arts & Science College
Kanhangad

Copy To: 1. The Examination Branch (through PA to CE)
2. PS to VC/PA to PVC/ PA to Registrar
3. DR/AR I Academic
4. The Computer Programmer (for uploading in website)
6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

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

KANNUR UNIVERSITY

SYLLABUS AND PROGRAMME STRUCTURE

FOR

Integrated M.Sc. in Computer Science
with Specialization in
Artificial Intelligence and Machine Learning

2020

About the Programme

An Integrated M.Sc. Programme in Computer Science with specialization 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. Through numerous workshops and discussion with experts and stakeholders in the area, this curriculum and syllabus clearly states the programme outcomes. Basic knowledge in mathematical and statistical tools and techniques is required to pursue various courses in this programme.

Programme Specific Outcomes

PSO1: Understand the concepts of Computer Science and Applications.

PSO2: Understand the concepts of System Software and Application Software.

PSO3: Understand the concepts of Algorithms and Programming.

PSO4: Understand the concepts of Computer Networks and Operating Systems

PSO5: Design, develop, implement and test software systems to meet the given specifications, following the principles of Software Engineering.

PSO6: Gain knowledge and experience in major areas of Artificial Intelligence and Machine Learning such as Prediction, Classification, Clustering, and Information Retrieval.

PSO7: Learn to analyze large and complex datasets and create systems that adapt and improve over time using machine learning techniques.

PROGRAMME STRUCTURE

SEMESTER-I

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
	Common Course – English -1*	5	0	0	10	40	50	4
	Common Course – English -2*	4	0	0	10	40	50	3
	Common Course – Additional Language -1*	5	0	0	10	40	50	4
1B01ICSC	Core Course -1 : Introduction to C Programming *	1	2	0	10	40	50	2
	Complementary - 1 (Mathematics)	4	0	0	10	40	50	3
	Complementary Elective -1 (Statistics)	4	0	0	10	40	50	3
	Total	23	2	0	60	240	300	19

* Syllabus and question paper pattern are same as BSc Computer Science programme in affiliated colleges in Kannur University (Implemented with effect from 2019 admission)

SEMESTER-II

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
	Common Course – English - 3 *	5	0	0	10	40	50	4
	Common Course – English – 4 *	4	0	0	10	40	50	3
	Common Course – Additional Language – 2 *	5	0	0	10	40	50	4
2B02ICSC	Core Course – 2 : Advanced C Programming *	1	0	0	10	40	50	2
2B03ICSC	Core Course – 3 : Lab 1 - C Programming *		2	0	5	20	25	2
	Complementary - 2 (Mathematics)	4	0	0	10	40	50	3
	Complementary Elective - 2 (Statistics)	4		0	10	40	50	3
	Total	23	2	0	65	260	325	21

* Syllabus and question paper pattern are same as BSc Computer Science programme in affiliated colleges in Kannur University (Implemented with effect from 2019 admission)

SEMESTER-III

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
3B04ICSC	Core Course – 4 : Python for Machine Learning	3	0	0	10	40	50	3
3B05ICSC	Core Course - 5 : Operating System	3	0	0	10	40	50	3
3B06ICSC	Core Course – 6 : Data Structures	4	0	0	10	40	50	3
3B07ICSC	Core Course – 7 : Lab-2 : Python for Machine Learning	0	3	0	5	20	25	2
3B08ICSC	Core Course – 8 : Lab-3 : Data Structures using C	0	2	0	5	20	25	2
	Complementary - 3 (Mathematics)	5	0	0	10	40	50	3
	Complementary Elective - 3 (Statistics)	5	0	0	10	40	50	3
	Total	20	5	0	60	240	300	19

SEMESTER-IV

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
4B09ICSC	Core Course - 9 : Computer Organization	3	0	0	10	40	50	3
4B10ICSC	Core Course - 10 : Database Management System	3	0	0	10	40	50	3
4B11ICSC	Core Course – 11 : Object Oriented Programming using Java	4	0	0	10	40	50	3
4B12ICSC	Core Course – 12 : Lab-4 : Object Oriented Programming using java	0	3	0	5	20	25	2
4B13ICSC	Core Course – 13: Lab-5: Database Management System	0	2	0	5	20	25	2
	Complementary - 4 (Mathematics)	5	0	0	10	40	50	3
	Complementary Elective - 4 (Statistics)	5		0	10	40	50	3
	Total	20	5	1	60	240	300	19

SEMESTER-V

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
5B14ICSC	Core Course - 14 : Introduction to Artificial Intelligence	4	0	0	10	40	50	3
5B15ICSC	Core Course - 15 : Software Engineering	4	0	0	10	40	50	3
5B16ICSC	Core Course – 16 : UNIX Shell Programming	3	0	0	10	40	50	3
5B17ICSC	Core Course – 17 : Introduction to Machine Learning	4	0	0	10	40	50	4
	General Elective Course	2	0	0	5	20	25	2
5B18ICSC	Core Course – 18 : Lab-6 : UNIX Shell Programming	0	4	0	5	20	25	2
5B19ICSC	Core Course – 19: Lab-7: Machine Learning	0	4	0	5	20	25	3
	Total	17	8	0	55	220	275	20

SEMESTER-VI

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESE	Total	
6B20ICSC	Core Course - 20 : Web Technology	4	0	0	10	40	50	3
6B21ICSC	Core Course - 21 : Introduction to Deep Learning	4	0	0	10	40	50	3
6B22ICSC	Core Course – 22 : Computer Networks	3	0	0	10	40	50	3
6B23ICSC	Core Course – 23 : Design and Analysis of Algorithms	3	0	0	10	40	50	3
6B24ICSC	Core Course – 24: Lab-8 : Web Technology	0	3	0	5	20	25	3
6B25ICSC	Core Course – 25 : Project		8	0	20	80	100	7
	Total	14	11	0	65	260	325	22

SEMESTER –VII

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESA	Total	
7B26ICSC	Mathematical Models of Machine Learning - 1	3	0	0	20	80	100	3
7B27ICSC	Theory of Computation	3	0	0	20	80	100	3
7B28ICSC	Soft Computing Techniques	3	0	0	20	80	100	3
7B29ICSC	Digital Image Processing	4	0	0	20	80	100	4
7B30ICSC	Seminar*	0	0	2	50	0	50	1
7B31ICSC	Lab- 9 : Digital Image Processing		6	0	20	80	100	4
7B32ICSC	Lab –10 : Soft Computing Techniques	0	6	0	20	80	100	4
	Total	13	12	2	170	480	650	22

* Seminar topic related to AI and ML

SEMESTER -VIII

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESA	Total	
8B33ICSC	Mathematical Models of Machine Learning - 2	3	0	0	20	80	100	3
8B34ICSC	Advanced Artificial Intelligence	3	0	0	20	80	100	3
8B35ICSC	Advanced Machine Learning Techniques	3	0	0	20	80	100	3
8B36ICSC	Data Mining	3	0	0	20	80	100	3
8B37ICSC	Research Methodology	1	0	2	50	0	50	1
8B38ICSC	Lab -11 : Case Study	0	6	0	20	80	100	4
8B39ICSC	Lab -12 : Advanced Machine Learning	0	6	0	20	80	100	4
	Total	13	12	2	170	480	650	21

* Case Study - Data Mining

SEMESTER -IX

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESA	Total	
9B40ICSC	Optimization Techniques	3	0	0	20	80	100	3
9B41ICSC	Deep Learning	4	0	0	20	80	100	4
9B42ICSC	Information Security and Blockchain Technology	3	0	0	20	80	100	3
9B43ICSC	Natural Language Processing	3	0	0	20	80	100	3
9B44ICSC	Lab-13 : Natural Language Processing	0	6	0	20	80	100	4
9B45ICSC	Lab-14 : Mini Project	0	6	2	20	80	100	4
	Total	13	12	2	120	480	600	21

* Mini Project : Implementation of journal paper published by IEEE/Springer/Elsevier etc. with more than one Impact factor (Scopus indexed) in the area of AI/ML

SEMESTER- X

Course Code	Course Title	Instructional Hrs/week			Marks			Credit
		L	P	T	CA	ESA	Total	
10B46ICSC	Elective - 1*	3	0	2	50	0	50	3
10B47ICSC	Elective - 2*	3	0	2	50	0	50	3
10B48ICSC	Project #		16	5	20	80	100	8
10B49ICSC	General Viva Voce	-	-	-	0	100	100	2
	Total	9	16	9	120	180	300	16

Project based on Artificial Intelligence/Machine Learning / Deep Learning.

* Elective-1 and Elective-2 courses will be proposed at the beginning of the IX semester due to the dynamic nature of the field. Above electives should be forwarded to the university and get prior approval from Board of Studies before the commencement of X semester. Electives may be changed every 2 years depending on the industrial needs. Electives courses may be offered on online or regular mode.

SYLLABUS

1B01ICSC: INTRODUCTION TO C PROGRAMMING

COURSE OUTCOME

CO1: Aware about basics of programming.
CO2: Capable to analyze the problem and design algorithm and flowchart.
CO3: Familiar the basics of high-level language – C.
CO4: Able to develop efficient and error free programs in C.

Unit I:

Computer Programming and Languages: Introduction, Developing a Program, Program Development Cycle, Algorithm, Flowchart: Flowchart Symbols, Guidelines for Preparing Flowcharts, Benefits of Flowcharts, Limitations of Flowcharts, Examples of Algorithm and Flowchart. [Text Book 1]

(5 Hrs)

Unit II:

Overview of C: History of C, Importance of C, Basic Structure of C Programming Style, Executing a C program, Source Code, Object Code, Executable File, File Extensions, Character Set, C Tokens - Keywords, Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Reading Data from Keyboard, Operators and Expressions: Arithmetic Operator, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operator, Special Operators,. Arithmetic Expressions, Precedence of Arithmetic Operators, Type Conversion in Expressions.

(5 Hrs)

Unit III:

Managing Input Output Operation: Reading a Character, Writing a Character, Formatted Input, Formatted Output. Decision Making and Branching: Decision Making with if Statement - Simple if, if - else, Nested if - else, else if Ladder, switch Statement, go to Statement, Decision Making and Looping: while, do-while, for Statement, Jumps in Loops - break and continue Statements.

(4 Hrs)

Unit IV:

Arrays: Introduction, One Dimensional Arrays - Declaration of Arrays, Initialization of Arrays; Two-Dimensional Arrays - Initializing Two-Dimensional Arrays, Multi-Dimensional Array, Handling of Character Strings: Introduction, Declaring and Initializing String

Variables, Reading a Line of Text, Writing Strings to Screen, Arithmetic Operations on Characters, String Handling functions: strlen, strcpy, strcmp, strcat, strrev.

(4 Hrs)

Books for Study:

1. Introduction to information technology ITL Education solutions Limited, second Edition

2. Programming in ANSI C Second Edition – E Balagurusamy – Tata McGraw-Hill Publishing company Limited

Books for Reference:

1. Let us C, YeshavantKanetkar, 16thEdn, BPB

2. Programming in C, Ashok N Kamthane, Pearson Education

3. Computer Basics and c Programming, V. Rajaraman, PHI, 2008 6

4. Fundamentals of information technology, Dr. S.B Kishor, A.S Khandelwal, 2nd Ed, Published by DAS GANU Prakashan.

Online References:

1. http://www.yspuniversity.ac.in/cic/algorithm-manual.pdf
2. https://www.it.iitb.ac.in/~vijaya/ssrvm/dokuwiki/media/s6_l7_20jan.pdf

Marks Including Choice:

Unit	Marks
I	14
II	14
III	16
IV	16

2B02ICSC: ADVANCED C PROGRAMMING

COURSE OUTCOME

CO1: Familiar with advanced concepts of C program.
CO2: Capable to work with user defined as well as library functions.
CO3: Skilled to solve more complex problems.
CO4: Able to develop C programs using structure, union, pointers and files.

Unit I:

User Defined Functions: Need for User-defined Functions, The Form of C Functions – Function Name, Argument List, Return value and Their Types, Calling a Function, Category of Functions – No Argument and No Return Values, Argument but no Return Values, Arguments with Return Values, Handling of Non-integer Functions, Functions Returning Nothing, Nesting of Functions, Recursion, The Scope and Life-time of Variables in a Function, Automatic Variables, External Variables, Static Variables, Register Variables.

(5 Hrs)

Unit II:

Pointers: Introduction; understanding pointers; Accessing the address of a variable; Declaration and initialization of a pointer; Accessing a variable through its pointer; Pointer expressions; Pointer increments and scale factor; Pointers and Arrays; Pointers and Functions – pointers as function arguments, pointers to functions; pointers and structures.

(4 Hrs)

Unit III:

Structures and Unions: Structure Definition; Giving values to members; Structure initialization; Comparison of structure variables; Arrays of Structures; Arrays within Structures; Structures within Structures; Unions; Dynamic Memory Allocation: Memory allocation process; Allocating a block of memory; Allocating multiple blocks of memory; Releasing the used space, Altering the size of a block.

(4 Hrs)

Unit IV:

File Management in C: Introduction; Defining and Opening a File; Closing a file; Input/ output operations on files – the getc and putc functions; getw and putw functions; fprintf and fscanf functions; Error handling during I/O operations; Random Access to Files; Command

line arguments; The preprocessor: Macro substitution-simple macro substitution; Macros with arguments; Nesting of macros; Undefining a macro; File inclusion.

(5 Hrs)

Books for Study:

1. Programming in ANSI C Second Edition – E Balagurusamy – Tata McGraw-Hill Publishing company Limited

Books for Reference:

1. Let us C, YeshavantKanetkar, 3rd Edn, BPB
2. Programming in C, Ashok N Kamthane, Pearson Education
3. Programming using C, Dr. S.B Kishor, 2nd Ed, DAS GANU Prakashan.

Marks including choice:

Unit	Marks
I	17
II	13
III	13
IV	17

2B03ICSC : LAB 1 - C PROGRAMMING

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.

18. Write a program to print sum of n natural numbers

Pointers

19. Write a program to swap two numbers using pointers

Pointers and function

20. Write a program to access the elements of an array using function pointer

Structure

21. Write a program to add two complex numbers using structure

22. 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

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

Macros

24. Write a program to print volume of a triangle using the concept macros with argument.

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		

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.
COMPONENT1: TEST	60%	MODEL EXAMINATION SHOULD BE CONDUCTED BEFORE EXTERNAL EXAM AND CONSIDERED FOR INTERNAL MARK

DISTRIBUTION OF MARKS FOR END SEMESTER EVALUATION

COMPONENT	PART A	PART B
Code Writing	3	3
Output	3	3
Modification for Part A or Part B	2	
Algorithm/Flowchart for part A or Part B	2	
Record	1	
Viva	3	
Total Marks	**20**	

KANNUR UNIVERSITY

(Abstract)

New Generation course- Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College Kanhangad- Syllabus of 3rd Semester Core Courses with Model Question Papers- Implemented w.e.f 2020 admission onwards- Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 (I) Dated: 11.08.2021

Read:-1. U.O Acad/C2/16586/NGCI/2021(I) dated 30.07.2021

2. Syllabus of 3rd Semester Core Course & Model Question Papers submitted by the Convener CSMC on 31.07.2021

ORDER

1.. As per paper read (1) above, the syllabus of 1st and 2nd Semester Core Course and Pattern of Question Papers of New Generation Course Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, was implemented.
2. As per paper read (2) above, the Convener, Curriculum Syllabus Monitoring Committee submitted the syllabus of 3rd Semester Core Course & Model Question Papers of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme prepared by the Expert Committee.
3. The Vice-Chancellor, after considering matter in detail and in exercise of the power of Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, accorded sanction to implement the syllabus of 3rd Semester Core Course & Model Question Paper of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS)w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, subject to reporting to the Academic Council.
4. The 3rd Semester Syllabus of Core Course & Model Question Papers for the Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), w.e.f 2020 admission are uploaded in the university website (www.kannuruniversity.ac.in).
5. Orders are issued accordingly.

sd/-

BALACHANDRAN V K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: The Principal
Nehru Arts & Science College

Copy To: 1.The Examination Branch (PA to CE)
2. PS to VC/PA to PVC/PA to Registrar
3. DR/ARi Academic
4.The Computer Programmer (for uploading in website)
5. SF/DF/FC

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

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SECTION OFFICER

3B04ICSC: PYTHON FOR MACHINE LEARNING

Semester	Course Code	Hours per Week	Exam Hours
3	3B04ICSC	3	3

Course Outcome

CO1: Understanding the basic building blocks of Python programs and develop programs by utilizingthe 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.

(16 Hours)

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.

(12 Hours)

Unit III

File Handling (Opening, Closing, Writing, Reading), Exceptions: Exception Handling, Built-in Exceptions (IndexError, OverflowError, ZeroDivisionError, RuntimeError), Modules - Built-in Modules (os, sys).

(10 Hours)

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.

(16 Hours)

Reference:

[1] The Python Tutorial (https://docs.python.org/3/tutorial/index.html)

[2] NumPy quickstart (https://www.numpy.org/devdocs/user/quickstart.html)

[3] Pandas User Guide (https://pandas.pydata.org/pandas-docs/stable/user_guide/index.html)

[4] Mark Pilgrim., *Dive Into Python3*, Apress (Freely available at https://diveintopython3.net/)

[5] Wes McKinney (2017), *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*, O'Reilly Media.

[6] John V. Guttag (2016), *Introduction to Computation and Programming Using Python with Application to Understanding Data*, PHI.

Marks Including Choice:

Unit	Marks
I	16
II	16
III	12
IV	16

3B05ICSC: OPERATING SYSTEM

Semester	Course Code	Hours per Week	Exam Hours
3	3B05ICSC	3	3

Course Outcome

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

CO2: Understand the concepts of process and process synchronization.

CO3: Understand the concepts of CPU scheduling and deadlocks

CO4: Understand memory management and file system concepts

Unit I

Introduction: Types of OS - Mainframe, server, multiprocessor, Personal computer, handheld, embedded, sensor-node, real-time, smart card. Operating System Concepts, System Calls - process management, file management, directory management, Miscellaneous System Calls. Operating System Structure. System boot process. Open-Source Operating Systems.

(12 Hours)

Unit II

Processes: Process concept, Process scheduling, Operations on processes, Inter-process communication. Overview of threads.

Process Synchronization: Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic problems of Synchronization.

Simple programs using fork(), semaphores and other IPC mechanisms should be discussed in class

(14 Hours)

Unit III

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms - First come First Served, Shortest Job First, Priority scheduling, Round robin scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling. Overview of Linux scheduling.

Deadlocks: System Model, Necessary conditions, Resource allocation graphs, Deadlock prevention, Deadlock avoidance - Banker's algorithms, Deadlock detection, Recovery from deadlock.

(14 Hours)

Unit IV

Memory Management: Concept of address spaces, Swapping, Contiguous memory allocation, Segmentation, Paging. Virtual memory, Demand paging, Page replacement algorithms.

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

File System Implementation: File System structure, implementation.

(14 Hours)

Text Book:

[1] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2013). *Operating System Concepts, 9th edition*, John Wiley & Sons.

[2] Andrew S. Tanenbaum, Herbert Bos (2016). *Modern Operating Systems, 4th edition*, Pearson Education India

[3] William Stallings (2018), *Operating systems - Internals and Design Principles, 9th Edition*, Pearson Education, PHI.

Reference:

[1] Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau (2018), Operating Systems: Three Easy Pieces, Arpaci-Dusseau Books. Available Online: https://pages.cs.wisc.edu/~remzi/OSTEP/

[2] Garry Nutt, NabenduChaki, SarmisthaNeogy, Operating Systems, 3rd Edition, Pearson Education.

[3] D. M. Dhamdhere (2011), Operating Systems, 2nd Edition, Tata McGraw Hill.

Marks Including Choice:

Unit	Marks
I	12
II	16
III	16
IV	16

3B06ICSC: DATA STRUCTURES

Semester	Course Code	Hours per Week	Exam Hours
3	3B06ICSC	4	3

Course Outcome

CO1: To understand how integer and floating point data is represented inside a computer.

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

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

CO4: To familiarize with various sorting, searching and hashing techniques.

Unit I

Information Storage - Hexadecimal notation, Data Sizes, Addressing and Byte Ordering, Representing strings, Introduction to Boolean Algebra, Integer representations - integral data types, Unsigned encoding, 2's complement encoding, Floating point - Fractional Binary Numbers, IEEE Floating-Point Representation.

(16 Hours)

Unit II

Basic data structures – Arrays, **Linked lists** - singly linked list, doubly linked list, Circular linked list, operations on linked list, linked list with header nodes, applications of linked list - polynomials. **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.

(18 Hours)

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. **Heaps**- Min-max heaps, **Graphs** – representation of graphs, BFS and DFS, applications. Minimum Spanning Trees – Prim's and Kruskal's algorithms. Shortest path algorithms – Dijkstra's and Warshall's algorithms. (20 Hours)

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, digit analysis, collision resolution and Overflow handling techniques.

(18 Hours)

Text Book:

[1] Randal E. Bryant, Davie Richard O'Hallaron (2016), *Computer Systems: A Programmer's Perspective, 3/E*, Pearson.

[2] Samanta D. (2009), *Classic Data Structures, 2/E*, Prentice Hall India.

Reference:

[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.

Marks Including Choice:

Unit	Marks
I	12
II	16
III	16
IV	16

3B07ICSC: LAB 3: PYTHON FOR MACHINE LEARNING

Semester	Course Code	Hours per Week	Exam Hours
3	3B07ICSC	3	3

Course Outcome

CO1: To 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.

3B08ICSC: LAB 4: DATA STRUCTURES USING C

Semester	Course Code	Hours per Week	Exam Hours
3	3B08ICSC	2	3

Course Outcome

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

CO2: To implement applications which uses these data structures.

CO3: To 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 represent polynomials using linked list and add polynomials.
7. Write a program to implement binary search trees – creation, insertion, deletion, search
8. Write a program to implement linear search algorithm and print number of comparisons
9. Write a program to implement binary search algorithm and print number of comparisons
10. Write a program to implement Insertion sort algorithm and print number of comparisons
11. Write a program to implement Bubble sort algorithm and print number of comparisons
12. Write a program to implement Quick sort algorithm and print number of comparisons
13. Write a program to implement Merge sort algorithm and print number of comparisons
14. Write a program to implement of hash tables using various mapping functions, various collision and overflow resolving schemes.
15. Write a program to implement BFS and DFS.

Model Question Papers

Model Question Paper

3B04ICSC: PYTHON FOR MACHINE LEARNING

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

Part A: Short Answer

Answer All Questions **(6 × 1 = 6 Marks)**

1. How comments are included in python?
2. What is the use of range function in python?
3. What is the use of ones function NumPy?
4. Mention any one function defined in sys module and specify its use.
5. What is Overflow error?
6. Write the syntax for opening a file in read mode in python.

Part B: Short Essay

Answer any 6 Questions **(6 ×2 = 12 Marks)**

7. Explain how input can be accepted in python. Explain how formatted output can be achieved in python.
8. Write about 4 built-in methods for lists in python.
9. Write a program to check whether a year is leap year or not.
10. Write a Python code to create a function called count_words that takes a string as input and prints the number of occurrences of each word.
11. Explain about broadcasting in NumPy.
12. Explain plotting methods in pandas.
13. Explain about any 4 functions in os module.
14. Explain different functions used to handle files in python.

Part C: Essay

Answer any 4 Questions **(4× 3 = 12 Marks)**

15. What is meant by mutable and immutable objects in python?
16. Explain about exception handling in python.
17. What are lambda functions? Write a program using lambda function to select numbers greater than 5 from a list.

18. Write a Python code to determine whether the given string is a Palindrome or not using slicing. Do not use any string function.
19. Explain about reshape, transpose and resize function in python.
20. Explain about arithmetic and data alignment operations in pandas.

Part D: Long Essay

Answer any 2 Questions **(2×5 = 10 Marks)**

21. Explain in detail about lists and dictionaries in python.
22. Explain about exception handling in python.
23. Explain abut series and data frame in pandas. Explain how pandas can be used to read and write csv files with the help of an example.
24. Explain how functions can be created in python? Write a Python program using functions to add two matrices and also find the transpose of the resultant matrix.

Model Question Paper

3B05ICSC: OPERATING SYSTEM

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

Part A: Short Answer

Answer All Questions **(6 × 1 = 6 Marks)**

1. Mention any two deadlock prevention mechanisms.
2. What is fork()?
3. List out different types of files
4. Define OS.
5. What are embedded operating systems?
6. What is a process?

Part B: Short Essay

Answer any 6 Questions **(6 × 2 = 12 Marks)**

7. Explain about shortest job first scheduling algorithm.
8. What are the necessary conditions for deadlock?
9. Explain about bounded buffer problem.
10. What is a semaphore?
11. Write short not about virtual memory.
12. What are the different file access methods?
13. With example explain system calls
14. What are the functions of an OS?

Part C: Essay

Answer any 4 Questions **(4 × 3 = 12 Marks)**

15. Explain about round robin scheduling.
16. Explain about Banker's algorithm.
17. What is critical section problem?
18. Explain inter process communication.
19. With example explain LRU page replacement algorithm.
20. Explain segmentation.

Part D: Long Essay

Answer any 2 Questions **(2 × 5 = 10 Marks)**

21. Explain the techniques for handling deadlocks.
22. Explain about different operating systems.
23. Explain about file system structure.
24. Explain about critical section problem and Peterson's solution.

Model Question Paper

3B06ICSC: DATA STRUCTURES

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

Part A: Short Answer

Answer All Questions **(6 × 1 = 6 Marks)**

1. What is meant by height of a tree?
2. What is ADT?
3. Mention any two hashing techniques.
4. Define Data Structure.
5. Convert the hexadecimal number 3CAD to binary.
6. What is meant by little endian byte ordering?

Part B: Short Essay

Answer any 6 Questions **(6 × 2 = 12 Marks)**

7. Explain Warshall's algorithm.
8. What is a complete binary tree? Give an example.
9. How is a stack different from a queue?
10. What is a priority queue?
11. What is a hash function?
12. Explain about hash tables.
13. Convert the decimal number1256.75_{10} to binary
14. Explain how negative numbers can be represented in binary.

Part C: Essay

Answer any 4 Questions **(4 × 3 = 12 Marks)**

15. List the properties ofa binary search tree. Write algorithm to perform searching in binary search tree.
16. Explain DFS with suitable example.
17. Explain how stacks can be used to evaluate a postfix expression.
18. How stacks can be implemented using linked lists.
19. Explain about quick sort algorithm.
20. Explain linear searching with linked lists.

Part D: Long Essay

Answer any 2 Questions **(2 × 5 = 10 Marks)**

21. Explain Prim's and Kruskal's algorithm with the help of suitable examples.
22. How floating-point numbers are represented in binary? Explain in detail about IEEE floating point representation.
23. What is hashing? Explain different hashing techniques with examples.
24. Explain how queues can implemented using arrays and linked lists. Explain in detail about circular linked lists.

KANNUR UNIVERSITY

(Abstract)

New Generation course - Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College Kanhangad- Syllabus of 4th Semester Core Courses with Model Question Papers- Implemented w.e.f 2020 admission onwards- Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 17.03.2022

Read:-1. U.O Acad/C2/16586/NGCI/2021(I) dated 30.07.2021
2. U.O Acad/C2/16586/NGCI/2021 dated 18.08.2021
3. Syllabus of 4th Semester Core Course & Model Question Papers submitted by the Expert Committee Convener, dated 02.03.2022

ORDER

1. As per paper read (1 & 2) above, the syllabus of 1st, 2nd and 3rd Semester Core Course and Pattern of Question Papers of New Generation Course Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, was implemented.
2. As per paper read (3) above, the Convener, Expert Committee submitted the syllabus of 4th Semester Core Course & Model Question Papers of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme prepared by the Expert Committee.
3. The Vice-Chancellor, after considering matter in detail and in exercise of the power of Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, accorded sanction to implement the syllabus of 4th Semester Core Course & Model Question Paper of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, subject to report the same to the Academic Council.
4. The 4th Semester Syllabus of Core Course & Model Question Papers for Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), w.e.f 2020 admission are uploaded on the university website (www.kannuruniversity.ac.in).
5. U. O read (1) &(2) stands modified to this extent.

Orders are issued accordingly.

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

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SECTION OFFICER

4B09ICSC: Computer Organization

Semester	Course Code	Hours per Week	Exam Hours
4	4B09ICSC	3	3

Course Outcome

CO 1: Understand the basics of digital electronics to design simple combinational logic and sequential logic circuits
CO 2: Understand the different design features of computer architecture
CO 3: Understand Processor logic design conventions and data path, pipelining and hazards, I/O organization, Interrupts and direct memory access
CO 4: 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.

(14 Hours)

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.

(14 Hours)

Unit III

Computer abstractions and technology - Introduction, Computer architecture -8 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 datapath, A simple implementation scheme, An overview of pipelining - Pipelined datapath and control - Structural hazards - Data hazards - Control hazards

(14 Hours)

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).

(12 Hours)

Text Books

[1] Floyd, T. L. (2017). Digital Fundamentals, 11th Edition. Pearson Education. (Unit I & II)

[2] Hennessy, J. L., Patterson, D. A. (2017). Computer Organization and Design MIPS Edition: The Hardware/Software Interface, *5th Edition*. Elsevier Science. (Unit III)

[3] Patterson, D. A., Hennessy, J. L. (2017). Computer Architecture: A Quantitative Approach, *6th Edition*. Elsevier Science. (Unit III)

[4] Zaky, S., Hamacher, C., Vranesic, Z. (2017). Computer Organization, *5th Edition*. McGraw-Hill. (Unit IV)

References

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

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

Marks Including Choice

Unit	Marks
I	16
II	16
III	16
IV	12

4B10ICSC: Database Management System

Semester	Course Code	Hours per Week	Exam Hours
4	4B10ICSC	3	3

Course Outcome

CO 1: Understand the structure and characteristics of database system
CO 2: Learn to design and query data using relational database management systems.
CO 3: Understand the concepts of database normalization
CO 4: Understand the basic concepts of transaction management and concurrency control
CO 5: Understand the basic concepts of NoSQL databases

Unit I

Introduction to Database and Database Management System - Evolution, Advantages, Applications, Overview of DBMS, Concept of Data Models, Schemas and Instances, Three-schema Architecture and Data Independence, Database Languages (DDL and DML), Database Users, DBA, Centralized and Client/Server Architecture for DBMS.
Entity relationship model - Entity Types, Entity Sets, Attributes, Keys, Relationship Types, Relationship Sets, Roles, Structural Constraints, Weak Entity Types, ER Diagram, Specialization and Generalization.

(14 Hours)

Unit II

Relational Data Model - Concepts, Relational Data Model Constraints and Schemas. Structured Query Language - Data Types, Data Definition, DDL statements - CREATE, ALTER, DROP, Specifying Constraints in SQL, DML Statements - INSERT, UPDATE, DELETE, SELECT, DCL Statements - GRANT and REVOKE, Joins in SQL, Aggregate Functions in SQL, GROUP BY and HAVING Clauses, Views, Indexes in SQL - Motivation, Declaration, Selection of Indexes.
Relational Algebra - Select, Project, Rename, Union, Intersection, Minus, Set Operations, Cartesian Product, Join, Equi Join and Natural Join.

(14 Hours)

Unit III

Functional Dependencies, Normal Forms - 1NF, 2NF, 3NF, BCNF, Multivalued Dependencies, 4NF.
Transaction Processing - Need for Concurrency Control, Transaction States, System Log, Commit Point, ACID Properties of Transactions, Schedules of Transactions, Characterizing Schedules Based on Recoverability and Serializability, Testing for Serializability, Two-phase Locking Techniques for Concurrency Control.

(14 Hours)

Unit IV

Introduction to NoSQL databases, Characteristics of NoSQL Databases, Overview of Document-Based NoSQL Systems and MongoDB, Overview of NoSQL Key-Value Stores, Overview of Column Based NoSQL Systems, Overview of NoSQL Graph Databases and Neo4j.

(12 Hours)

Text Books

[1] Navathe, S., Elmasri, R. (2017). *Fundamentals of database systems*, *7th Edition*, Pearson Education.

[2] Sudarshan, S., Silberschatz, A., Korth, H. F. (2019). *Database System Concepts, 7th Edition*. McGraw-Hill.

References

[1] Ullman, J. D., Garcia-Molina, H., Widom, J. (2014). *Database Systems: The Complete Book, 2nd Edition*. Pearson Education.

[2] Ramakrishnan, R., Gehrke, J. (2000). *Database Management Systems, 3rd Edition*, McGraw-Hill.

[3] Ramesh, V., Hoffer, J. A., Topi, H. (2018). *Modern Database Management, 12th Edition*, Pearson Education.

[4] Begg, C., Connolly, T. (2020). D*atabase Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition,* Pearson Education.

Marks Including Choice

Unit	Marks
I	16
II	16
III	16
IV	12

4B11ICSC: Object Oriented Programming using Java

Semester	Course Code	Hours per Week	Exam Hours
4	4B11ICSC	4	3

Course Outcome

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.

(16 Hours)

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, String Class, String Buffer and String Builder, Varargs. Inheritance - Basics, Member Access and Inheritance, Multi-level Inheritance, Method Overriding, Dynamic Method Dispatching, Abstract Class, Object Class.

(20 Hours)

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.

(16 Hours)

Unit IV

Multi-threaded Programming - Basics of threading, Creating threads, Thread Life Cycle, Thread Priorities, Synchronization. Enumerations, Type Wrappers, Autoboxing, Annotations, Generics - Basics, Wildcard Arguments, Generic Methods. Collections - Overview, Collection Classes - ArrayList Class, LinkedList Class.

(20 Hours)

Text Books

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

References

[1] Schildt, H. (2020). *Java: A Beginner's Guide, 8th Edition*. McGraw-Hill Education.
[2] Bloch, J. (2016). *Effective Java, 3rd Edition*. Pearson Education.
[3] Horstmann, C. (2016). *Core Java Volume I-Fundamentals, 10th Edition*. Pearson Education.
[4] Horstmann, C. (2020). *Core Java Volume II-Advanced Features, 11th Edition*. Pearson Education.
[5] Sierra, K., Bates, B. (2005). *Head First Java: A Brain-Friendly Guide, 2nd Edition*. O'Reilly Media.
[6] Horstmann, C. (2012). *Object-Oriented Design And Patterns, 2nd Edition*. Wiley.
[7] West, D., McLaughlin, B., Pollice, G. (2011). *Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D*. O'Reilly Media.

Marks Including Choice

Unit	Marks
I	12
II	16
III	16
IV	16

4B12ICSC: Lab 4: Object Oriented Programming Using Java

Semester	Course Code	Hours per Week	Exam Hours
4	4B12ICSC	3	3

Course Outcome

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.

Exercises

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 finally statements.
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.
10. Write a Java program using Java Swing to create a simple calculator. Arrange Buttons for digits and the + - * % operations properly. Add a text field to display the result. Handle any possible exceptions like divide by zero.
11. Write a Java program to display all records from a table using Java Database Connectivity (JDBC).
12. Write a program that demonstrates generics.

Text Books

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

References

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

[5] Sierra, K., Bates, B. (2005). *Head First Java: A Brain-Friendly Guide, 2nd Edition*. O'Reilly Media.
[6] Horstmann, C. (2012). *Object-Oriented Design And Patterns, 2nd Edition*. Wiley.
[7] West, D., McLaughlin, B., Pollice, G. (2011). *Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D*. O'Reilly Media.

4B13ICSC: Lab 5: Database Management System

Semester	Course Code	Hours per Week	Exam Hours
4	4B13ICSC	3	3

Course Outcome

CO 1: Understand the structure and characteristics of database system
CO 2: Learn to design and query data using relational database management systems.
CO 3: Implement queries using SQL for database creation, interaction, modification, and updation
CO 4: Implement procedures, functions, and control structures using PL/SQL
CO 5: Practice of SQL TCL commands like Rollback, Commit, Savepoint

Exercises

1. Implement DDL Statements in SQL.
2. Implement DML Statements in SQL.
3. Implement DCL statements in SQL.
4. Implement different types of operators in SQL
    a. Arithmetic, relational and logical operators
    b. BETWEEN … AND
    c. LIKE
    d. IN
5. Implement different types of SQL functions
    a. Character Functions (Character Manipulation, Case Conversion)
    b. Number Functions
    c. Aggregate Functions
6. Implement Join Statements in SQL
    a. Inner Join
    b. Outer Join (Left outer join, Right outer Join)
7. Implement Subqueries in SQL.
    a. Single Row Subqueries
    b. Multiple Row Subqueries
8. Implement views in SQL.
9. Implement WHERE, GROUP BY, ORDER BY and HAVING clauses in SQL.
10. Create a database procedure to add, update and delete a book to a Library database (use parameters).
11. Simple program for implementing cursors.

References

[1] Navathe, S., Elmasri, R. (2017). *Fundamentals of database systems*, *7th Edition*, Pearson Education.
[2] Sudarshan, S., Silberschatz, A., Korth, H. F. (2019). *Database System Concepts, 7th Edition*. McGraw-Hill.
[3] Ullman, J. D., Garcia-Molina, H., Widom, J. (2014). *Database Systems: The Complete Book, 2nd Edition*. Pearson Education.

[4] Ramakrishnan, R., Gehrke, J. (2000). *Database Management Systems, 3rd Edition*, McGraw-Hill.
[5] Ramesh, V., Hoffer, J. A., Topi, H. (2018). *Modern Database Management, 12th Edition*, Pearson Education.
[6] Begg, C., Connolly, T. (2020). D*atabase Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition,* Pearson Education.

Model Question Paper

4B09ICSC: Computer Organization

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. Draw the truth table for XOR gate
2. State the Demorgan's theorem
3. What is meant by the Sum-of-Products (SOP) Form?
4. Draw the circuit of an SR latch
5. What is Moore's law?
6. What is a structural hazard?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Implement a full adder using 8:1 MUX
8. What are edge-triggered flip flops?
9. Draw a 4 bit Serial In Serial Out Shift register.
10. Write the design features of computer architecture.
11. Differentiate between data hazard and control hazard.
12. Explain about LRU Replacement algorithm used for cache memories.
13. What is PROM?
14. Explain memory hierarchy inside a computer.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain about full adder.
16. Differentiate between multiplexers and demultiplexers
17. Differentiate between synchronous and asynchronous counters
18. Explain up/down synchronous counter in detail
19. Explain 4 stage pipelining with a diagram.
20. Explain how an instruction set can be encoded.

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Write a note on K Map. Use a Karnaugh map to minimize the following SOP expression B'C'D'+A'BC'D'+ABC'D'+A'B'CD+AB'CD+A'B'CD'+ A'BC'D'+ABCD'+AB'CD'
22. Demonstrate the working of a JK flip flop. How does it eliminate the invalid condition in SR flip flop? List out its applications.
23. Explain how a single data path can be represented for memory instructions and R-type instructions with the help of a diagram.
24. Explain in detail about various cache memory mapping techniques.

Model Question Paper

4B10ICSC: Database Management System

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is meant by a weak entity type?
2. What is meant by a database schema?
3. Define super key.
4. Give 2 DCL statements in SQL.
5. What is the criteria for a relation to be in 1 NF.
6. What are the 4 properties of a transaction known as ACID properties?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. What are the functions of a DBA?
8. Explain about INSERT statement in SQL.
9. Explain about left outer join in SQL.
10. What are views in SQL?
11. Explain about UPDATE statement in SQL.
12. What are aggregate functions in SQL?
13. Write a short note about MongoDB CRUD operations.
14. Write a short note about Neo4j Data Model.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain about centralized and Client/Server architectures of DBMS.
16. Explain about specialiazation and generalization.
17. What is the need for concurrency control in a DBMS.
18. Explain about multivalued dependencies.
19. Explain how schedules can be characterized based on recoverability.
20. What are the characteristics of NOSQL systems?

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain about ER Model in detail.
22. Explain in detail about different relational algebra operations.
23. Explain in detail about different normal forms.
24. Explain in detail about NOSQL Key-Value stores.

Model Question Paper

4B11ICSC: Object Oriented Programming using Java

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. Define Byte code.
2. Define DMD.
3. What is the use of this keyword?
4. Differentiate between class and object.
5. What is the use of finally?
6. What is meant by autoboxing?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. What are the features of Java?
8. How is garbage collection done in Java?
9. What is a constructor?
10. What is meant by multi-level inheritance?
11. What is the use of the CLASSPATH environment variable?
12. Explain about chained exceptions.
13. Write a short note about type wrappers.
14. Write a short note about the ArrayList class.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain about bitwise operators in Java.
16. What are the characteristics of Object oriented programming?
17. What are packages? How can packages be imported?
18. What is an interface? Explain with the help of an example.
19. Explain about the LinkedList class in Java with the help of an example.
20. Explain how thread synchronization is achieved in Java with the help of an example.

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain about different control statements in Java.
22. Differentiate between method overloading and method overriding with the help of examples.
23. Explain how exceptions are handled in Java with the help of an example.
24. What are generic methods? Explain with the help of an example.

KANNUR UNIVERSITY

(Abstract)

Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College Kanhangad- Syllabus of 5th Semester Core Courses with Model Question Papers- Implemented w.e.f 2020 admission onwards- Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 19.10.2022

Read:-1. U.O Acad/C2/16586/NGCI/2021(I) dated 30.07.2021
2. U.O Acad/C2/16586/NGCI/2021 dated 18.08.2021
3. U.O Acad/C2/16586/NGCI/2021 dated 17.03.2022
4. Syllabus of 5th Semester Core Course & Model Question Papers submitted by the Expert Committee Convener, dated 20.09.2022

ORDER

1. As per paper read (1), (2) & (3) above, the Scheme, Syllabus of 1st, 2nd , 3rd and 4th Semester Core Course and Model Question Papers of the New Generation programme Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning (CBCSS) w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, was implemented.
2. As per paper read (4) above, the Convener, Expert Committee submitted the syllabus of 5th Semester Core Course & Model Question Papers of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme prepared by the Expert Committee.
3. The Vice-Chancellor, after considering matter in detail and in exercise of the power of Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, accorded sanction to implement the syllabus of 5th Semester Core Course & Model Question Paper of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) w.e.f 2020 admission, offered at Nehru Arts & Science College Kanhangad, and to report the same to Academic Council.
4. The Syllabus of 5th Semester Core Course & Model Question Papers for Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), w.e.f 2020 admission are appended and uploaded in the university website (www.kannuruniversity.ac.in).
5. U. O read (1) ,(2) & (3) stands modified to this extent.

Orders are issued accordingly.

sd/-
BALACHANDRAN V K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: The Principal
Nehru Arts & Science College

Copy To: 1.The Examination Branch (PA to CE)
2. PS to VC/PA to PVC/PA to Registrar
3. DR/AR I Academic, EXCI
4.The Web Manager (for uploading in website)
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KANNUR UNIVERSITY CIVIL STATION P.O. KANNUR Pin-670 002

Forwarded / By Order

SECTION OFFICER

5B14ICSC: Introduction to Artificial Intelligence

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B14ICSC	4	3	3

Course Outcome

CO 1: A detailed idea about AI and its applications
CO 2: Describe AI knowledge representation methods and concept of Robot
CO 3: Implementation of AI in real world problem like Machine learning and natural language Processing
CO 4: Understand basics of AI programming using LISP and PROLOG

Unit I

Artificial Intelligence: History and Applications,,Agent and Rational Agent Approaches-Types of Agent,Searching Strategies for state space search-Data driven and goal driven search , Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search-Best First Search with 8 puzzle problem, A* Algorithm, AO* Algorithm, Constraint Satisfaction problem, heuristics in games-Minimax Search procedure, Alpha Beta pruning.

(20 Hours)

Unit II

Knowledge representation schemes - Semantic Networks, Frames, Scripts, Conceptual graph, ConceptualDependency,Logic approaches - Propositional calculus,Predicate Calculus ,Unification, Overview of Expert System Technology-Rule based Expert Systems, case based Expert Systems,Model based Expert Systems, expert system drawbacks, ProductionSystems.

(18 Hours)

Unit III

MachineLeaming and Types- Supervised ML, Unsupervised ML, Reinforcement ML, TheGeneticAlgorithm-GeneticProgramming, Introduction to Natural Language Processing - Steps in NLP, difficulties in Natural Language Understanding, NLP Terminology.

(18 Hours)

Unit IV

Languages and Programming Techniques for Al-Introduction to PROLOG-Defining relations by facts,defining relations by rules,recursive rules, Head and body of the clause,Variables, atoms. Introduction to LISP, Features of LISP Programming Language, Prefix Notation, predicates atom,equal,eq,number,listp.

(16 Hours)

Text Books

[1] George. F. Luger, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, 6/e, 2021, Pearson Education.

[2] Rich E., Knight K., Nair B. S (2017). *Artificial Intelligence*, Tata McGraw-Hill Publ.
[3] Winston, P. H., Horn, B. (2000). *Lisp*, Addison-Wesley.
[4] Ivan Bratko, *Prolog Programming for Artificial Intelligence*, 3/e, Addison Wesley, 2000.

References

[1] Norvig, P., Russell, S. J. (2016). *Artificial Intelligence: A Modern Approach*, Pearson.
[2] Mitchell, Melanie (2020). *Artificial Intelligence: A Guide for Thinking Humans*. Penguin Books.

Marks Including Choice

Unit	Marks
I	18
II	18
III	12
IV	12

5B15ICSC: Software Engineering

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B15ICSC	4	3	3

Course Outcome

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, Digital Learning Environment.

(16 Hours)

Unit II

Software Processes - Software Process Models, Activities- Software Specification, Software Design and Implementation, Software Validation, Software Evolution, Coping with Change, Process Improvement.

(20 Hours)

Unit III

Introduction to Agile methods - Agile development techniques. Software Requirement specification - Functional and non-functional requirements, Requirements engineering processes, Requirements elicitation and specification. Architectural design decisions. Architectural views and patterns.

(16 Hours)

Unit IV

Object-oriented design using the UML, Implementation issues, Open-source development. Configuration Management - Version Management. Software Testing.

(20 Hours)

Text Books

[1] Sommerville, I. (2017). *Software Engineering, 10th Edition*. Pearson Education.

References

[1] Maxim, B. 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

Marks Including Choice

Unit	Marks
I	14
II	16
III	16
IV	14

5B16ICSC: UNIX Shell Programming

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B16ICSC	3	3	3

Course Outcome

CO 1: Understand the Open Source ecosystem
CO 2: Understand UNIX file system concepts and simple commands
CO 3: Understand UNIX shell programming concepts
CO 4: Understand AWK scripting concepts

Unit I

Unix Philosophy, History of Unix, Comparing Unix with MacOs, Windows and Linux, Open Source Software - Issues, Portability, Documentation, Best Practises for Working with Open Source Developers, Varieties of Open Source Licences, Free Software vs Open Source software.

(16 Hours)

Unit II

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. .

(12 Hours)

Unit III

Job Control. Regular Expressions - grep. Text editors - vim, emacs. Shell Programming - variables, quotes, comments, command substitution, arguments, decisions, loops, reading and printing data, functions.

(14 Hours)

Unit IV

Awk - Invoking and Basic Concepts, Patterns, Actions, Variables, Printing, Operators, BEGIN and END, for, while, if, break, continue, next, exit.

(12 Hours)

Text 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

References

[1] Kanetkar, Y. P. (2003), *UNIX Shell Programming, 1st Edition*, BPB Publications.

[2] Forouzan, B. A., Gilberg, R. F. (2003), *UNIX and Shell Programming, 1st Edition*, Cengage Learning India
[3] Das, S. (2017), *UNIX : Concepts and Applications, 4th Edition*, McGraw Hill Education.

Marks Including Choice

Unit	Marks
I	12
II	16
III	16
IV	16

5B17ICSC: Introduction to Machine Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B17ICSC	4	3	4

Course Outcome

CO 1: Understand applications of machine learning
CO 2: Understand different learning techniques
CO 3: Apply clustering of raw data
CO 4: Analyse the performance of classification methods
CO 5: Evaluate hierarchical methods
CO 6: Create a semi supervised learning model.

Unit I

What is Machine Learning? Machine Learning Vs. Traditional Programming, HowMachine Learning Works? Applications of Machine Learning, Selecting the right features, Understanding data:- numeric variables – mean, median, mode, Measuring spread. Types of Learning – Supervised Learning, Unsupervised Learning, Semi-supervised Learning, Challenges in Machine Learning.

(14 Hours)

Unit II

Regression - Introduction, Types of Regression, Linear Regression, Multiple Linear Regression, Non-Linear Regression (Polynomial Regression)Classification –Introduction, Logistic Regression, Decision Trees, Naïve Bayes Classification, Support Vector Machines, K-Nearest Neighbours, Random Forest.

(18 Hours)

Unit III

Clustering- Introduction, Requirements of Clustering, Types of Data in Cluster Analysis -Interval-Scaled Variables, Binary Variables, Categorical Variables, Ordinal Variables, Ratio-Scaled Variables, Variables of Mixed Types. Categorization of Major Clustering Methods - Partitioning Methods - K-means, K-medoids, CLARANS. Hierarchical Methods - Agglomerative Clustering, BIRCH, Density-based Methods – DBSCAN.

(20 Hours)

Unit IV

Advanced multivariate analysis – Introduction-Dimensionality Reduction - Principal Component Analysis, Linear Discriminant Analysis, Principal Component Analysis Vs. Linear Discriminant Analysis. Multidimensional scaling. Evaluating Model Performance:Precision and recall, Confusion matrix, Cross validation Bootstrap sampling, Improving model performance with ensemble learning, Bagging and Boosting.

(20 Hours)

References

[1] C. Bishop (2010), *Pattern Recognition and Machine Learning*, Springer.

[2] K. Murphy (2012), *Machine Learning: A Probabilistic Perspective*, MIT Press.
[3] Brett Lantz, *Machine Learning with R*, Packt Publishing, 2nd Edition.
[4] Tom Micheal (1997), *Machine Learning*, Mcgraw Hill
[5] Simon Rogers, Mark Girolami, *A First course in Machine Learning*, CRC Press, First Indian reprint, 2015.
[6] N. P. Padhy, *Artificial Intelligence and Intelligent Systems*, Oxford University Press, 1st Edition.
[7] E. Alpayidin, *Introduction to Machine Learning*, Prentice Hall of India (2005)
[8] T. Hastie, RT Ibrashiran and J. Friedman, *The Elements of Statistical Learning*, Springer 2001
[9] https://www.coursera.org/learn/machine-learning

Marks Including Choice

Unit	Marks
I	14
II	14
III	16
IV	16

5B18ICSC: Lab-6 : UNIX Shell Programming

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B18ICSC	4	3	2

Course Outcome

CO 1: Understand basic UNIX 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. Familiarisation 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.

References

[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.

5B19ICSC: Lab-7 : Machine Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
5	5B19ICSC	4	3	3

Course Outcome

CO 1: To implement programs to familiarise the usage of machine learning algorithms.
CO 2: Understand the usage of different types of dataset

Exercises

1. Prepare a dataset of customer having the features date, price, product_id, quantity_purchased, serial_no, user_id,user_type, user_class, purchase_week and visualise the data with
    a. Plot diagram for Price Trends for Particular User, Price Trends for Particular User Over Time
    b. Create box plot Quantity and Week value distribution having parameters of quantity_purchased','purchase_week'
2. Write a program to Transforming Nominal Features, Transforming Ordinal Features and Encoding Categorical Features using one-hot Encoding Scheme
3. Write a program to implement Raw Measures such as Values, count, Binarization, Rounding, Interactions, Binning, Fixed-width binning,Quantile based binning and Mathematical Transformations such as Log transform, Box–Cox transform
4. Write a classification program for implementing logistic regression using wine dataset
5. Write a classification program for implementingSVM using MNIST dataset
6. Write a classification program for implementing Naïve Bayes algorithm using iris dataset
7. Write a classification program for implementing decision tree using pima-indians-diabetes dataset
8. Write a classification program for implementing kNN
9. Write a clustering program for implementing k Means , k-medoids and Hierarchical Clustering using Wisconsin Breast Cancer Dataset
10. Write a program to implement PCA
11. Write a program to evaluate Classification Model using different Evaluation Metrics
12. Write a program to evaluate a Clustering Model using different Evaluation Metrics

References

[1] C. Bishop (2010), *Pattern Recognition and Machine Learning*, Springer.
[2] K. Murphy (2012), *Machine Learning: A Probabilistic Perspective*, MIT Press.
[3] Brett Lantz, *Machine Learning with R*, Packt Publishing, 2nd Edition.
[4] Tom Micheal (1997), *Machine Learning*, Mcgraw Hill
[5] Simon Rogers, Mark Girolami, *A First course in Machine Learning*, CRC Press, First Indian reprint, 2015.
[6] N. P. Padhy, *Artificial Intelligence and Intelligent Systems*, Oxford University Press, 1st Edition.
[7] E. Alpaydin, *Introduction to Machine Learning*, Prentice Hall of India (2005)
[8] T. Hastie, RT Ibrashiran and J. Friedman, *The Elements of Statistical Learning*, Springer 200

Model Question Paper

5B14ICSC: Introduction to Artificial Intelligence

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is Unification?
2. List out different searching strategies.
3. Write the steps following in NLP.
4. What is the use of equal predicates in LISP?
5. Define Agent.
6. What is Min-Max in Heuristic games?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. What are the applications of AI?
8. Compare A* and AO* algorithms.
9. Explain prefix notation in LISP with Example.
10. Write genetic algorithm.
11. Write a short note on the Rule based expert system.
12. What is the difference between semantic network and conceptual graph
13. Write algorithm for Depth first Search.
14. What is the use of Alpha beta Pruning in Gaming?

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain production system with Example.
16. What are the types of machine learning, Explain.
17. Define a relation using facts in PROLOG
18. Write a note on Constraint satisfaction problems with examples.
19. List and explain all genetic operators.
20. What are the types of Environment in an Agent based system?

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain Best first searching algorithm with 8 puzzle problems.
22. What are the different knowledge representation mechanisms in AI?
23. Explain the importance of AI in Natural Language Processing.
24. Explain the Expert system and its components with a neat diagram.

Model Question Paper

5B15ICSC: Software Engineering

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What are the major activities common to all software processes
2. Explain Internet software engineering.
3. Explain the incremental development model in software engineering
4. Explain user stories
5. Explain user testing
6. What are the major activities involved in configuration management

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Explain redundancy and diversity in software engineering
8. What are the major approaches for process improvement
9. Explain major levels in the process maturity model
10. Explain the concept of test-first development
11. Differentiate between functional and non-functional requirements
12. What are the different architectural views?
13. What are the major open source licences?
14. Explain software reuse.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. What are the three major stages in development testing
16. Explain the requirement elicitation techniques
17. What are the advantages of pair programming
18. What are the major software process activities
19. Differentiate between structural and dynamic models
20. Explain version management concepts

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain software engineering ethics
22. Explain software validation techniques
23. Explain agile development techniques
24. Explain different UML diagrams

Model Question Paper

5B16ICSC: UNIX Shell Programming

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. Explain UNIX philosophy
2. Explain how to change file permissions
3. Explain the usage of echo command
4. Explain the need of grep command
5. Give examples of shells available under UNIX
6. What is the major use of AWK language

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Explain how command line arguments can be given in shell
8. Explain the history of UNIX
9. Write a shell script which moves files from one directory to another
10. Write an AWK program to print odd numbers in a file (write the assumptions made)
11. Explain the command to print the current working directory
12. Explain the concept of pipes
13. Explain shell redirection operators
14. Explain how patterns are provided in AWK

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain how to change file ownership
16. Explain the importance of documentation in Open Source software
17. Write a shell script to print odd numbers in a range
18. Explain the usage of command to list all the currently running processes
19. Explain how loops are used in shell
20. Differentiate between AWK BEGIN and END blocks

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain different open source licences
22. Explain any five basic commands
23. Explain shell job control in detail
24. Explain different loops in AWK

Model Question Paper

5B17ICSC: Introduction to Machine Learning

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is Machine Learning?
2. What is a feature vector?
3. What is meant by Linear Regression?
4. Explain classification.
5. Describe clustering.
6. Explain precision

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Compare machine learning with traditional programming.
8. Explain the numeric variables of a data.
9. Explain about Naïve Bayes Classification.
10. Explain the different methods to choose appropriate k values for K-NN.
11. Describe the different types of Data in Cluster Analysis.
12. Explain the storing condition for k means clustering.
13. Write a note on Confusion matrix.
14. Differentiate between Bagging and Boosting.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Write applications of Machine Learning.
16. Explain SVM with different kernels.
17. Differentiate between Hierarchical and Agglomerative Clustering
18. Differentiate between k means and K-medoids
19. Explain PCA with an example
20. Write a note on Cross validation Bootstrap sampling and its usages.

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain different types of Learning with an example

22. Create Decision Trees for the following dataCross validation Bootstrap sampling

Day	Weather	Temperature	Humidity	Wind	Play?
1	Sunny	Hot	High	Weak	No
2	Cloudy	Hot	High	Weak	Yes
3	Sunny	Mild	Normal	Strong	Yes
4	Cloudy	Mild	High	Strong	Yes
5	Rainy	Mild	High	Strong	No
6	Rainy	Cool	Normal	Strong	No
7	Rainy	Mild	High	Weak	Yes
8	Sunny	Hot	High	Strong	No
9	Cloudy	Hot	Normal	Weak	Yes
10	Rainy	Mild	High	Strong	No

23. Explain density based methods for clustering
24. How to improve the model performance in machine learning

6B20ICSC: Web Technology

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B20ICSC	4	3	3

Course Outcome

CO 1: Develop skills to design a web page using HTML and CSS
CO 2: Familiarise python skills required to develop web application using django framework
CO 3: Understand basics of Django framework
CO 4: Understand steps in creating web applications using Django
CO 5: Familiarise client side scripting using JavaScript

Unit I

Introduction to WWW and HTML, Structure of HTML, HTML elements and attributes, Headings, Paragraphs, Formatting tags, line breaks, Comments, Links, Images, Lists, HTML5 Semantic Elements (header, footer, nav, section, article, nav, aside), HTML Tables.

(10 Hours)

Unit II

HTML Forms (input, select, textarea, button, datalist), Input types (text, password, submit, radio, checkbox, date, email), Input attributes (value, readonly, disabled, maxlength, autocomplete, list, min, max, placeholder), HTML5 form validation (required and pattern attribute of input type), Applying style to html using CSS (Inline, Internal and External CSS, Colors, Fonts, Borders, Padding, Applying style using class and id attribute), Positioning Elements: Absolute Positioning, Relative Positioning, Basics of Responsive CSS, Media port & Media Queries

(16 Hours)

Unit III

Python basics - variables, control statements, lists, tuples, dictionaries, sets, functions, modules, basics of object oriented programming in python, decorators, lambda functions, exceptions. Introduction to web applications, django framework, routes, templates, conditionals, django forms, sessions, Basics of Django Models, Migrations, Django Admin, User Management.

(16 Hours)

Unit IV

Introduction, JavaScript Fundamentals - variables, operators, data types, strings, arrays, functions, objects, control statements, events, querySelector, DOM Manipulation - JavaScript Console, Arrow Functions, Intervals, Local Storage, overview of JSON - JSON Data Interchange Format: Syntax, Data Types, Object, JSON Schema, using APIs in Javascript, User interfaces, Window Object, Animation in Javascript, overview of react, Testing - Assert, unit Testing, Django testing- Client Testing.

(12 Hours)

References

[1] Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, *Internet & World Wide Web How to Program* 5/e, Pearson, 2018.

[2] Julie C. Meloni, *PHP, MySQL & JavaScript All in One, Sams Teach Yourself*, 6/e, Sams, 2017.

[3] https://docs.djangoproject.com/en/4.2/

[4] https://cs50.harvard.edu/web/2020/

[5] David Flanagan, *Javascript, The Definitive Guide*, 7/e, O'Reilly, 2020.

[6] Lindsay Bassett, *Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON*, O'Reilly, 2015.

Marks Including Choice

Unit	Marks
I	16
II	16
III	14
IV	14

6B21ICSC: Introduction to Deep Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B21ICSC	4	3	3

Course Outcome

CO 1: To understand the fundamental concepts of deep learning and its basic building blocks.

CO 2: To be able to describe the basic architecture of artificial neural networks, including perceptrons and multilayer perceptrons.

CO 3: To explore the concepts of fairness, accountability, and transparency in machine learning, and how they apply to deep learning applications.

CO 4: To examine various activation functions used in deep learning and how they impact deep network performance.

CO 5: To analyze the challenges of deep network optimization, including overfitting, underfitting, hyperparameters, and validation sets, and explore different optimization algorithms.

CO 6: To investigate regularization techniques for deep learning.

Unit I

What is Deep Learning?,Deep Learning Vs Machine Learning ,What are Neural Networks?, The Basic Architecture of Artificial Neural Network ,Perceptrons, Multilayer perceptrons,The basic building blocks of deep learning, Fairness, Accountability, and Transparency in Machine Learning, Applications of Deep Learning

(13 Hours)

Unit II

Activation Functions-ReLU Function, Sigmoid Function, Tanh Function, Leaky ReLU, Swish, Softmax, Capacity, overfitting and underfitting, hyper parameters and validation sets, Estimators, Bias and Variance, Deep Networks: Feed forward networks – Learning XOR- Gradient based Learning – Hidden units – Architecture design- Back propagation – Differentiation algorithms

(13 Hours)

Unit III

Regularization for Deep Learning: Parameter norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised learning, Multi-task learning, Early Stopping, Parameter Typing and Parameter Sharing, Sparse Representations, Bagging and other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, tangent Prop and Manifold, Tangent Classifier

(15 Hours)

Unit IV

Optimization for Train Deep Models: How learning differs from pure optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with

Adaptive Learning Rates, Approximate SecondOrder Methods, Optimization Strategies and Meta-Algorithms

(13 Hours)

Text Books

[1] Ian Goodfellow and Yoshua Bengio and Aaron Courville, *Deep Learning*, MIT Press (2016)
[2] Simon Haykin, *Neural Networks and Learning Machines*, 3/E, Pearson Prentice Hall (2016)
[3] Aston Zhang, Zachary C. Lipton, Mu Li, Alexander J. Smola, *Dive into Deep Learning*, Cambridge University Press

References

[1] Charu C. Aggarwal, *Neural Networks and Deep Learning*, Springer (2018)
[2] Francois Chollet, *Deep Learning with Pytho*n, 2/e, Manning (2021)
[3] Laurene Fausett, *Fundamentals of Neural Networks: Architectures, Algorithms and Applications*, Pearson (2004)
[4] Jan Brinkhuis, *Optimization : Insights And Applications*, New Age (2010)
[5] Jon Krohn, Grant Beyleveld, Aglaé Bassens, Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence, Pearson (2020)

Marks Including Choice

Unit	Marks
I	14
II	16
III	16
IV	14

6B22ICSC: Computer Networks

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B22ICSC	3	3	3

Course Outcome

CO 1: Understand the basic elements that work together to form the internet
CO 2: Understand the concept of layered network architecture
CO 3: Understand the protocols and services offered by application, transport, network and link layers
CO 4: Understand the basic physical layer protocols

Unit I

Introduction to internet - protocol, access networks, physical media, packet switching, circuit switching, delay, loss and throughput in packet switched networks, Layered architecture, OSI Model. Application Layer - Network applications, Processes Communication - ports, sockets, web, HTTP, FTP, electronic mail protocols - SMTP, POP3, DNS.
Familiarization of wireshark, Simple HTTP Client using python**

(16 Hours)

Unit II

Transport Layer - Services, Multiplexing and demultiplexing, UDP - segment structure, checksum, Reliable data transfer - Go-Back-N, Selective Repeat. TCP - segment structure, Flow control, connection management, congestion control - causes, approaches to congestion control, TCP congestion control.
Wireshark Lab: TCP and UDP*

(12 Hours)

Unit III

Network layer- Forwarding and routing, network service models, routers, Internet Protocol (IP) - Datagram Format, IPv4 Addressing - DHCP, NAT, ICMP, IPv6. Routing Algorithms - Link-State routing algorithm, Distance-Vector routing algorithm, Routing in the Internet - Intradomain OSPF and Interdomain BGP.

(14 Hours)

Unit IV

Link Layer - Services, Error detection and correction techniques - parity checks, checksum methods and CRC, Multiple Access links and protocols - channel partitioning protocols (TDM, FDM and CDMA), random access protocols (Slotted ALOHA, Aloha, CSMA,CSMA/CD). Link layer addressing and ARP, Ethernet, Wireless Links - CDMA, WiFi - 802.11 architecture.

(12 Hours)

**Only for CE (Continuous Evaluation) and shall not be considered for ESE (End Semester Evaluation)*

Text Books

[1] Kurose, J. and Ross, K. (2017). *Computer Networking: A Top-down Approach*, 6th edition, Pearson Education.

References

[1] Tanenbaum, A.S. and Wetherall, D. (2011), *Computer Networks*, 5th edition, Pearson Education.
[2] Peterson, L. L., Davie, B. S. (2011). *Computer Networks: A Systems Approac*h, 5th edition, Morgan Kaufmann.
[3] Stallings, W. (2017). *Data and Computer Communicatio*n, 10th edition, Pearson Education.
[4] Stevens, W. R., Fall, K. R. (2011). *TCP/IP Illustrated, Volume 1: The Protocols*, 2nd edition, Pearson Education.

Marks Including Choice

Unit	Marks
I	16
II	14
III	16
IV	14

6B23ICSC: Design and Analysis of Algorithms

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B23ICSC	3	3	3

Course Outcome

CO 1: Understand the asymptotic performance of algorithms.
CO 2: Understand various algorithm design techniques.
CO 3: Demonstrate familiarity with major algorithms and data structures.
CO 4: Understand the concepts of P, NP and NP-Complete class of problems.

Unit I

Introduction to Algorithms, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures, Fundamentals of the Analysis of Algorithm Efficiency - The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes.

(14 Hours)

Unit II

Mathematical Analysis of Nonrecursive Algorithms, Mathematical Analysis of Recursive Algorithms, Example: Computing the nth Fibonacci Number. Brute Force and Exhaustive Search - Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.

(16 Hours)

Unit III

Divide-and-Conquer - Mergesort, Quicksort, Binary search, Binary Tree Traversals. Dynamic Programming - The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. Greedy Technique - Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.

(12 Hours)

Unit IV

P, NP, and NP-Complete Problems. Backtracking - n-Queens Problem, subset-sum problem. Approximation Algorithms for NP-Hard Problems (overview only).

(12 Hours)

Text Books

[1] Anany Levitin (2012). *Introduction to the Design and Analysis of Algorithms*, 3rd edition, Pearson.

References

[1] Thomas H. Cormen. Charles E. Leiserson. Ronald L. Rivest. Clifford Stein. I*ntroduction to Algorithms*, Third Edition. The MIT Press.
[2] Jon Kleinberg, Eva Tardos (2013), *Algorithm Design*, First Edition, Pearson Education India
[3] Jeff Erickson (2019), *Algorithms*, First Edition, (Online) https://jeffe.cs.illinois.edu/teaching/algorithms/book/Algorithms-JeffE.pdf
[4] Steven S. Skiena (2020), *The Algorithm Design Manual*, 3/E, Springer

[5] Alfred V. Aho, John E. Hopecroft, Jeffrey D. Ullman (2002), *Design and Analysis of Computer Algorithms*, Pearson
[6] Michael T. Goodrich, Roberto Tamassia (2006), *Algorithm Design: Foundations, Analysis and Internet Examples*, Wiley
[7] Robert Sedgewick, Philippe Flajolet, *An Introduction to Analysis of Algorithms*, Addison-Wesley Professional
[8] Tim Roughgarden (2017), *Algorithms Illuminated: Part 1: The Basics*

Marks Including Choice

Unit	Marks
I	14
II	16
III	16
IV	14

6B24ICSC: Lab-8: Web Technology

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B24ICSC	3	3	3

Course Outcome

CO 1: Develop skills to design a web page using HTML and CSS
CO 2: Understand steps in creating web applications using Django
CO 3: Familiarise client side scripting using JavaScript

Exercises

1. Create a web pages using basic html formatting tags
2. Create a web page containing images and hyperlinks
3. Create a web page containing table
4. Create a web page containing all types of lists
5. Create a form with at least 5 form elements and appropriate validation.
6. Create a web pages using
    a. In-line CSS
    b. Internal CSS
    c. External CSS

   Note: use positioning css attributes
7. Create a web page using various CSS selectors
8. Create a web page using bootstrap css framework
9. Write a JavaScript code using functions to perform arithmetic operations on two numbers.
10. Write a JavaScript code to sort and reverse array elements.
11. Write a javascript code to create a TODO list.
12. Write a javascript program using queryselector.
13. Write a javascript program to implement animations.
14. Write a javascript program to implement an event handler.
15. Create a table with following schema books(title, author, shelfno). Create a django project which contains a form to accept book's title, author and shelf no. It should have features to insert title, author and shelf no in the form to the books table. Insert 3 books' details using this. Create a url to display all the book details.
16. Create a django project which uses sessions.

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.

References

[1] Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, *Internet & World Wide Web How to Program* 5/e, Pearson, 2018.
[2] Julie C. Meloni, *PHP, MySQL & JavaScript All in One, Sams Teach Yourself*, 6/e, Sams, 2017.
[3] https://docs.djangoproject.com/en/4.2/
[4] https://cs50.harvard.edu/web/2020/

[5] David Flanagan, *Javascript, The Definitive Guide*, 7/e, O'Reilly, 2020.
[6] Lindsay Bassett, *Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON*, O'Reilly, 2015.

6B25ICSC: Project

Semester	Course Code	Hours per Week	Exam Hours	Credits
6	6B25ICSC	8	-	7

*Refer regulations for the programme

Model Question Paper
6B20ICSC: Web Technology

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is a URL?
2. Differentiate between WWW and the Internet.
3. What is the use of placeholder attribute?
4. What is absolute positioning in CSS?
5. What is a module in python?
6. What is the use of sessions in django?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Explain how images can be added in HTML with the help of an example.
8. What are different formatting tags in HTML?
9. Explain how hyperlinks are created in HTML
10. What are lambda functions
11. What are decorators in python?
12. Write a short note about JSON
13. What is the use of window object in Javascript?
14. How unit testing can be done in django?

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain about media port and media queries.
16. Explain in detail how radio input is different from checkbox.
17. Explain about different types of lists in HTML
18. Explain about different form validation techniques in HTML
19. Explain how classes are defined in python? Give an example.
20. How events are handled in Javascript? Give an example

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain about different semantic elements
22. Explain in detail about different ways with which CSS can be applied to HTML elements. How css styling is applied using class and id attributes?
23. What is the django framework used for? How are templates used to render HTML in django? Explain with the help of an example.
24. What are different control statements in Javascript?

Model Question Paper
6B21ICSC: Introduction to Deep Learning

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is Deep Learning?
2. What is a ReLU Function?
3. What is the purpose of dropout in deep learning?
4. What is the relationship between number of hidden layers and model capacity?
5. If you increase the number of hidden layers in a Multi Layer Perceptron, the classification error of test data always decreases. True or False? Justify your answer.
6. What is the advantage of batch Normalization?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. What Is a Multi-layer Perceptron(MLP)?
8. What Is the Role of Activation Functions in a Neural Network?
9. What Are Hyperparameters?
10. What will happen if the learning rate is set too low or too high?
11. What Is Dropout and Batch Normalization?
12. Explain Dataset Augmentation
13. Write an note on two Simple Strategies to Optimise/Tune the Hyperparameters:
14. Why might early stopping be considered a regularisation technique?

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain Fairness, Accountability, and Transparency in Machine Learning
16. What is a Hyperparameter in a Machine Learning Model?
17. What Is the Difference Between Batch Gradient Descent and Stochastic Gradient Descent?
18. What is Overfitting and Underfitting, and How to Combat Them?
19. Explain Challenges in Neural Network Optimization.
20. Explain the following variant of Gradient Descent: Stochastic, Batch, and Mini-batch?

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain different applications of Deep Learning.
22. Explain back propagation.
23. Explain Norm penalties.
24. How learning differs from pure optimization.

Model Question Paper
6B22ICSC: Computer Networks

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. What is meant by packet switching?
2. What is a port?
3. What is the primary function of the transport layer in the OSI model?
4. What is routing?
5. What is the purpose of BGP in internet routing?
6. What is ARP?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Explain UDP segment structure
8. Explain about multiplexing and demultiplexing in Transport layer
9. What Is ICMP?
10. Differentiate between IPV4 and IPV6
11. Explain about slotted aloha
12. What is MAC address?
13. How parity checking is used for error detection?
14. What is ethernet?

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Differentiate between goBack N and selective repeat
16. Explain about DHCP.
17. Explain about different types of delay in packet switched network
18. Explain about FTP
19. Explain about SMTP and POP3.
20. With the help of a diagram explain the segment structure of TCP.

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain about different layers in OSI model
22. Explain about TCP congestion control
23. Explain about link state and distance vector routing algorithms
24. Explain in detail about CSMA and CSMA/CD.

Model Question Paper
6B23ICSC: Design and Analysis of Algorithms

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

Part A: Short Answer

Answer All Questions **(6 x 1 = 6 Marks)**

1. Define NP Hard
2. Quicksort algorithm is better than selection sort for sorting a large set of numbers. Justify this statement
3. What is the worst case time complexity of sequential search
4. List any 2 linear data structures
5. What is the most appropriate data structure for answering telephone calls in the order of their known priorities
6. What is a brute-force algorithm?

Part B: Short Essay

Answer Any 6 Questions **(6 x 2 = 12 Marks)**

7. Briefly describe any 4 problem types.
8. Outline an exhaustive-search algorithm for the knapsack problem.
9. Discuss the pros and cons of the recursive Fibonacci series over its non recursive form
10. Explain binary search.
11. Explain Prim's algorithm
12. Explain warshall's algorithm
13. Defines subset sum problem and specify its complexity class.
14. Can every decision problem be solved in polynomial time? Justify your answer.

Part C: Essay

Answer Any 4 Questions **(4 x 3 = 12 Marks)**

15. Explain in detail about various asymptotic efficiency classes.
16. Differentiate best case, worst case, and average case.
17. Show that the worst time complexity of selection sort is O(n2)
18. Differentiate Sequential Search and Brute-Force String Matching
19. Explain Dijkstra's Algorithm
20. Define n-Queens Problem. How can it be solved?

Part D: Long Essay

Answer Any 2 Questions **(2 x 5 = 10 Marks)**

21. Explain in detail various asymptotic notations.
22. Explain in detail about exhaustive search.
23. Explain merge sort algorithm and analyse its time complexity.
24. Differentiate P, NP and NP Complete problems.

7B26ICSC: Mathematical Models of Machine Learning - I

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B26ICSC	4	3	3

Course Outcome

CO 1: Understand Linear Algebra concepts for Machine Learning
CO 2: Understand analytic geometry concepts
CO 3: Understand Matrix decomposition concepts for Machine Learning
CO 4: Understand basics of Vector Calculus for Machine Learning

Unit I

Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings

(10 Hours)

Unit II

Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product and Functions, Orthogonal Projections, Rotations

(16 Hours)

Unit III

Matrix Decompositions: Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation.

(16 Hours)

Unit IV

Vector Calculus: Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued functions, Gradients of Matrices, Useful identities, Backpropagation and Automatic Differentiation.

(12 Hours)

References

[1] Marc Peter Deisenroth, A Aldo Faisal and Cheng Soon Ong (2021). *Mathematics for Machine Learning*, Cambridge University Press.
https://mml-book.github.io/

[2] Lieven Vandenberghe, Stephen P. Boyd (2018). *Introduction to Applied Linear Algebra Vectors, Matrices, and Least Squares*, Cambridge University Press.
https://web.stanford.edu/~boyd/vmls/

[3] Kuldeep Singh (2020). *Linear Algebra: Step by Step*. Oxford University Press..
[4] Gilbert Strang (2020). *Linear Algebra and Learning from Data*, Wellesley Publishers.
[5] David Lay, Steven Lay, Judi McDonald (2015). *Linear Algebra and Its Applications*, Pearson Education.

Marks Including Choice

Unit	Marks
I	28
II	36
III	36
IV	24

Model Question Paper

7B26ICSC: Mathematical Models of Machine Learning - I

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the vector space with the concept of group.
2. What is Linear independence property?
3. Explain Manhattan and Euclidean norms.
4. Explain Symmetric, Positive Definite Matrices in terms of inner products.
5. Explain Eigenvalues and Eigenvectors with example.
6. Briefly explain Jacobian in terms of partial derivative.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Find the inverse of the matrix

$$\begin{bmatrix} 1 & 0 & 2 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 2 & 0 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

8. Explain Norm with an example.
9. Explain automatic differentiation
10. Explain orthogonal projection.
11. Differentiate between basis and rank.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Prove that For any square matrix A $\in R_{n\times n}$ it holds that A is invertible if and only if det(A)$\neq$ 0
13. Explain Gram-Schmidt orthogonalization
14. Given a set of linearly independent vectors b1,b2,b3,b4 $\in$ RExplain.

$$\begin{aligned} x_1 &= b_1 - 2b_2 + b_3 - b_4 \\ x_2 &= -4b_1 - 2b_2 + 4b_4 \\ x_3 &= 2b_1 + 3b_2 - b_3 - 3b_4 \\ x_4 &= 17b_1 - 10b_2 + 11b_3 + b_4 \end{aligned}$$

Are the vectors $x_1, ..., x_4 \in R^n$ linearly independent?

15. Explain back propagation algorithm using gradient descent
16. Explain linear mapping and its types.

(3 x 12 = 36 Marks)

7B27ICSC: Theory of Computation

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B27ICSC	4	3	3

Course Outcome

CO 1: Outline the concept of Finite Automata and Regular Expression
CO 2: Illustrate the design of Context Free Grammar for any language set
CO 3: Demonstrate the push down automaton model for the given language
CO 4: Make use of Turing machine concept to solve the simple problems
CO 5: Familiarize decidability or undecidability of various problems

Unit I

Introduction: Introduction to the Theory of computation and Finite Automata: Mathematical preliminaries and notation, Proof techniques, Three basic concepts: languages, grammar & automata. Finite automata: Deterministic Finite Acceptors, Nondeterministic Finite Acceptors, Equivalence of deterministic and nondeterministic finite acceptors, Reduction of the number of states in finite automata. Mealy Machines,Moore Machines and Inter conversion.

(14 Hours)

Unit II

Regular Expression: Regular Languages and Regular grammars: Regular expressions, connection between regular expressions and regular languages, regular grammars. Properties of Regular Languages: closure properties of regular languages, identifying non regular Language. Context-free grammars and languages Context-free grammars, parsing and ambiguity. Simplification of Context free Grammars, Normal forms: methods of transforming grammars,normal forms.

(12 Hours)

Unit III

Pushdown Automata: Pushdown automata for context-free languages.Non deterministic pushdown automata, PDA and context-free languages, deterministic pushdown automata and deterministic context-free languages.Properties of Context-Free Languages: pumping lemmas for context free languages and linear languages, closure properties for context-free languages.

(16 Hours)

Unit IV

Turing Machines: Standard Turing machine, combining Turing machines for complicated tasks, Turing's thesis. Other models of Turing machine: Minor variations on the Turing machine theme, Turing machine with complex storage, nondeterministic Turing machine, a universal Turing machine, Linear bounded automata. Limits of Algorithmic computation: Problems that cannot be solved by Turing machines, Undecidable Problems for Recursively enumerable Languages, The Post Correspondence problem. Computational Complexity :The class P, Examples of Problems,Boolean Satisfiability, The class NP, NP-completeness.

(12 Hours)

References

[1] Peter Linz (2016), *An introduction to Formal Languages and Automata*, 6th edn, Jones & Bartlett.

[2] John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), *Introduction to Automata Theory Languages and Computation*, 3rd edition, Pearson Education, India.

[3] John C Martin (1997), *Introduction to Languages and the Theory of Automata*, McGraw Hill.

Marks Including Choice

Unit	Marks
I	28
II	28
III	32
IV	36

Model Question Paper

7B27ICSC: Theory of Computation

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Is the language ww^R where w is a string of zeros and ones, accepted by DPDA?Why?
2. Explain Chomsky hierarchy
3. Is the following grammar ambiguous?
   E→E+E|E*E|I
   I →0|1|a|b
4. State the closure properties of regular sets.
5. Compare recursive and recursively enumerable languages.
6. State pumping lemma for context free languages.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

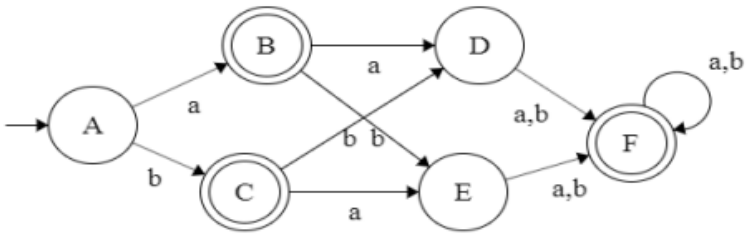
7. Design a Moore machine to determine the residue of mod 2 of the input treated as a binary string.
8. Convert the following grammar to Chomsky Normal Form.
   S→0S0|1S1| ε
9. Find a DFA for the language on Σ = {a, b} L = {w: |w| mod 2 = 0}
10. Write a note on Universal Turing machines.
11. Construct the PDA for the language {0^n1^n}*

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Minimize the following DFA.



13. (i)Define PDA. Give an Example for a language accepted by PDA by empty stack (6)
    (ii) Convert the following grammar into PDA that accepts the same language by the empty stack (6)
    S→0S1|A
    A→1A0|S| ε
14. Consider the grammar
    S→aAa|bBb|ϵ
    A→C|a
    B→C|b

$C \rightarrow CDE|\epsilon$

$D \rightarrow A|B|ab$

a)Eliminate ϵ-production

b)Eliminate any unit production in the resulting grammar

c) Eliminate any useless symbols in the resulting grammar

15. Write notes on the following:

    i) decidable and undecidable problems

    ii) Halting Problem of Turing machine.

16. Explain the different types of Turing Machine. Design a turing machine that accepts the language of all strings over the alphabet $\sum=\{a,b\}$ whose second letter is b

(3 x 12 = 36 Marks)

7B28ICSC: Soft Computing Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B28ICSC	4	3	3

Course Outcome

CO 1: To learn the basic concepts of Soft Computing
CO 2: To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
CO 3: To apply soft computing techniques to solve problems.

Unit I

Soft Computing and Conventional Artificial Intelligence: Hard Computing Vs. Soft Computing. Soft Computing Methods: Artificial Neural Network, Fuzzy Sets and Fuzzy Logic, Intuitionistic Fuzzy Sets, Rough Set Theory . Applications of Soft Computing.

(12 Hours)

Unit II

Fuzzy Set theory: Fuzzy versus Crisp set. Fuzzy Sets: Fuzzy Set Operations, Properties of Fuzzy Sets, Non-interactive Fuzzy Sets, Alternative Fuzzy Set Operations. Fuzzy Relations: Fuzzy Relations, Cardinality of Fuzzy Relations , Operations on Fuzzy Relations , Properties of Fuzzy Relations, Fuzzy Cartesian Product and Composition , Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

(16 Hours)

Unit III

Genetic algorithms (GA): History of Genetic Algorithms-working principle, Various Encoding methods, Fitness function,, GA Operators: Reproduction, Crossover, Mutation, A Simple Genetic Algorithm. Convergence of GA, Bit wise operation in GA, Multi-level Optimization, TSP problem using GA.

(14 Hours)

Unit IV

Evolutionary Computing, Simulated Annealing, Random Search, Downhill Simplex Search, Swarm optimization. Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems.

(12 Hours)

References

[1] Roy, S. and Chakraborty, U. (2013). *Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms*, Pearson India.

[2] Timothy J. Ross (2010), *Fuzzy Logic with Engineering Applications* (3rd Edn.), Willey.
[3] F. Martin, Mc Neill, and Ellen Thro (2000), *Fuzzy Logic: A Practical Approach*, AP Professional.
[4] Melanie Mitchell (2000), *An Introduction to Genetic Algorithms*, MIT Press.

Marks Including Choice

Unit	Marks
I	28
II	48
III	24
IV	24

Model Question Paper

7B28ICSC: Soft Computing Techniques

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

17. Explain Hard Computing.
18. What is fuzzy logic?
19. Explain cross over.
20. Differentiate between Fuzzy set versus Crisp set.
21. Explain Predicate logic.
22. Briefly explain Random Search.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

23. Differentiate between soft computing and hard computing.
24. Explain Fuzzy Cartesian product and Composition.
25. Explain Defuzzification Method with example.
26. Explain the working principle of genetic algorithms.
27. Explain Downhill Simplex Search algorithm.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

28. Explain the applications of soft computing.
29. Explain Fuzzy Set Operations with examples.
30. Explain Minmax Composition with example.
31. Explain genetic algorithms with TSP problem.
32. Explain different hybrid systems.

(3 x 12 = 36 Marks)

7B29ICSC: Digital Image Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B29ICSC	4	3	4

Course Outcome

CO 1: Integrate concepts of various image processing steps.
CO 2: Evaluate current technologies and issues in Image processing.
CO 3: Familiar the basic python libraries and functions that support IP
CO 4: Aware about developing efficient Image Processing programs using Python..

Unit I

Digital Image Fundamentals: Definition of digital image, pixels, representation of digital image - spatial domain and matrix form. Block diagram of fundamentals steps in digital image processing, application of digital image processing system, Components of Digital Image processing, Processing systems-Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, CMY models.

(12 Hours)

Unit II

Image Enhancement Spatial Domain: Gray level transformations - Histogram processing ,histogram equalization, Smoothing and Sharpening - Gaussian Smoothing, Mean Smoothing, Median Smoothing, Basics of Spatial Filtering– Basics of Spatial Filtering, Linear filters, Spatial Low pass smoothing filters, Averaging, Weighted Averaging, Non-Linear filters, Median filter, Maximum and Minimum filters..

(16 Hours)

Unit III

Image Restoration: degradation model, Properties, Noise models, Salt-and-Pepper Noise, Mean Filters, Order Statistics, Adaptive filters, Band reject Filters, Band pass Filters, Notch Filters, Frequency Rejection - Applications.
Image Segmentation: Point Detection, Line Detection, Edge detection, Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation.

(14 Hours)

Unit IV

Feature Extraction: Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation, DIP basic libraries and methods in Python- OpenCV, Numpy and Scipy libraries, Scikit, Python Imaging Library (PIL), methods-Open() and show(), imread(), imshow() Convert and Save(), thumbnails(), convert()

(12 Hours)

References

[1] Rafael C. Gonzalez, Richard E. Woods (2018), Digital Image Processing, 4th Edition, Pearson Education.

[2] William K. Pratt (2010), *Digital Image Processing*, 4th Edition, Wiley India.

[3] Kenneth R. Castleman (2007), *Digital Image Processing*, Pearson India.

[4] D,E. Dudgeon and RM. Mersereau (1990), *Multidimensional Digital Signal Processing*, Prentice Hall Professional Technical Reference.

[5] Anil K. Jain (2015), *Fundamentals of Digital Image Processing*, Pearson.

[6] Sandipan Dey (2018), *Hands-On Image Processing with Python: Expert techniques for advanced image analysis and effective interpretation of image data*, Packt Publishing.

Marks Including Choice

Unit	Marks
I	30
II	35
III	35
IV	24

Model Question Paper

7B29ICSC: Digital Image Processing

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Differentiate between Smoothing and Sharpening.
2. Compare RGB and HSI.
3. What do you mean Thresholding in segmentation?
4. Explain any 5 applications of DIP.
5. Explain Image Sampling and Quantization.
6. Give the methods for Morphological processing.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explain importance of Feature Extraction .
8. What are Non-Linear filters in image enhancement? Explain any 3 techniques.
9. Explain different predefined methods for handling images in Python?
10. Describe Image Restoration.
11. Write about the importance of image segmentation.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain the Steps of DIP.
13. Give a detailed account of Segmentation techniques
14. Explain Histogram equalization with suitable example
15. Explain importance of image restoration
16. Explain Spatial Filtering for image enhancement..

(3 x 12 = 36 Marks)

7B31ICSC: Lab-9: Digital Image Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B31ICSC	4	3	4

Exercises

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Implementation of Image Intensity slicing technique for image enhancement
11. Canny edge detection Algorithm

7B32ICSC: Lab-10: Soft Computing Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
7	7B32ICSC	5	3	4

Exercises

1. Write a Program to implement Multiple Perceptron Model.
2. Write a Program to implement XOR with backpropagation algorithm.
3. Write a Program to implement Union, Intersection and Complement operations.
4. Write a Program to implement De-Morgan's Law.
5. Write a Program to implement Fuzzy Relations (Max-min Composition).
6. Write a Program to implement Fuzzy Controller (Washing Machine).
7. Write a program for Genetic algorithm to maximize the function f(x)=x2.
8. Write a Program to implement Simple Genetic Application.
9. Programming exercises on maximizing a function using Genetic algorithm.
10. Write a program to show Multi objective optimization in Genetic Algorithm.

KANNUR UNIVERSITY

(Abstract)

Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College Kanhangad w.e.f.2020 Admission- Syllabus of 8th Semester Courses with Model Question Papers- Approved - Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 20.02.2024

Read:-1. U.O Acad/C2/16586/NGCI/2021(I) dated 30.07.2021
2. U.O Acad/C2/16586/NGCI/2021(1) dated 11.08.2021
3. U.O Acad/C2/16586/NGCI/2021 dated 17.03.2022
4. U.O Acad/C2/16586/NGCI/2021 dated 19.10.2022
5. U.O Acad/C2/16586/NGCI/2021 dated 24.05.2023
6. U.O Acad/C2/16586/NGCI/2021 dated 05/10/2023
7. Syllabus & Model Question Papers of VIII semester courses submitted by the Convenor, Expert Committee, vide e-mail dtd. 01/02/2024

ORDER

1. As per paper read (1) above, the Scheme and Syllabus of the Ist and 2nd Semester Core courses and the Pattern of Question Papers of the New Generation programme viz, integrated M.Sc in Computer Science with Specialization in Artificial Intelligence and Machine Learning (CBCSS) , offered at Nehru Arts & Science College, Kanhangad, was approved and implemented w.e.f 2020 admissions.
2. The Syllabus of 3rd , 4th , 5th, 6th and 7th semester Core Courses and Model Question Papers of integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning (CBCSS) programme was approved and implemented w.e.f 2020 admission vide papers read (2), (3), (4), (5) & (6) above,
3. As per paper read (7) above, the Convenor, Expert Committee submitted the syllabus of 8th Semester Courses & Model Question Papers of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme prepared by the Expert Committee.
4. The Vice-Chancellor, after considering matter in detail and in exercise of the power of the Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, ***accorded sanction to implement the syllabus of 8th Semester Courses & Model Question Paper of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) , w.e.f 2020 admission***, subject to report to the Academic Council.
5. The Syllabus of VIII th Semester Courses & Model Question Papers for Integrated M.Sc in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), w.e.f 2020 admission, are appended and uploaded in the university website (www.kannuruniversity.ac.in).
6. Orders are issued accordingly.

Sd/-
Narayanadas K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: 1.The Principal
Nehru Arts & Science College, Kanhangad
2. The Convener, Expert committee.

Copy To: 1.The Examination Branch (Through PA to CE)
2. PS to VC/PA to Registrar/PA to CE
3. DR/AR I (Acad)
4. EXCI/ EG I/ AR II (Exam)
4.The Web Manager, Computer Programmer (for uploading in the website)
5. SF/DF/FC

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

Forwarded / By Order
SECTION OFFICER

KV

8B33ICSC: Mathematical Models of Machine Learning - II

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B33ICSC	4	3	3

Course Outcome

CO 1: Understand the concepts of probability and distributions.
CO 2: Understand the optimization techniques.
CO 3: Understand regression and classification techniques.
CO 4: Understand classification using SVM and dimensionality reduction.

Unit I

Probability and Distributions: Construction of probability space, Discrete and continuous probabilities, Sum rule, Product rule and Bayes' Theorem, Summary statistics and Independence.

(10 Hours)

Unit II

Continuous Optimization: Gradient descent, stepsize, gradient descent with momentum, stochastic gradient descent, constrained optimization and Lagrange Multipliers, Convex optimization. Data, models and learning, cross-validation.

(16 Hours)

Unit III

Linear Regression and Classification: Problem formulation, Parameter estimation, assessing the accuracy of coefficient estimates and model, Multiple linear regression. Overview of classification, Logistic regression and KNN introduction.

(16 Hours)

Unit IV

Classification with Support Vector Machines: Hyperplanes, Separating Hyperplanes, primal support vector machine, concept of margin, geometric view, kernels. Introduction to dimensionality reduction.

(12 Hours)

Text Boks

[1] Marc Peter Deisenroth, A Aldo Faisal and Cheng Soon Ong (2021). *Mathematics for Machine Learning*, Cambridge University Press.
https://mml-book.github.io/

[2] Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (2013). *An Introduction to Statistical Learning*. Springer

References

[1] Shai Ben-David and Shai Shalev-Shwartz (2014). *Understanding Machine Learning: From Theory to Algorithms*. Cambridge University Press.

[2] Aurélien Géron (2019). H*ands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly Media, Inc.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B33ICSC: Mathematical Models of Machine Learning - II

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the axioms of probability with respect to the concepts sample space, event space, and probability measure.
2. Explain Probability Density Function.
3. How Gradient descent is used for optimisation?
4. Explain logistic regression in terms of probability theory.
5. Explain how PCA minimises the average reconstruction error.
6. How to maximise the variance of the low-dimensional code using a sequential approach?

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explain Discrete and Continuous Probabilities with examples.
8. How Cross-Validation is used to assess the generalization performance?
9. Explain how to estimate the regression coefficients in multiple regressions with examples.
10. Find low-dimensional representations to minimize the compression loss.
11. Explain the geometry behind the Separation of Hyper planes.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain Bayes' Theorem as the sequences of product and sum rules.
13. Explain different summary statistics for the random variables.
14. Explain how Lagrange Multipliers used in constrained optimization problems.
15. Explain how to find good parameters and how to evaluate whether a parameter set works well for the model.
16. Explain the different methods to find out the margin of the hyperplane in SVM.

(3 x 12 = 36 Marks)

8B34ICSC: Advanced Artificial Intelligence

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B34ICSC	3	3	3

Course Outcome

CO 1: Understand Knowledge-Based Systems and First Order Logic
CO 2: Proficiency in Advanced Planning Techniques and Knowledge Representation:
CO 3: Skills in Ensemble and Statistical Learning
CO 4: Comprehensive Knowledge in Probabilistic Reasoning and Models
CO 5: Foundational Understanding of Robotics and Explainable AI

Unit I

Knowledge reasoning and planning: Knowledge base agents, first order logic, Knowledge engineering in first order logic, Logic-Based Application Example: Financial Advisor, Inference in first order logic: forward chaining, backward chaining, resolution-CNF for FOL, standardise variable, Skolemization, drop universal quantifiers. Practical uses of resolution theorem provers.

(14 Hours)

Unit II

Planning: classical planning, Algorithm for planning as state space search-forward and backward state space search, Basics of Planning graph, hierarchical planning, Knowledge Representation: Introduction to Ontology, Components, categories and objects, Events, Mental events and mental objects, Reasoning systems for categories, Description logic.

(12 Hours)

Unit III

Learning from example: Ensemble learning, knowledge in Learning Explanation based learning, statistical learning, learning with complete data, uncertain knowledge, combining beliefs and desires under uncertainty, Probabilistic Reasoning: Introduction ,Overview of Probability Theory ,Bayes Networks. Hidden markov model, variant of HMM, autoregressive HMM, factorial HMM, Hierarchical HMM.

(16 Hours)

Unit IV

Introduction to Robotics: Robot Locomotion and its types, Hardware-sensors, range finders, cameras, GPS. Robotic perception, localaization and mapping. Software architecture for a robotic car, other applications. Applications of Robotics Human-Computer Interaction (HCI) and AI, Explainable AI-Methods- SHAP, LIME, Permutation Importance, Partial Dependence Plot, Anchors.

(12 Hours)

Textbook

[1] Norvig, P., Russell, S. J. (2016). *Artificial Intelligence: A Modern Approach*, Pearson.
[2] Daphne, Koller, Friedman Nir, and Bach Francis (2009). *Probabilistic graphical models: principles and techniques*. Adaptive Computation and Machine Learning, MIT Press.

References

[1] Mitchell, Melanie (2020). *Artificial Intelligence: A Guide for Thinking Humans*. Penguin Books.
[2] George. F. Luger, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, 6/e, 2021, Pearson Education.
[3] Rich E., Knight K., Nair B. S (2017). *Artificial Intelligence*, Tata McGraw-Hill Publ.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B34ICSC: Advanced Artificial Intelligence

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define Skolemization .
2. What are the applications of Robotics?
3. Write the Importance of knowledge in Learning
4. Describe FOL in detail.
5. What are the variant of HMM?
6. Write a short note on Components of Ontology.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Describe Ensemble learning in detail.
8. Represent a Financial advisor as a logic based method.
9. What is planning in AI, What are the components of planning?
10. Explain all inference of FOL with suitable examples
11. How to represent a partial dependable plot?

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain Robot and its architecture in detail .
13. Give a detailed account of Importance of probability theory in AI
14. Explain Ontological representation of knowledge in AI
15. Explain importance of Knowledge representation using Logic
16. Compare the algorithm for forward state space search and backward state space search in planning.

(3 x 12 = 36 Marks)

8B35ICSC: Advanced Machine Learning Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B35ICSC	4	3	3

Course Outcome

CO 1: Understand model fitting and performance
CO 2: Understand machine learning for images using Convolutional networks
CO 3: Understand machine learning for text using transformer networks
CO 4: Understand reinforcement learning concepts

Unit I

Deep Neural Networks: Composing neural networks, From composing networks to deep networks, Hyperparameters, General formulation, Large, structured inputs, Training and generalization. Fitting models: Gradient descent, Stochastic gradient descent, Momentum, Adam, Training algorithm hyperparameters. Measuring performance: Noise, bias, and variance, Bias-variance trade-off.

(14 Hours)

Unit II

Convolutional networks: Invariance and equivariance, Convolutional networks for 1D inputs, Convolutional networks for 2D inputs, Downsampling and upsampling, Applications. Residual networks: Sequential processing, Residual connections and residual blocks, Exploding gradients in residual networks, Batch normalization, ResNet, DenseNet.

(12 Hours)

Unit III

Transformers: Processing text data, Dot-product self-attention, Extensions to dot-product self-attention, Transformers, Transformers for natural language processing, BERT, GPT3, Transformers for long sequences, Transformers for images, ImageGPT.

(16 Hours)

Unit IV

Reinforcement learning - Markov decision processes, returns, and policies, Expected return, Tabular reinforcement learning, Fitted Q-learning, Policy gradient methods, Offline reinforcement learning.

(12 Hours)

Textbook

[1] Simon J.D. Prince (2023). *Understanding Deep Learning*. MIT Press. https://udlbook.github.io/udlbook/

References

[1] Chris Bishop, Hugh Bishop (2024). Deep Learning: Foundation and Concepts. Springer International Publishing AG. https://www.bishopbook.com/
[2] K. Murphy (2012), *Machine Learning: A Probabilistic Perspective*, MIT Press.
[3] Brett Lantz, *Machine Learning with R*, Packt Publishing, 2nd Edition.
[4] Tom Micheal (1997), *Machine Learning*, Mcgraw Hill
[5] Simon Rogers, Mark Girolami, *A First course in Machine Learning*, CRC Press, First Indian reprint, 2015.
[6] E. Alpayidin, *Introduction to Machine Learning*, Prentice Hall of India (2005)
[7] T. Hastie, RT Ibrashiran and J. Friedman, *The Elements of Statistical Learning*, Springer 2001
[8] https://www.coursera.org/learn/machine-learning

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B35ICSC: Advanced Machine Learning Techniques

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Why are hyper parameters crucial in the training process?
2. Define the terms noise, bias, and variance in the context of evaluating the performance of a machine learning model.
3. Compare ResNet and DenseNet architectures.
4. Explain Positional encoding.
5. Explain Bellman equations.
6. Briefly explain Role of Fitted Q-learning in reinforcement learning.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explore the evolution of neural network architectures from shallow to deep.
8. Explain strategies to find an optimal balance between bias and variance
9. Explain the role of CNN in spatial processing.
10. Explain Dot-product self-attention.
11. Explain Tabular reinforcement learning.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain how to visualize the multivariate inputs.
13. Explain the role of convolutional networks 1D inputs.
14. Explain how transformers are worked in NLP.
15. Explain Markov process in reinforcement learning.
16. Explain the optimization algorithms used in training deep neural networks.

(3 x 12 = 36 Marks)

8B36ICSC: Data Mining

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B36ICSC	4	3	3

Course Outcome

CO 1: Understand Data Mining Concepts and Ethics
CO 2: Learn Data Preprocessing and Distributed File Systems
CO 3: Familiarity with Distance Measures and Mining Data Streams
CO 4: Familiarize Clustering Techniques and Recommendation Systems

Unit I

What is Data Mining - Modeling, Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction. Statistical Limits on Data Mining - Total Information Awareness, Bonferroni's Principle, An Example of Bonferroni's Principle. Applications - The weather problem, Irises. Data mining and ethics.

(14 Hours)

Unit II

Data preprocessing - Data cleaning - Sparse data, Missing values, Inaccurate values, Data transformation, Data reduction, Discretization and generating concept hierarchies. Distributed File Systems - Physical Organization of Compute Nodes, Large-Scale File-System Organization, MapReduce - The Map Tasks, Grouping by Key, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce.

(12 Hours)

Unit III

Distance Measures - Euclidean Distances, Jaccard Distance, Cosine Distance, Hamming Distance, Mahalanobis distance. Mining Data Streams - The Stream Data Model, Sampling Data in a Stream, Filtering Streams. Frequent Itemsets - The Market-Basket Model, Market Baskets and the A-Priori Algorithm, FPGrowth Algorithm.

(16 Hours)

Unit IV

Clustering - Introduction to Clustering Techniques, Hierarchical Clustering, The CURE Algorithm. Clustering in Non-Euclidean Spaces. Recommendation Systems - A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. Dimensionality Reduction - UV-Decomposition, Root-Mean-Square Error, Incremental Computation of a UV-Decomposition, Building a Complete UV-Decomposition Algorithm, The Netflix Challenge.

(12 Hours)

Textbook

[1] Ullman, Jeffrey D., and Jure Leskovec (2020). *Mining of massive datasets*. 3rd Edition. http://www.mmds.org/
[2] Ian H. Witten, Eibe Frank, and Mark A. Hall. 2011. *Data Mining: Practical Machine Learning Tools and Techniques* (3rd. ed.). Morgan Kaufmann Publishers.

References

[1] Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang (2009); *Principles and Theory for Data Mining and Machine Learning*, Springer Publishing.
[2] Tan, Steinbach & Kumar (2016), *Introduction to Data Mining*, Pearson.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B36ICSC: Data Mining

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Compare and contrast statistical modelling with other modelling approaches used in data mining.
2. How does sparse data affect the quality of data analysis? Provide an example of a real-world scenario
3. Outline two common techniques for handling missing data and their advantages.
4. Explain the significance of selecting an appropriate distance measure based on the nature of the data
5. Compare and contrast agglomerative and divisive hierarchical clustering.
6. Explain the Stream Data Model.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explore different techniques used for data cleaning in data preprocessing
8. Discuss the concepts of shuffling and sorting in MapReduce in detail
9. Explain Bonferroni's Principle with an example.
10. Explain the market basket analysis problem.
11. Define Clustering? Explain about Types of Data in Cluster Analysis?

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. a) Explain different phases of map reduce
    b) Explain different types of distance measures used for measuring similarity or difference between pair of objects
13. a) Explain about the Apriori algorithm for finding frequent itemsets with an example
    b) You are given the transaction data shown in the Table below from a fast food restaurant. There are 9 distinct transactions (order:1 – order:9). There are a total of 5 meal items that are involved in the transactions. For Simplicity meal items are assigned short names (M1 – M5) rather than the full descriptive names

Meal Item	List of Item IDs
Order: 1	M1, M2, M5
Order: 2	M2, M4
Order: 3	M2, M3
Order: 4	M1, M2, M4

Order: 5	M1, M3
Order: 6	M2, M3
Order: 7	M1, M3
Order: 8	M1, M2, M3, M5
Order: 9	M1, M2, M3

Compute the following :

i) Apply the Apriori algorithm to the dataset of transactions and identify all frequent itemsets with minimum support count as 2. Clearly explain the step by step procedure of the algorithm.

ii) Find all strong association rules of the form: X Y →Z and note their confidence values.

14. a) What are the different types of Hierarchical Clustering
    b) Explain CURE algorithm with example
15. a) Write the steps for generating frequent itemsets using FP-Growth algorithm
    b) Generate frequent itemsets for the following data using FP-Growth algorithm with min support=5

TID	Items
1	1,2,3,5
2	2,5,7,9
3	1,3,5,7
4	2,4,6,8
5	1,2,3,4
6	2,3,4,5
7	3,4,5,6
8	4,5,6,7
9	5,6,7,8,9
10	9,1,2,5
11	8,2,9,7
12	5,6,3,2

16. Write a Short note on
    a) UV-Decomposition
    b) Utility matrix
    c) Content based recommendation system

(3 x 12 = 36 Marks)

8B37ICSC: Research Methodology

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B37ICSC	1	2	1

Course Outcome

CO 1: Understand Fundamentals of Research Methodology
CO 2: Develop Skills in Observation and Literature Review
CO 3: Learn Basic Statistical Analysis and Academic Writing
CO 4: Learn Technical Writing and Document Formatting with LaTeX

Unit I

Research Methodology: Research, Types of Research, Research and Scientific Method-Observation, Questions, Hypothesis, Experimentation, Critical Communication, Formulation of Research Problem. Scientific Methods- Empiricism- induction and deduction, Positivism, Falsification, objectivity and subjectivity.

(4 Hours)

Unit II

Where to study? Making observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations. Research questions – Source of ideas, hypothesis and predictions, types of research reports- literature review, theory article and empirical article.

Exploring past research - Online scholarly research databases, electronic search resources,

(4 Hours)

Unit III

Basic Statistical Measurements - Measures of central tendency- Arithmetic mean, median, mode, Geometric mean and harmonic mean.
Data collection: Data collection methods - Sampling Techniques.
Statistical inference: Null and Research hypothesis, Type I and Type II errors, t Test and F test.
Article and Thesis Writing Guidelines: Fundamentals of good writing - Clarity, Acknowledging the work of others, Active versus Passive voice, Report formatting.
Organization of the report – Title page, Abstract, Body of the paper, References, Appendix, Footnotes, Tables, Figures.
Use of headings, Citing and Referencing styles, Abbreviations, Style of reporting number and statistics. Basics of Paper and poster presentation.

(6 Hours)

Unit IV

*This unit is for assignment purposes only.
Technical Writing in Latex: Latex compilation, formatting, writing books as chapters, designing header and footer, designing chapters and sections, creating lists, tables, inserting images, setting

labels and reference, index, list of figures and tables, math formulae, hyperlinks, bookmarks, bibliography

(4 Hours)

References

[1] Paul C. Cozby, Scott C. Bates (2017). *Methods in Behavioural Research*., 13th Edition, McGraw-Hill.

[2] Gieryn, T.f. *Cultural Boundaries of Science*. Univ. Chicago Press, 1999.

[3] Collins H. and T. Pinch. *The Golem: What Everyone should know about Science*, Cambridge Univ Press, 1993

[4] Kothari, C.R., 1990. *Research Methodology: Methods and Techniques*. New Age International.Publishers (Second revised edition)

[5] S.P Satarkar, S.V., 2000. *Intellectual Property Rights and Copyright*. Ess Publications.

[6] Lamport, L. (1994). *Latex: A Document Preparation System, 2/E. (1994)*. India: Pearson Education.

Marks Including Choice

Unit	Marks
I	15
II	15
III	20
IV	0

Model Question Paper

8B37ICSC: Research Methodology

Time: 3 Hours **Max. Marks: 50**

Section A

Answer any 1 questions. Each question carries 2 marks

1. What are Type I and Type II errors?
2. What are the elements of IPR/
3. How does sample size affect the interpretation of survey results?

(1 x 2 = 2 Marks)

Section B

Answer any 2 questions. Each question carries 4 marks

4. Define and distinguish between
   a) hypothesis, theory and law
   b) induction and deduction
   c) objectivity and subjectivity
   d) Positivism, Falsification
5. Why are samples used in research?
6. Distinguish between literature reviews, theory articles, and empirical research articles.
7. What information does the researcher communicate in each of the sections of a research article?

(2 x 4 = 8 Marks)

Section C

Answer any 2 questions. Each question carries 8 marks

8. Distinguish between probability and nonprobability sampling techniques. What are the implications of each?
9. Why is it important for anyone in our society to have knowledge of research methods?
10. How to cite and reference the sources in a research report

(2 x 8 = 16 Marks)

Section D

Answer any 2 questions. Each question carries 8 marks

11. How does basic research differ from applied research? Explain with examples.
12. Distinguish between simple random, stratified random, quota sampling and cluster sampling.
13. Make a short note on the organisation of a report.

(2 x 12 = 24 Marks)

8B38ICSC: Lab-11: Case Study (Data Mining)

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B38ICSC	4	3	4

The goal of this case study is to cultivate self-learning skills in mastering data mining tools and techniques. Students are required to use Python or R as data mining tools. The teacher-in-charge will introduce the selected data mining tools. A flipped classroom approach has to be used, wherein students will be directed by the teacher to explore and utilize online tutorials and courses as a means to independently enhance their understanding of data mining techniques prior to class discussions and activities. A series of lab assignments will be prepared by the teacher. Each student is expected to apply data mining techniques to solve a specific problem using the selected tools. Students will be required to submit a comprehensive report including the problem statement, solution description, code (if any), and output for end semester evaluation.

Evaluation Scheme for ESE

Report	10
Demonstration of Data Mining Techniques	20
Viva on Data Mining Tool and Techniques	10
Model Performance and Analysis	15
Data Exploration and Visualization	15
Overall Presentation and Communication	10

8B39ICSC: Lab-12: Advanced Machine Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B39ICSC	5	3	4

Course Outcome

CO 1: Ability to Compose Multiple Neural Network Modules for Complex Models
CO 2: Understanding the Role of Hyperparameters in Machine Learning Models
CO 3: Appreciation of the Importance of Tokenization in Natural Language Processing
CO 4: Knowledge of 1D Convolutional Neural Networks and Their Application in Sequence Processing
CO 5: Observation of the Impact of Dimensionality Reduction on SVM Model Performance

Exercises

1. Implement the gradient descent algorithm for linear regression.
2. Implement the stochastic gradient descent algorithm for logistic regression.
3. Use the MNIST dataset and compose a neural network with layers suitable for image classification.
4. Implement a Support Vector Machine for classification using the MNIST dataset with feature extraction using Principal Component Analysis to reduce the dimensionality of the data.
5. Implement a 1D Convolutional Neural Network for sequence classification.
6. Implement a 2D convolutional network using the CIFAR-10 dataset for image classification.
7. Evaluate the trained model on the Fashion MNIST dataset and analyze bias, variance, and the trade-off.
8. Build a ResNet model with residual connections and Batch Normalization using the SVHN dataset (Street View House Numbers)
9. Implement a transformer for sentiment analysis using the IMDB movie review dataset.
10. Implement the Markov Decision Processes algorithm to find the optimal policy using the given environment actions, transitions, and rewards. Print the optimal policy for each state.
11. Implement a Q-learning algorithm to solve a tabular reinforcement learning problem using the OpenAI Gym environment.

KANNUR UNIVERSITY

(Abstract)

Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College, Kanhangad w.e.f.2020 Admission-Modified Scheme, Syllabus and Model Question papers (9th and 10 th Semesters) Approved - Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 19.09.2024

Read:-1. U.O.s No Acad/C2/16586/NGCI/2021 dated: 30.07.2021,11.08.2021,17.03.2022,19.10.2022,24.05.2023,05/10/2023,20/02/2024

2. E- mail dtd : 28/06/2024 and 11/07/2024 Received from Chairperson BoS in Computer Science (PG)

3. Minutes of the Meeting of the standing committee of the Academic Council held on 12.07.2024

4. E-mail dtd 30/07/2024 received from the Dean Faculty of Technology

5. Minutes of the meeting of the Standing Committee held on 30/08/2024

6. The Orders of the Vice Chancellor in File Number: Acad/C2/16586/NGCI/2021 dtd 18/9/2024

ORDER

1.As per paper read (1) above, the Scheme (1 to 10 Semesters) Syllabus, Pattern of Question Papers and Model Question Papers of Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), offered at Nehru Arts & Science College, Kanhangad, up to VIIIth Semesters were approved and implemented w.e.f 2020 admissions.

2.Subsequently, as per paper read (2) above, the Chairperson BoS in Computer Science(PG) submitted the Modified Scheme (X semester), Syllabus & Model Question Papers of 9th and 10 th Semester Integrated M.Sc. Computer Science with specialization in Artificial Intelligence and Machine Learning Programme, for approval and implementation and the same was forwarded to the Dean, Faculty of Technology for verification.

3.The matter was considered by the Standing Committee of the Academic Council held on 12.07.2024 (paper read 3) and the Standing Committee recommended to place the same before the forthcoming meeting, as the Remarks of Dean was not received at that time.

4. The Dean, Faculty of Technology, after vetting the Syllabus, vide paper read 4 remarked that the Syllabus can be approved.

5. Subsequently, the Syllabi, along with the Remarks of Dean, were placed before the Standing Committee of the Academic Council and the Committee vide paper read (5) above recommended to approve the same.

6.The Vice Chancellor, after considering the recommendation of the Standing Committee of the Academic Council and in exercise of the power of the Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, ***approved the Modified Scheme, Syllabus & Model Question Papers of 9th and 10 th Semesters of Integrated M.Sc. Computer Science with Specialization in Artificial Intelligence and Machine Learning programme***

(CBCSS) and accorded sanction to implement the same w.e.f 2020 admission in affiliated Colleges, subject to reporting to the Academic Council.

7.The Modified Scheme, Syllabus & Model Question Papers of 9th and 10 th Semester Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) in affiliated colleges w.e.f 2020 admission are appended with this U.O.and uploaded in the University website (www.kannuruniversity.ac.in).

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: 1. The Principal, Nehru Arts & Science College, Kanhangad

2. Chairperson BoS in Computer Science (PG)

Copy To: 1.The Examination Branch (Through PA to CE)

2. PS to VC/PA to R/PA to CE

3. AR I/AR II (Acad)

4. EXCI/ EG I/ AR II/ AR I (Exam)

5.The Web Manager, Computer Programmer (for uploading in the website)

6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KV

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

9B40ICSC: Optimization Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B40ICSC	3	3	3

Course Outcome

CO 1: Understand fundamental mathematical optimization techniques.
CO 2: Grasp the principles and applications of convex optimization.
CO 3: Analyze the interplay between learning algorithms and optimization methods.
CO 4: Understand advanced optimization algorithms in machine learning contexts.

Unit I

Mathematical optimization: Solution methods, Least-squares and linear programming: Least-squares problems, Linear programming. Convex optimization: Solution, usage. Nonlinear optimization - local and global. Convex sets - Affine and Convex Sets, hyper planes and half spaces, separating and supporting hyper planes.

(10 Hours)

Unit II

Convex Functions - Basic properties and examples. Operations and preserve convexity, conjugate function, Overview of Convex optimization problems, Lagrange dual function and problem, geometric interpretation, saddle point interpretation, optimality conditions.

(16 Hours)

Unit III

Unconstrained Minimization Problems - Descent Methods, Gradient Descent, Steepest Descent, Newton's Method. Learning Vs Optimization - Empirical risk minimization, surrogate loss functions and early stopping, batch and minibatch algorithms.

(16 Hours)

Unit IV

Challenges in Neural Network Optimization - ill conditioning, local minima, plateaus, saddle points, cliffs and exploding gradients, long term dependencies, indexact gradients, theoretical limits. Algorithms with adaptive learning rates - AdaGrad, RMSProp, Adam, Choosing the right algorithm. Batch Normalization, coordinate descent, supervised pretraining. Designing models to aid optimization.

(12 Hours)

Text Boks

[1] Stephen Boyd and Lieven Vandenberghe, *Convex Optimization*, Cambridge University Press. https://stanford.edu/~boyd/cvxbook/.

[2] Ian Goodfellow, Yoshua Bengio and Aaron Courville. *Deep Learning*, The MIT Press.

References

[1] Marc Peter Deisenroth, A Aldo Faisal and Cheng Soon Ong (2021). *Mathematics for Machine Learning*, Cambridge University Press. https://mml-book.github.io/
[2] Gilbert Strang. *Linear Algebra and Learning from Data* (2019), Wellesley Cambridge Press.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B40ICSC: Optimization Techniques

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define mathematical optimization and describe its importance in real-world applications.
2. Explain the concept of least-squares problems and provide an example.
3. What are convex sets? Provide two examples.
4. Differentiate between affine and convex sets.
5. Discuss the significance of separating and supporting hyperplanes in convex optimization.
6. Describe the supervised pretraining.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Solve a linear programming problem using the simplex method.
8. Explain the operations that preserve convexity with suitable examples.
9. Describe the geometric and saddle point interpretations of the Lagrange dual problem.
10. Discuss the Gradient Descent method and its application in unconstrained minimization problems.
11. Explain the Challenges in Neural Network Optimization.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Compare and contrast local and global optimization techniques in nonlinear optimization. Discuss the challenges associated with global optimization and methods to mitigate these challenges.
13. Discuss optimality conditions in convex optimization problems. Compare and contrast the geometric interpretation and the saddle point interpretation of optimality conditions.
14. Explain how adaptive learning rate algorithms like AdaGrad, RMSProp, and Adam work, and how to choose the right algorithm for a given problem.
15. Explain the significance of batch normalization and coordinate descent in optimizing deep learning models.
16. Illustrate the design of models that aid optimization with specific examples.

(3 x 12 = 36 Marks)

9B41ICSC: Deep Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B41ICSC	4	3	4

Course Outcome

CO 1:

Unit I

Generative Adversarial Networks (GANs): Generative models and their applications -image/text generation, Adversarial training process - generator and discriminator. Deep Convolutional GANs (DCGANs) architecture Loss functions for GANs - adversarial loss, WGAN loss Training stability techniques - gradient penalty, spectral normalization Applications of GANs in specific domains (only in chosen field of interest)

(14 Hours)

Unit II

Attention Mechanisms: Transformer architecture and self-attention mechanism. Applications of attention in a chosen domain (NLP, computer vision), Multi-head attention and its benefits, Encoder-decoder architectures with attention, Masked self-attention for tasks like machine translation, Attention visualization techniques

(12 Hours)

Unit III

Explainable AI (XAI): Importance of explainability in deep learning models, Techniques for interpreting model predictions - LIME, SHAP, Model-agnostic vs. model-specific explainability methods, Evaluating the faithfulness and fairness of explanations, Applications of XAI in a chosen critical domain - healthcare, finance

(16 Hours)

Unit IV

Deep Reinforcement Learning Deep Q-Networks (DQNs) and their limitations, Advanced Deep Q-Learning technique - Double DQN, Exploration vs. exploitation strategies in reinforcement learning, Applications of deep Q-Learning in robotics and game playing

(12 Hours)

References

[1] Ian Goodfellow, Yoshua Bengio and Aaron Courville. *Deep Learning*, The MIT Press.
[2] François Chollet (2017), *Deep Learning with Python,* Manning Publications Company
[3] David Foster (2023), *Generative Deep Learning,* O'Reilly
[4] Maxim Lapan. *Deep Reinforcement Learning Hands-On*, Packt Publishing.
[5] Denis Rothman (2021), *Transformers for Natural Language Processing*. Packt Publishing

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B41ICSC: Deep Learning

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the fundamental components and training process of Generative Adversarial Networks .
2. Discuss the key characteristics of Deep Convolutional GANs
3. Explain how self-attention facilitates capturing relationships between different words in a sequence in NLP
4. Discuss the concept of multi-head attention in Transformer models.
5. Discuss the importance of explainability in deep learning models.
6. Discuss the limitations of Deep Q-Networks (DQNs) in reinforcement learning

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Discuss the evolution of attention mechanisms in deep learning.
8. Write any application of XAI in detail
9. What is the role of self-attention mechanisms in Transformers?.
10. Explain the architecture and training process of Deep Convolutional GANs (DCGANs)
11. What are the Applications of deep Q-Learning in robotics

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. a. Describe the Transformer architecture and the role of self-attention mechanisms .(6 marks)
    b. Discuss encoder-decoder architectures with attention mechanisms (6 marks)
13. a. Compare model-agnostic techniques with model-specific explainability methods in interpreting model predictions. (6 marks)
    b.Explain different attention visualisation techniques in detail
14. Discuss how DCGANs address the limitations of traditional GANs for image generation
15. Discuss challenges and ethical considerations encountered when implementing XAI in healthcare.
16. Draw the architecture of the Deep Q-Network (DQN), discuss its features, and explain how it aids in reinforcement learning.

(3 x 12 = 36 Marks)

9B42ICSC: Information Security and Blockchain Technology

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B42ICSC	3	3	3

Course Outcome

CO 1: Comprehend Information Security Principles
CO 2: Understand Cryptographic Techniques
CO 3: Identify and Mitigate Security Threats
CO 4: Understand basics of Blockchain Technology

Unit I

Introduction to Information Security-The need for Security, Principles of security-Confidentiality, Integrity, Availability, Authentication, Authorization, Non repudiation.
Ciphers and secret messages, security attacks and services, Types of attacks-Passive attacks, Active attacks. Virus and related threats, virus countermeasures. Introduction to Cryptography-Symmetric cipher model, substitution techniques, transposition techniques.

(14 Hours)

Unit II

Mathematics for cryptography: Euclid's algorithm, modular arithmetic, polynomial arithmetic. Block cipher principles- DES: Data Encryption Standard -Introduction, DES Structure-Initial and final permutations, DES function; Round Key Generation; Avalanche and completeness effect. Multiple DES- Double DES, Triple DES, Security of DES- Brute force attack. Advanced encryption standard – AES structure – AES transformation function – key expansion. Application of Block Ciphers.

(12 Hours)

Unit III

Public Key cryptography- Principles of Public Key Cryptosystems; Applications of public Key Crypto systems, Public Key Cryptanalysis. RSA Algorithm. Diffie-Hellman Key exchange, Elgamal Cryptographic systems. Hash functions- examples, application. Secure Hash algorithm. Message authentication functions – requirements of message authentication codes. Digital Signature- signing, verification. Digital signature Services, RSA digital signature scheme.

(16 Hours)

Unit IV

Introduction To BlockChain Technology, History, Features of BlockChain Technology, Terminologies, Benefits. Types of Block Chain- Public, Private, Hybrid, Consortium. Cryptography in BlockChain, BlockChain Structure, BlockChain Transaction Life Cycle. BlockChain Cryptocurrency. BlockChain Security. BlockChain Applications.

(12 Hours)

Textbook

[1] Forouzan and Mukhopadhyay, *Cryptography And Network Security,* 3rd Ed, McGraw Hill. https://udlbook.github.io/udlbook/

[2] William Stallings, *Cryptography and Network Security - Principles and Practice*, 7th Ed, Pearson.

[3] Sonali Vyas, Vinod Kumar Shukla, Shaurya Gupta, Ajay Prasad. *Blockchain Technology: Exploring Opportunities, Challenges, and Applications*.

References

[1] Bishop Matt, *Introduction to Computer Security*, Addison-Wesley,2004.

[2] Buce Schneier., *Applied cryptography – protocols and algorithms*, Springer Verlag 2003.

[3] Zibin Zheng, Shaoan Xie, Hongning Dai, Xiangping Chen, and Huaimin Wang. *An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends*-IEEE 2017.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B42ICSC: Information Security and Blockchain Technology

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define confidentiality and authentication.
2. Explain Euclid's algorithm in cryptography.
3. Explain Block chain cryptography.
4. Discuss El-Gamal cryptosystem.
5. Explain RSA algorithm.
6. Describe Digital signature and its services.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explain Diffie-Hellman key exchange with example.
8. Discuss the various encryption techniques with example.
9. Explain in detail the key generation technique in AES algorithm.
10. Discuss the various types of Block chain.
11. Explain the types of attacks in information security.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain substitution and transposition techniques with examples.
13. Explain DES structure and multiple DES techniques.
14. Explain the working of AES algorithm with example.
15. Discuss the importance of Digital signature in cryptography.
16. Explain in detail about Block chain? Explain Block chain security.

(3 x 12 = 36 Marks)

9B43ICSC: Natural Language Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B43ICSC	3	3	3

Course Outcome

CO 1: Understand the Fundamentals and Historical Context of NLP
CO 2: Master Morphological Analysis and Parsing Techniques
CO 3: Develop Proficiency in Part-of-Speech Tagging and Sequence Labelling
CO 4: Explore Advanced NLP Applications and Techniques

Unit I

History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP.
Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory: Entropy, perplexity, the relation to language, Cross entropy.

(14 Hours)

Unit II

Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams: N-gram language model, N-gram for spelling correction.

(12 Hours)

Unit III

Part-Of-Speech tagging(POS)- Tag set for English (Penn Treebank) , Rule based POS tagging, Stochastic POS tagging, Issues –Multiple tags & words, Unknown words. Introduction to CFG, Sequence labeling: Hidden Markov Model (HMM), Maximum Entropy, and Conditional Random Field (CRF).

(16 Hours)

Unit IV

Discourse –reference resolution, reference phenomenon, syntactic & semantic constraints on co reference. Applications of NLP: Machine translation, Information retrieval, Question answers system, categorization, summarization, sentiment analysis, Named Entity Recognition, Natural language generation.

(12 Hours)

Textbook

[1] Christopher D. Manning and Hinrich Schutze, *Foundations of Natural Language Processing* , 6 th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003

[2] Daniel Jurafsky and James H. Martin, *Speech and Language Processing*, 3rd edition, Prentice Hall, 2009.

References

[1] Nitin Indurkhya, Fred J. Damerau, *Handbook of Natural Language Processing* second edition, Published February 23, 2010 by Chapman & Hall.
[2] Jacob Eisenstein, *Introduction to Natural Language Processing* ,The MIT Press.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

9B43ICSC: Natural Language Processing

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the challenges in NLP.
2. What is entropy in NLP?
3. Explain Regular expression.
4. Explain Conditional Random Field.
5. Explain semantic constraints on co reference.
6. Briefly explain Natural language generation.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Differentiate between Inflectional morphology & Derivational morphology.
8. Explain Information retrieval in NLP.
9. Explain Rule based POS tagging with examples.
10. Explain Hidden Markov Model.
11. Explain Discourse-reference resolution.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain the applications of NLP.
13. Explain Part-Of-Speech tagging in NLP.
14. Explain Morphological parsing with FST.
15. Explain N-grams in detail.
16. Explain stages in NLP.

(3 x 12 = 36 Marks)

9B44ICSC: Lab-13: Natural Language Processing

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B44ICSC	6	3	4

Course Outcome

CO 1: Implementing fundamental NLP tasks such as tokenization, part-of-speech tagging, and named entity recognition.

CO 2: Developing a basic search engine and sentiment analysis classifier using these NLP techniques.

CO 3: Implementing and evaluating machine learning approaches like SVM for sentiment analysis on labelled datasets.

CO 4: Leveraging pre-trained models for named entity recognition to extract entities from text effectively.

CO 5: Visualizing NLP outputs using tools like spaCy's displacy to enhance interpretation and validation of results.

List of Programs

1. Write a program to calculate the entropy and perplexity of a given text corpus.
2. Implement a basic morphological parser using regular expressions in Python that can distinguish between different morphological forms of a given set of words.
3. Build a bigram and trigram language model from a sample text corpus and use it to generate probable word sequences.
4. Implement a simple POS tagger using the Penn Treebank tag set and evaluate its performance on a test corpus.
5. Implement a POS tagger using the HMM approach and evaluate it against a standard dataset.
6. Use a CRF library to train a POS tagger and evaluate its performance.
7. Implement a simple reference resolution algorithm to resolve pronouns in a given text.
8. Use a pre-trained translation model to translate a paragraph from English to another language and analyse the output for accuracy and fluency.
9. Build a basic search engine using Python that indexes a set of documents and retrieves relevant documents based on a user query.
10. Implement a sentiment analysis classifier using a machine learning approach and evaluate its accuracy on a labelled dataset.
11. Create a simple NLP program using Python that performs basic text processing tasks such as tokenization, part-of-speech (POS) tagging, and named entity recognition (NER) using spaCy.
12. Use a pre-trained NER model to extract named entities from a given text and visualize the results using a tool like spaCy.

9B45ICSC: Lab-14: Mini Project

Semester	Course Code	Hours per Week	Exam Hours	Credits
9	9B45ICSC	6	3	4

List of Elective Courses for Elective I

Sl. No.	Course Code	Course title	Hours per week	Credits
1	10B46ICSCE01	Human Computer Interaction	3	3
2	10B46ICSCE02	Grid and Cloud Computing	3	3

*Elective I should be chosen from this list

List of Elective Courses for Elective II

Sl. No.		Course title	Hours per week	Credits
1	10B47ICSCE01	Computer Vision	3	3
2	10B47ICSCE02	Internet of Things	3	3

*Elective II should be chosen from this list

Syllabi for Elective Courses

10B46ICSCE01: Human Computer Interaction

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B46ICSCE01	3	-	3

Course Outcome

CO 1: Understand the principles of human memory, thinking, and the interaction between humans and computers

CO 2: Understand the design process with a focus on users, scenarios, and navigation.

CO 3: Understand usability principles, HCI patterns, and techniques for software evaluation through user participation.

CO 4: Grasp the principles of human-AI interaction, interactive machine learning, and guidelines.

Unit I

The Human: Human Memory, Thinking. Computer - Text entry devices, positioning, pointing and drawing, display devices, VR and 3D interaction, understanding computer memory speed and capacity, storage format and standards

Unit II

Interaction: Models of interaction, Frameworks and HCI, Ergonomics, Interaction Styles. Interaction Design: What is design?, Process of design, user focus, scenarios, navigation design.

Unit III

Principles to support usability, HCI Patterns, Evaluating a software through user participation, Web usability, usability testing. Universal Design: Multimodal interaction, Designing for diversity.

Unit IV

Human-AI interaction: Interactive machine learning, IML applications, Human-Ai interaction guidelines. Explainable AI, AI Ethics and Fairness.

Text Books

[1] Alan Dix (2004). *Human-Computer Interaction.* 3rd edition.

[2] Steve Krug, *Don't Make Me Think, Revisited*: A *Common Sense Approach* to *Web Usability* (Voices That Matter). 3rd Edition.

References

[1] *A Review of User Interface Design for Interactive Machine Learning* (TIIS 2018) by Dudley and Kristensson

[2] *Guidelines for Human-AI Interaction (*CHI 2019*)* by Amershi et al

[3] *Biases in AI Systems (*Communications of ACM, 2021*),* Srinivasan and Chander.

[4] *Effects of Explanations in AI-Assisted Decision Making: Principles and Comparisons* (ACM Transactions on Interactive Intelligent Systems, 2022), Wang and Yin.

10B46ICSCE02: Grid and Cloud Computing

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B46ICSCE02	3	-	3

Course Outcome

CO 1: To understand the fundamental concepts of Distributed Computing, Grid Computing and its large scale scientific applications

CO 2: To acquire knowledge on the concept of virtualization

CO 3: To gain knowledge about different cloud deployment models and cloud computing categories

CO 4: To learn implementations of open source grid middleware packages and Hadoop Framework

CO 5: To understand the security issues in the grid and the cloud environment

Unit I

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers – Grid computing Infrastructures – cloud computing – service oriented architecture – Introduction to Grid Architecture and standards –

Elements of Grid – Overview of Grid Architecture.Introduction to Open Grid Services Architecture (OGSA) – Motivation – Functionality Requirements – Practical & Detailed view of OGSA/OGSI – Data intensive grid service models – OGSA services.

Unit II

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software, Security as a Service – Pros and Cons of cloud computing – Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices, Desktop Virtualization – virtual clusters and Resource Management – Virtualization for data center automation. Tools and Products available for Virtualization.

Unit III

Open source grid middleware packages – Globus Toolkit (GT4) Architecture, Configuration – Usage of Globus – Main components and Programming model – Introduction to Hadoop Framework – Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Design of Hadoop file system, HDFS concepts, command line and java interface, dataflow of File read & File write.

Unit IV

Trust models for Grid security environment – Authentication and Authorization methods – Grid security infrastructure – Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud, Key privacy issues in the cloud.

Text Books

[1] Kai Hwang, Geoffery C. Fox and Jack J. Dongarra, *Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet, First Edition*, Morgan Kaufman Publisher, an Imprint of Elsevier, 2012

References

[1] Jason Venner, *Pro Hadoop - Build Scalable, Distributed Applications in the Cloud,* A Press, 2009

[2] Tom White, *Hadoop The Definitive Guide, First Edition.* O Reilly, 2009

[3] Bart Jacob (Editor), *Introduction to Grid Computing,* IBM Red Books, Vervante, 2005

[4] Ian Foster, Carl Kesselman, *The Grid: Blueprint for a New Computing Infrastructure, 2nd Edition,* Morgan Kaufmann

[5] Frederic Magoules and Jie Pan, *Introduction to Grid Computing,* CRC Press, 2009

[6] Daniel Minoli, *A Networking Approach to Grid Computing,* John Wiley Publication, 2005

[7] Barry Wilkinson, *Grid Computing: Techniques and Applications, Chapman and Hall*, CRC, Taylor and Francis Group, 2010

[8] Kris Jamsa, *Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more*, Jones & Bartlett Learning Company, 2013

[9] R. Buyya, C. Vecchiola, S. T. Selvi, *Mastering Cloud Computing*, McGraw Hill (India) Pvt Ltd., 2013

10B47ICSCE01: Computer Vision

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B47ICSCE01	3	-	3

Course Outcome

CO 1: To introduce and discuss the basic concepts of computer vision techniques
CO 2: Understandings on the applications of machine vision
CO 3: To accomplish knowledge about motion analysis

Unit I

Introduction: Motivation, Difficulty, Image analysis tasks, Image representations, Image digitization, Image properties, Color images, Cameras. Data Structures: Levels of image data representation - Traditional image data structures - Hierarchical data structures. Texture: Statistical texture description, Syntactic texture description methods, Hybrid texture description methods, Texture recognition method applications.

Unit II

Object Recognition: Knowledge representation, Statistical pattern recognition, Neural nets, Syntactic pattern recognition, Recognition as graph matching, Optimization techniques in recognition, Fuzzy systems.

Unit III

Introduction to Bag of Features, Classifying images with Bag of features, Common Issues in Image classification, Recent object detection algorithms-YOLO, Fully Convolutional Networks, RetinaNet, EfficientDet

Unit IV

Motion Analysis: Differential motion analysis methods, Optical flow, Analysis based on interest points, Detection of specific motion patterns, Video Tracking, Motion models to aid tracking.

Text Books

[1] Szeliski, Richard, *Computer Vision: Algorithms and Applications* - 2nd Edition, Springer Verlag, 2022.

[2] Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing, Analysis and Machine Vision*, Cengage Learning, New Delhi, 2014.
[3] Wesley E. Synder and Hairong Qi, *Machine Vision*, Cambridge University Press, USA, 2010.
[4] *Geron* Aurelien, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition*, O'Reilly

References

[1] Rafael C Gonzalez, Richard E Woods, Steven L Eddins, *"Digital Image Processing"*, Pearson Education, New Delhi, 2009.
[2] Shapiro L and Stockman G, *Computer Vision*, Prentice-Hall, 2001.

10B47ICSCE02: Internet of Things

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B47ICSCE02	3	-	3

Course Outcome

CO 1: Understand the fundamental concepts and principles of the Internet of Things (IoT) and its applications.
CO 2: Gain knowledge of the different technologies, protocols, and architectures used in IoT systems.
CO 3: Develop skills to design and implement IoT solutions using sensor technologies, data analytics, and cloud computing.
CO 4: Recognize the challenges and security considerations associated with IoT deployments and learn strategies to mitigate them.
CO 5: Explore the potential impact of IoT in various industries and understand its role in transforming business processes and enabling smart environments.

Unit I

Introduction to IoT: Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

Unit II

IoT Architecture: M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture. IoT Protocols: Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards.

Unit III

Protocols – IEEE 802.15.4 – BACnet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP–Security. Building IoT with RASPBERRY PI &ARDUINO: Building IOT with

RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces.

Unit IV

Programming Raspberry Pi with Python - Other IoT Platforms - Arduino. Case Studies and Real World Applications :Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

Text Books

[1] ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015

[2] Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

[3] Honbo Zhou, ―The Internet of Things in the Cloud: A Middleware Perspective‖, CRC Press, 2012.

References

[1] Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

[2] Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012

10B48ICSC: Project

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B48ICSC	16	-	8

Guidelines given in the regulation (Acad/C2/16586/NGCI/2021 dated 31.05.2021)

10B49ICSC: General Viva Voce

Semester	Course Code	Hours per Week	Exam Hours	Credits
10	10B49ICSC	-	-	2

Guidelines given in the regulation (Acad/C2/16586/NGCI/2021 dated 31.05.2021)