CURRICULUM AND CREDIT FRAMEWORK FOR UNDERGRADUATE PROGRAMME

Syllabus for

Department of Computer Science
Nagaland University
Core Courses (For Minor)

2024-Revised

Computer Science Course Structure: Core Courses (For Minor)

PaperCode	CourseCode	Title of the Paper	Total Credit
SEMESTER-I			
Min-1	**CSMIN-01(T)**	Computer Fundamentals	3
	CSMIN-01(P)	Computer Fundamental - Practical	1
SEMESTER-II			
Min-2	**CSMIN-02(T)**	Database Management Systems	3
	CSMIN-02(P)	Database Management System -Practical	1
SEMESTER-III			
Min-3	**CSMIN-03(T)**	Web Design using HTML	3
	CSMIN-03(P)	Web Design using HTML- Practical	1
SEMESTER-IV			
Min-4	**CSMIN-04(T)**	PHP Programming	3
	CSMIN-04(P)	PHP Programming – Practical	1
SEMESTER-V			
Min-5	**CSMIN-05(T)**	Internet Technologies	3
	CSMIN-05(P)	Internet Technologies – Practical	1
SEMESTER-VI			
Min-6	**CSMIN-06(T)**	Artificial Intelligence	3
	CSMIN-06(P)	Artificial Intelligence– Practical	1
SEMESTER-VII			
Min-7	**CSMIN-07(T)**	Machine Learning	3
	CSMIN-07(P)	Machine Learning– Practical	2

Detailed Syllabus

Core Courses (Minor)
Course Code: CSMIN-01: Computer Fundamentals
(Credits: Theory-3; Practical-1)

Semester: I

Computer Fundamentals: THEORY

Course Objective

This course provides an overview of introductory concepts about computers, components of computer system, Windows Operation System, Word Processor, Spreadsheets and Internet. It builds the foundation of the computer application courses that follow.

Course Learning Outcomes

On successful completion of this course, a student will be able to:

- handle a computer system for day-to-day use.
- enumerate different types of input/ output devices and types of memory.
- use Windows OS.
- differentiate between system and application software.
- prepare Text documents& spreadsheets.

Unit-I: Introduction to computer:

Introduction to Computer: Definition, Characteristics, Capabilities and Limitations. Components of a Computer, Memory Introduction and its Classifications.
Introduction to Software and its different types: System Software, Application software. Compiler, Interpreter and Assembler.

Unit-II Memory Unit and data representation:

Memory unit, unit- Bit, nibble, byte, word, kilo byte, Megabyte, Giga byte, Tera byte, Peta byte. Decimal Number System, Binary Number System, Converting Decimal to Binary, Hexadecimal Number System: Converting Binary to Hexadecimal, Hexadecimal to Binary, Converting Hexadecimal to Decimal, Converting Decimal to Hexadecimal, Octal Numbers: Binary to Octal Conversion. Binary Arithmetic (Addition/Subtraction/multiplication).

Unit-III: Windows Operating System: Overview

What is an operating system and basics of Windows, Using Mouse and Moving Icons on the screen, The My Computer Icon, The Recycle Bin, Status Bar, Start and Menu & Menu-selection, Running an Application, Windows Explorer Viewing of File, Folders and Directories, Creating and Renaming of files and folders, Opening and closing of different Windows, Parts of a Window, Windows Setting, Control Panel, Wall paper and Screen Savers, Setting the date and Sound, Creating Short cuts, Window accessories

Unit IV: Application Software: MS-Word and MS-Excel

Application Software: Starting word - Parts of word window - formatting features - menus, commands, Toolbars - File menu, Edit, view, insert, Format and tool menus - Working with text, tables - checking spelling and Grammars.

Creating Work Sheets - Formulas - Functions - Charts - Coping Data, between worksheets - Case studies pay bill, profit and loss accounts.

Unit-V- The Internet and WWW:

World Wide Web, Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net, .in etc.), Types of Networks, Internet Service Provider, client-server, search engine, Web Browsing software, Basic of electronic mail, Using Emails, Document handling

Books Recommended:
1. Digital Design- M. Morris Mano, Prentice Hall of India 2007
2. A. Goel, Computer Fundamentals, Pearson Education, 2010.
3. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
4. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007
5. E-Commerce Concepts, Models, Strategies-:-G.S.V.Murthy Himalaya Publishing House
6. E-Commerce :-Kamlesh K Bajaj and Debjani Nag

Computer Fundamentals: PRACTICAL

Practical exercises based on MS Office/ Open Office tools using document preparation and spreadsheet handling packages.

MS Word

1. Prepare **a grocery list** having four columns (Serial number, The name of the product, quantity and price) for the month of April, 06.

   • Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
   • The headings of the columns should be in 12-point and bold.
   • The rest of the document should be in 10-point Times New Roman.
   • Leave a gap of 12-points after the title.

2. Create a **telephone directory**.

   • The heading should be 16-point Arial Font in bold
   • The rest of the document should use 10-point font size
   • Other headings should use 10-point Courier New Font.
   • The footer should show the page number as well as the date last updated.

3. Design a **time-table form** for your college.

   • The first line should mention the name of the college in 16-point Arial Font and should be bold.
   • The second line should give the course name/teacher's name and the department in 14-point Arial.
   • Leave a gap of 12-points.
   • The rest of the document should use 10-point Times New Roman font.
   • The footer should contain your specifications as the designer and date of creation.

4. BPB Publications plans to release a new book designed as per your syllabus. Design the **first page of the book** as per the given specifications.

   • The title of the book should appear in bold using 20-point Arial font.
   • The name of the author and his qualifications should be in the center of the page in 16-point Arial font.
   • At the bottom of the document should be the name of the publisher and address in 16-point Times New Roman.
   • The details of the offices of the publisher (only location) should appear in the footer.

5. Create the following one-page documents.
   a. Compose a note inviting friends to a get-together at your house, including a list of things to bring with them.
   b. Design a certificate in landscape orientation with a border around the document.
   c. Design a Garage Sale sign.
   d. Make a sign outlining your rules for your bedroom at home, using a numbered list.

6. Create the following documents:

(a) A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.

(b) Use a newsletter format to promote upcoming projects or events in your classroom or college.

7. Convert following text to a table, using comma as delimiter
   Type the following as shown (do not bold).
   Color, Style, Item
   Blue, A980, Van
   Red, X023, Car
   Green, YL724, Truck
   Name, Age, Sex
   Bob, 23, M
   Linda, 46, F
   Tom, 29, M

MS Excel

1. Enter the Following data in Excel Sheet

	REGIONAL SALES PROJECTION					
State	**Qtr1**	**Qtr2**	**Qtr3**	**QTR4**	**Qtr Total**	**Rate Amount**
Delhi	2020	2400	2100	3000	15	
Punjab	1100	1300	1500	1400	20	
U.P.	3000	3200	2600	2800	17	
Haryana	1800	2000	2200	2700	15	
Rajasthan	2100	2000	1800	2200	20	

TOTAL
AVERAGE
(a) Apply Formatting as follow:

    i. Title in TIMES NEW ROMAN
    ii. Font Size - 14
    iii. Remaining text - ARIAL, Font Size -10
    iv. State names and Qtr. Heading Bold, Italic with Gray Fill Color.
    v. Numbers in two decimal places.
    vi. Qtr. Heading in center Alignment.
    vii. Apply Border to whole data.

(b) Calculate State and Qtr. Total
(c) Calculate Average for each quarter
(d) Calculate Amount = Rate * Total.

2. Given the following worksheet

A	B	C	D
Roll No.	Name	Marks	Grade
1001	Sachin	99	
1002	Sehwag	65	
1003	Rahul	41	
1004	Sourav	89	
1005	Har Bhajan	56	

Calculate the grade of these students on the basis of following guidelines:

If Marks	Then Grade
>= 80	A+
>= 60 < 80	A
>= 50 < 60	B
< 50	F

3. Given the following worksheet

A	B	C	D	E	F	G	H
1	**Salesman**		**Sales in (Rs.)**				
2	No.	Qtr1	Qtr2	Qtr3	Qtr4	Total	Commission
3	S001	5000	8500	12000	9000		
4	S002	7000	4000	7500	11000		
5	S003	4000	9000	6500	8200		
6	S004	5500	6900	4500	10500		
7	S005	7400	8500	9200	8300		
8	S006	5300	7600	9800	6100		

Calculate the commission earned by the salesmen on the basis of following Candidates:	
If Total Sales	**Commission**
< 20000	0% of sales
>= 20000 and < 25000	4% of sales
> 25000 and < 30000	5.5% of sales
> 30000 and < 35000	8% of sales
>= 35000	11% of sales

The total sales is the sum of sales of all the four quarters.

4. A company XYZ Ltd. pays a monthly salary to its employees which consists of basic salary, allowances & deductions. The details of allowances and deductions are as follows:
Allowances
    • HRA Dependent on Basic
    30% of Basic if Basic <=1000

25% of Basic if Basic>1000 & Basic<=3000

20% of Basic if Basic >3000

• DA Fixed for all employees, 30% of Basic

• Conveyance Allowance Rs. 50/- if Basic is <=1000 Rs. 75/- if Basic >1000 & Basic<=2000

Rs. 100 if Basic >2000

• Entertainment Allowance NIL if Basic is <=1000 Rs. 100/- if Basic > 1000

Deductions

• Provident Fund 6% of Basic

• Group Insurance Premium Rs. 40/- if Basic is <=1500

Rs. 60/- if Basic > 1500 & Basic<=3000

Rs. 80/- if Basic >3000

Calculate the following:

Gross Salary = Basic + HRA + DA + Conveyance + Entertainment

Total deduction = Provident Fund + Group Insurance Premium

Net Salary = Gross Salary – Total Deduction

5. The following table gives year wise sale figure of five salesmen in Rs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

(a)   Calculate total sale year wise.
(b)   Calculate the net sale made by each salesman
(c)   Calculate the maximum sale made by the salesman
(d)   Calculate the commission for each salesman under the condition.
       (i) If total sales >4,00,000 give 5% commission on total sale made by the salesman.
       (ii) Otherwise give 2% commission.
(e)   Draw a bar graph representing the sale made by each salesman.
(f)   Draw a pie graph representing the sale made by salesman in 2000.

Core Courses (For Minor)
Course Code: CSMIN-02: Database Management Systems
(Credits: Theory-3; Practical-1)

Semester: II

Database Management Systems: THEORY

Course Objective

The course introduces the students to the fundamentals of database management system and the methods to store and retrieve data. It enables the student to understand, how data is organized for efficient storage and retrieval.

Course Learning Outcomes

On successful completion of this course, a student will be able to:

- differentiate between database systems and file systems.
- describe the features of database management systems.
- analyze the problem and arrive at an information model in the form of an ER diagram.
- normalize a database.
- transform an ER model into a relational database schema.
- to implement SQL commands

Unit – I

DBMS Definition, Characteristics of DBMS, Application and advantages of DBMS, Instances, Schemas and Database States, Three Levels of Architecture, Data Independence, DBMS languages, Data Dictionary, Database Users, Data Administrators.

Unit – II

Data Models, types and their comparison, Entity Relationship Model, Entity Types, Entity Sets, Attributes and its types, Keys, E-R Diagram, Data Integrity

Unit – III

RDBMS –Concept, Components and Codd's rules, Relational Algebra (selection, projection, union, intersection, Cartesian product, Different types of Joins like theta join, equi-join, natural join, outer join)

Unit – IV

Functional Dependencies, Good & Bad Decomposition, Anomalies as a database: A consequences of bad design, Normalization: 1NF, 2NF, 3NF, BCNF

Unit – V

Introduction to SQL, DDL, DML, and DCL statements, Creating Tables, Adding Constraints, Altering Tables, Update, Insert, Delete & various Form of SELECT- Simple, Using Special Operators for Data Access. Aggregate functions, forms and reports.

Book Recommended:

1. Elmasri, R., &Navathe, S.B. (2015). *Fundamentals of Database Systems.* 7th edition. Pearson Education.

Additional Resources

1. Date, C. J. (2004). *An Introduction to database systems.* 8th edition. Pearson Education.

2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). *Database System Concepts.* 6th edition. McGrawHill.

Database Management Systems: PRACTICAL

1. Consider Employee table

EMPNO	EMP_NAME	DEPT	SALARY	DOJ	BRANCH
E101	Amit	Production	45000	2000-03-12	Bangalore
E102	Amit	HR	70000	2002-06-03	Bangalore
E103	Sunita	Management	120000	2001-01-11	Mysore
E104	Sunita	IT	67000	2001-08-01	Mysore
E105	Mahesh	Civil	145000	2003-09-20	Mumbai

Write SQL queries to perform the following

1. Display all the fields of employee table

2. Retrieve employee number and their salary

3. Retrieve average salary of all employees

4. Retrieve number of employees

5. Retrieve distinct number of employees

6. Retrieve total salary of employee group by employee name and count similar names

7. Retrieve total salary of employee which is greater than >120000

8. Display name of employee in descending order

9. Display details of employee whose name is AMIT and salary greater than 50000.

2. Create and use the following database schema to answer the given queries.

EMPLOYEE Schema

Field	Type	NULL KEY
Eno	Char(3)	NO PRI
Ename	Varchar(50)	NO
Job_type	Varchar(50)	NO
Manager	Char(3)	Yes
Hire_date	Date	NO
Dno	Integer	YES FK
Commission	Decimal(10,2)	YES
Salary	Decimal(7,2)	NO

DEPARTMENT Schema

Field	Type	NULL KEY
Dno	Integer	No PRI
Dname	Varchar(50)	Yes

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.

2. Query to display unique Jobs from the Employee Table.

3. Query to display the Employee Name concatenated by a Job separated by a comma.

4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.

5. Query to display the Employee Name and Salary of all the employees earning more than $2850.

6. Query to display Employee Name and Department Number for the Employee No= 7900.

7. Query to display Employee Name and Salary for all employees whose salary is not in the range of $1500 and $2850.

8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.

9. Query to display Name and Hire Date of every Employee who was hired in 1981.

10. Query to display Name and Job of all employees who don't have a current Manager.

11. Query to display the Name, Salary and Commission for all the employees who earn commission.

12. Sort the data in descending order of Salary and Commission.

13. Query to display Name of all the employees where the third letter of their name is ‗A'.

14. Query to display Name of all employees either have two ‗R's or have two ‗A's in their name and are either in Dept No = 30 or their Manger's Employee No = 7788.

15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.

Core Courses (For Minor)
Course Code: CSMIN-03: Web Design using HTML
(Credits: Theory-3; Practical-1)

Semester: III

Web Design using HTML: THEORY

Course Objective

The course introduces the students to planning and designing effective web pages, implementing web pages by writing HTML, CSS code and JavaScript and producing a functional website.

Course Learning Outcomes

On successful completion of this course, a student will be able to:

- define the principle and basics of Web page design
- visualize the basic concept of HTML.
- recognize the elements of HTML.
- apply basic concept of CSS and JavaScript.
- publish the web pages.

Unit 1: Introduction:

Basic HTML Concepts, HTML tags, Paragraphs, Formatted and Unformatted Text, Hyperlink, Font, Lists and its attributes, Relative Links, Absolute Links, Link Attributes, Using the ID Attribute to Link Within a Document.

Unit 2: Designing Web Pages:

Image attributes, inserting an Image in a Page, Web Graphic Format (GIF, JPEG, and PNG), Inline Images Using Images as Links, inserting an Image in the Background, comments, inserting Audio and Video files in a page, Working with <div> tags.

Unit 3: Tables and Forms:

Creating a Table, Table Headers, Captions, Spanning Multiple Rows/Columns, Styling Table

How HTML Forms work, inserting a form, Using Text fields, Providing Checkboxes and Radio Buttons, creating form lists and Menus, activating forms with buttons, Using Hidden fields and File fields.

Unit 4: Introduction to CSS

Concept of CSS, creating style sheet, CSS properties, CSS styling (background, text format, controlling fonts), working with block elements and objects, working with lists and tables, CSS id and class, box model (introduction, border properties, padding properties, margin properties).

Unit-5: JavaScript Fundamentals:

Data types and variables, functions, events, controlling program flow, JavaScript object model, built-in objects and operators.

Book Recommended:

1. Boehm, A., &Ruvalcaba, Z. (2018). *Munarch's HTML5 and CCS* (4th Edition). Mike Murach& Associates.

2. Introduction to HTMLand CSS- -- O'Reilly, 2010

3. Jon Duckett, HTML and CSS John Wiely, 2012

4. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer W. Willard,2009

Web Design using HTML: PRACTICAL

1. Create HTML document with following formatting – Bold, Italics, Underline, Colors, Headings, Title, Font and Font Width, Background, Paragraph, Line Brakes, Horizontal Line, Blinking text as well as marquee text.

2. Create HTML document with Ordered and Unordered lists, Inserting Images, Internal and External linking
3. Create HTML document with Table:
4. Create Form with Input Type, Select and Text Area in HTML.
5. Create an HTML containing Roll No., student 's name and Grades in a tabular form.
6. Create a website of 6 – 7 pages with different effects as mentioned in above problems.

7. Create a form using HTML which has the following types of controls:

     Text Box, Option/radio buttons, check boxes, Reset and Submit buttons

Create JavaScript event driven program for the following:

8. Print a table of numbers from 5 to 15 and their squares and cubes using alert.

9. Print the largest of three numbers.

10. Find the factorial of a number n.

11. Enter a list of positive numbers terminated by Zero. Find the sum and average of these numbers.

12. A person deposits Rs 1000 in a fixed account yielding 5% interest. Compute the amount in the account at the end of each year for n years.

13. Read n numbers. Count the number of negative numbers, positive numbers and zeros in the list.

Core Courses (For Minor)
Course Code: CSMIN-04: PHP Programming
(Credits: Theory-3; Practical-1)

Semester: IV

PHP Programming: THEORY

Course Objective

This course is designed as a first course in PHP programming. The course focuses on the principle of server-side scripting and building dynamic web applications.

Course Learning Outcomes

On successful completion of this course, a student will be able to:

- write PHP scripts to handle HTML forms.
- write regular expressions including modifiers, operators, and meta-characters.
- write PHP programs that use various PHP library functions, and that manipulate files and directories.
- create a dynamic web site employing server-side scripting.

Unit 1: Introduction to PHP:

PHP introduction, inventions and versions, important tools and software requirements (like Web Server, Database, Editors etc.). PHP with other technologies, scope of PHP. Basic Syntax, PHP variables and constants Types of data in PHP, Expressions, scopes of a variable (local, global), PHP Operators: Arithmetic, Assignment, Relational, Logical operators, Bitwise, ternary and MOD operator. PHP operator Precedence and associativity

Unit 2:

Handling HTML form with PHP: Capturing Form Data, GET and POST form methods, Dealing with multi value fields, Redirecting a form after submission, Validating data: Using Filters and common ctype() functions

Unit 3:

PHP conditional events and Loops: PHP IF Else conditional statements (Nested IF and Else), Switch case, while, For and Do While Loop, Goto, Break, Continue and exit.

Unit 4:

PHP Functions: Function, Need of Function, declaration and calling of a function, PHP Function with arguments, Default Arguments in Function, Function argument with call by value, call by reference, Scope of Function Global and Local

Unit 5:

MySQL Basics and Database Connectivity with MySQL:

MySQL introduction Creating a database, creating a database table, CRUD in MySQL, populating a MySQL database, Relational database tables, Populating the relational table.
Connecting to MySQL Database with PHP, performing basic database operation (Insert, Select, retrieving data from MySQL, working with retrieved data, creating records with PHP, Updating and deleting records with PHP.

Reference Books:

1. Steven Holzner, "PHP: The Complete Reference Paperback", McGraw Hill Education (India), 2007.

2. Timothy Boronczyk, Martin E. Psinas, "PHP and MYSQL (Create-Modify-Reuse)", Wiley India Private Limited, 2008.

3. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5", 3rd Edition Paperback, O'reilly, 2014.

PHP Programming: PRACTICAL

Software Lab Based on PHP:

1. Create a PHP page using functions for comparing three integers and print the largest number.
2. Write a function to calculate the factorial of a number (non-negative integer). The function accepts the number as an argument.
3. WAP to check whether the given number is prime or not.
4. Create a PHP page which accepts string from user. After submission that page displays the reverse of provided string.
5. Write a PHP function that checks if a string is all lower case.
6. Write a PHP script that checks whether a passed string is palindrome or not? (A palindrome is word, phrase, or sequence that reads the same backward as forward, e.g., madam or nurses run)
7. WAP to sort an array.
8. Write a PHP script that removes the whitespaces from a string.
Sample string: 'The quick " " brown fox' Expected Output:Thequick""brownfox

Course Code: CSMIN-05: Internet Technologies
(Credits: Theory-3; Practical-1)

Semester V

Internet Technologies: THEORY

Course Objective

The objective of this course is to provide students with a comprehensive understanding and practical experience in key programming concepts and tools essential for developing dynamic and interactive web applications.

Course Learning Outcomes

On successful completion of the course, students will be able to:
- Master object-oriented programming concepts in Java, Demonstrate proficiency in JavaScript syntax.
- Understand JDBC fundamentals to establish database connectivity.
- Design dynamic web pages using JavaServer Pages (JSP), implement MVC architecture, and handle database access for web application development.
- Develop a strong understanding of JavaBeans fundamentals, including creating components, packaging them into JAR files, and integrating them with databases.

UNIT 1: Java: Use of Objects, Array and ArrayList class

UNIT 2: JavaScript: Data types, operators, functions, control structures, events and event handling.

UNIT 3: JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

UNIT 4: JSP: Introduction to JavaServer Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

UNIT 5: Java Beans: Java Beans Fundamentals, JAR files, Introspection, Developing a simple Bean, Connecting to DB

Recommended Books:
1. Ivan Bayross, Web Enabled Commercial Application Development Using Html, Dhtml,javascript, Perl Cgi , BPB Publications, 2009.
2. Cay Horstmann, BIG Java, Wiley Publication , 3rd Edition., 2009
3. Herbert Schildt , Java 7, The Complete Reference, , 8th Edition, 2009.
4. Jim Keogh ,The Complete Reference J2EE, TMH, , 2002.
5. O'Reilly , Java Server Pages, Hans Bergsten, Third Edition, 2003.

Internet Technologies Lab
Practical

1. Develop static pages (using Only HTML) of an online book store. The website should consist the following pages.
   a) Home page
   b) Registration and user Login
   c) User Profile Page
   d) Books catalog
   e) Shopping Cart
   f) Payment By credit card
   g) Order Conformation
2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
3. Create and save an XML document on the server, which contains 10 users information. Write a program, which takes User Id as an input and returns the user details by taking the user information from the XML document.
4. Install TOMCAT web server. Convert the static web pages of assignments 2 into dynamic web pages using servlets and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
5. Redo the previous task using JSP by converting the static web pages of assignments 2 into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. Follow the MVC architecture while doing the website.

Course Code: CSMIN-06: Artificial Intelligence
(Credits: Theory-3; Practical-1)

SEMESTER VI

Artificial Intelligence: Theory

Course Objective

This course introduces the basic concepts and techniques of Artificial Intelligence (AI). The course aims to introduce intelligent agents and reasoning, heuristic search techniques, game playing, knowledge representation, reasoning with uncertain knowledge.

Course Learning Outcomes

On successful completion of this course, students will be able to:

- Identify problems that are amenable to solution by specific AI methods
- Represent knowledge in Prolog and write code for drawing inferences.
- Identify appropriate AI technique for the problem at hand
- Compare strengths and weaknesses of different artificial Intelligence techniques.

UNIT 1: Introduction

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

UNIT 2: Problem Solving and Searching Techniques

Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

UNIT 3: Knowledge Representation

Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs.

Programming in Logic (PROLOG)

UNIT 4: Dealing with Uncertainty and Inconsistencies

Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

UNIT 5: Understanding Natural Languages

Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

BOOKS RECOMMENDED:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.

Artificial Intelligence Lab
1. Write a prolog program to calculate the sum of two numbers.
2. Write a prolog program to find the maximum of two numbers.
3. Write a prolog program to calculate the factorial of a given number.
4. Write a prolog program to calculate the nth Fibonacci number.
5. Write a prolog program, insert_nth(item, n, into_list, result) that asserts that result is the list into_list with item inserted as the n'th element into every list at all levels.
6. Write a Prolog program to remove the Nth item from a list.
7. Write a Prolog program, remove-nth(Before, After) that asserts the After list is the Before list with the removal of every n'th item from every list at all levels.
8. Write a Prolog program to implement append for two lists.
9. Write a Prolog program to implement palindrome(List).
10. Write a Prolog program to implement max(X,Y,Max) so that Max is the greater of two numbers X and Y.
11. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List.
12. Write a Prolog program to implement sumlist(List,Sum) so that Sum is the sum of a given list of numbers List.
13. Write a Prolog program to implement two predicates evenlength(List) and oddlength(List) so that they are true if their argument is a list of even or odd length respectively.
14. Write a Prolog program to implement reverse(List,ReversedList) that reverses lists.
15. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List using cut predicate.
16. Write a Prolog program to implement GCD of two numbers.
17. Write a prolog program that implements Semantic Networks/Frame Structures.

Core Courses (For Minor)
Course Code: CSMIN-07: Machine Learning
(Credits: Theory-3; Practical-2)

SEMESTER VII

Machine Learning: Theory

Course Objective
       The course aims at introducing the basic concepts and techniques of machine learning so that a student can apply machine learning techniques to a problem at hand.

Course Learning Outcomes
       On successful completion of this course, the student will be able to:
- Differentiate between supervised and unsupervised learning tasks.
- Differentiate between linear and non-linear classifiers.
- Describe theoretical basis of SVM
- Implement various machine learning algorithms learnt in the course.

UNIT 1: Introduction: Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

UNIT 2: Linear Regression: Prediction using Linear Regression, Gradient Descent, Linear Regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.

UNIT 3: Logistic Regression: Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

UNIT 4: Regularization: Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

UNIT 5: Classification: Introduction to Decision trees, Naive Bayes classifier, k-nearest neighbor classifier, perceptron, multilayer perceptron, neural networks, back-propagation algorithm, Support Vector Machine (SVM), Kernel functions.

Suggested Books:
1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.

2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.

3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

Machine Learning Lab

For practical Labs for Machine Learning, students may use softwares like MABLAB/Octave or Python. For later exercises, students can create/use their own datasets or utilize datasets from online repositories like UCI Machine Learning Repository (http://archive.ics.uci.edu/ml/).

1. Perform elementary mathematical operations in Octave/MATLAB like addition, multiplication, division and exponentiation.
2. Perform elementary logical operations in Octave/MATLAB (like OR, AND, Checking for Equality, NOT, XOR).
3. Create, initialize and display simple variables and simple strings and use simple formatting for variable.
4. Create/Define single dimension / multi-dimension arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.
5. Use command to compute the size of a matrix, size/length of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current scope.
6. Perform basic operations on matrices (like addition, subtraction, multiplication) and display specific rows or columns of the matrix.
7. Perform other matrix operations like converting matrix data to absolute values, taking the negative of matrix values, additing/removing rows/columns from a matrix, finding the maximum or minimum values in a matrix or in a row/column, and finding the sum of some/all elements in a matrix.
8. Create various type of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.
9. Generate different subplots from a given plot and color plot data.
10. Use conditional statements and different type of loops based on simple example/s.
11. Perform vectorized implementation of simple matrix operation like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.
12. Implement Linear Regression problem. For example, based on a dataset comprising of existing set of prices and area/size of the houses, predict the estimated price of a given house.
13. Based on multiple features/variables perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built – predict the price of a house.
14. Implement a classification/ logistic regression problem. For example based on different features of students data, classify, whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.
15. Use some function for regularization of dataset based on problem 14.