ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

M.Sc. COMPUTER SCIENCE

2nd Semester

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M.Sc. Computer Science 2nd Semester

Semester II / M.Sc. Computer Science

Course Structure

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	T	P	C
Theory						
1	MCS182201	Data Structures	3	1	0	4
2	MCS182202	Database Management System/ RDBMS	3	1	0	4
3	MCS182203	Data Communication & Computer Networks	3	1	0	4
4	MCS182204	Theory of Computation	3	1	0	4
Practical						
1	MCS182215	Lab II: Python Programming and SQL	0	0	4	2
Total			12	4	4	**18**
Total Contact Hours per week : 20						
Total Credit: 18						

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182201	Data Structures	3-1-0	4

Module 1: Basics of Data Structures

Arrays and Strings; Linear Data Structures – Stacks, Queues and Circular Queues: Operations and Applications; Linked Lists - Operations, and Doubly Linked List; Binary Tree, Binary Search Tree; Traversal Circular Linked Lists , Insertion and Deletion in Binary Search Trees

Module 2: Dictionary ADT

Search trees, balancing of search trees – AVL trees, B Trees, Red-Black trees, multi way search trees, 2-3 trees, 2-3-4 trees, Splay trees, Insertion and Deletion in each of the above data structures.

Module 3 : Sorting and Searching Techniques
Insertion Sort, Bubble sort, Merge Sort, Quick Sort, Heap sort, Shell sort, Radix sort, Searching – Linear, Binary, Hashing – hash functions and their computations.

Module 4: Priority Queue ADT

Binary heaps, heap operations, implementation and applications; Priority queue operations, and double-ended priority queues; min (max) heaps, binomial heap, fibonacci heap and its amortized analysis.

Module 5: Graphs

Representation and Traversal, Basic Algorithms.

Text Books:

1. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum, "Data Structures Using C and C++", PHI
2. Seymour Lipschutz, "Data Structures", Schaum's Outlines

Reference Books:

1. Reema Thareja, "Data Structures Using C", Oxford University Press
2. A A Puntambekar, "Data Structures", Technical Publications, Pune

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182202	Database Management System/RDBMS	3-1-0	4

Module 1: Relational model, relational algebra, and relational calculus :
Relational model concepts, relational databases and schemas; Relational algebra operations, queries in relational algebra; overview of relational calculus; Commercial query language SQL- data definition, constraints, SQL queries, insertion, deletion, updation.

Module 2: Modeling:
introduction, The E-R model, E-R diagrams, design of database with E-R model, Transformation of ER model to relational schema.

Module 3: Normalization and functional dependencies:
design guidelines, functional dependencies – equivalence of sets of functional dependencies, cover, minimal cover; normal forms- 1NF, 2NF, 3NF, BCNF, 4 NF, dependency-preserving property, lossless join property, algorithms to ensure dependency -preserving property and lossless join property.

Module 4: System implementation techniques:
Query processing and optimization- translation between SQL queries and relational algebra ; Transaction processing- transaction and system concepts, desirable properties, schedules and recoverability; Concurrency control- locking techniques, concurrency control based on timestamp ordering, multiversion concurrency control techniques; Database recovery- concepts and techniques, recovery in multidatabase systems; Security and authentication- issues, access control techniques, introduction to multilevel security.

Module 5: Object oriented database systems:
Concepts of object-oriented databases; Standards, languages and design; Object relational database systems.

Module 6: Distributed databases:
Concepts; Data fragmentation, replication, and allocation techniques; Types of distributed database systems; Query processing in distributed databases; Overview of concurrency control and recovery in distributed databases.

Module 7: Image, multimedia, and spatial databases:
Concepts of Image, multimedia, and spatial databases; Content-based indexing and retrieval, Indexing techniques- R trees, R+ trees, KD trees.

Recommended Books:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems", Pearson Education.
2. C. J. Date, "An Introduction To Database Systems", Pearson Education.
3. D. Stamper and W. Price, "Database Design And Management- An Applied Approach", McGraw Hill.
4. C. S. R. Prabhu, "Object-Oriented Database Systems- Approaches And Architectures", PHI.
5. J. D. Ullman, "Principles of Database Systems", Galgotia.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182203	**Data Communication and Computer Networks**	**3-1-0**	**4**

Module 1:
Data Communication concepts and terminologies: Data representation, Data transmission, Transmission channels, Signal encoding, Transmission impairments, Transmission media: Guided transmission media (*Twisted pair, Coaxial and Optical fiber);* Wireless transmission (*Terrestrial microwave, satellite microwave, Broadcast Radio and Infrared)*

Module 2:
Asynchronous and Synchronous transmission, Baseband and Broadband transmission, Modulation methods, Modems, Multiplexing.

Module 3:
Evolution of computer networks: Circuit switching, Development of packet switching: 1961-1972, Proprietary networks and internetworking: 1972-1980, Proliferation of networks: 1980-1990. The internet explosion: 1990s.

Module 4:
Network standards and protocols: The IEEE standards, OSI 7 layer model, TCP/IP protocol suit. Data Link Layer: Frame design, Flow control, Error handling, HDLC, PPP, Sliding window protocol.

Module 5:
Network Layer: IP, X.25, Frame Relay, ATM, Routing, Queuing theory. Transport Layer: TCP, UDP, Congestion control, Flow control, Socket interface. Application Layer: SNMP, Authentication, Encryption, Web and HTTP, FTP, Email, DNS, Network File System (NFS) and File sharing, Remote Procedure Calling (RPC).

Module 6:
Local Area Network (LAN): Needs, Architecture and Technology, Ethernet: CSMA/CD operation, parameters and specifications, Cabling: 10Base5, 10Base2, 10BaseT, 10BaseF, Hubs, patch panels and wiring closets. Bridges, Switches, 100BaseT, 100BaseVGANY,Gigabit Ethernet. FDDI, Token Ring, Wireless, ISDN, B-ISDN

Module 7:
VSAT technology, Wireless LAN: Technologies, IEEE standards and protocols. Basics of Network management and Security, Infrastructure for network management and security.

Recommended Readings:

1. Stallings, W.; Data and Computer Communications; Prentice Hall of India.

2. Tanenbaum A.S.; Computer Networks; Prentice Hall of India.

3. Kurose and Ross; Computer Networking; Addison Wesley

4. Prakash C. Gupta; Data Communication; Prentice Hall of India

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182204	Theory of Computation	3-1-0	4

Module 1: Theory of Automata
Description of an Automaton, Definition of a Finite Automaton, Transition System, Properties of a Transition Function, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, Equivalence of DFA and NDFA, Mealy and Moore Model of Automaton, Minimization of a Finite Automata.

Module 2: Formal Languages, Regular Sets & Regular Grammars
Definition of formal languages with illustration, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Various Operations on Languages, Languages and their corresponding Automata; Regular Sets & Regular Grammars: Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma.

Module 3: Context-free Languages
Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars: Chomsky Normal Form & Grebaich Normal Form, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages.

Module 4: Pushdown Automata Turing Machine and Linear Bounded Automata
Pushdown Automata: Definition, Acceptance by pushdown automata, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata; Turing machine Model: Representation of Turing Machine, Language Acceptability by Turing Machine, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machine.

Recommended Books

1. Mishra, K. L. P.; N. Chandrasekaran, Theory of Computer Science (Latest Edition), New Delhi: BPB Publications, Prentice-Hall of India, 1998

2. Hopcraft, H. E.; J. D. Ullman, Introduction to Automata Theory, Languages and Computation, New Delhi: Narosa Publications, 2001

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182215	Lab II: Python Programming and SQL	0-0-4	2

Programming Techniques - Python

Module 1:

Structured Programming and Object Oriented Programming paradigms.

Getting started with Python programming

Running code in the iterative shell; Input, Processing and output; Editing, Saving and running a script.

Module 2:

Strings, Assignments and comments, Data types, variables, Docstrings, character sets, Arithmetic expressions, Type conversions

Module 3:

Calling Functions: Arguments and return types; math module, Main module, Program format and Structure;

Module 4:

Control statements: if and if-else statements, multi-way if statements, for and while loop

Module 5: Lists and Dictionaries

Module 6: Design with classes

Recommended Books:

1. Fundamentals of PYTHON, K.A. Lambert and B.L.Juneja, Cencage Publication
2. An introduction to Python, G.V.Rossum, SPD publication

Using PYTHON

List of Experiments: (Any 15)

1. Write a program to calculate salary of an employee given his basic pay (to be entered by the user), HRA=10% of basic pay, TA=5% of basic pay. Define HRA and TA as constants and use them to calculate the salary of the employee.
2. Write a program to calculate the bill amount for an item given its quantity sold, value, discount and tax.
3. Write a program the distance between two points.

4. Write a program to calculate the roots of a quadratic equation.

5. Write a program to enter the marks of a student in four subjects. Then calculate the total and aggregate, and display the grade obtained by the student. If the student scores an aggregate greater than 75%, then the grade is Distinction. If aggregate is greater than equal 60% and less than 75%, then the grade is First Division. If aggregate is greater than equal 50% and less than 60%, then the grade is Second Division. If aggregate is greater than equal 40% and less than 50%, then the grade is Third Division. Else the grade is Fail.

6. Write a program to calculate tax given the following conditions:
   If income is less than 1, 50, 000 then no tax.
   If income is 1, 50, 001 – 3, 00, 000 then charge 10% tax.
   If income is 3, 00, 001 – 5, 00, 000 then charge 20% tax.
   If income is above 5, 00, 000 then charge 30% tax.

7. Write a program to calculate the sum of numbers from m to n.

8. Write a program to find whether the given number is an Armstrong number.

9. Write a program to enter a binary number and convert it into decimal number.

10. Write a program to calculate the factorial of a number.

11. Write a program to generate calendar of a given month given the start-day and the number of days in that month.

12. Write a program to sum the series:

    $1/2 + 2/3+ \dots\dots\dots\dots\dots\dots + n/ (n+1)$

13. Write a program using function to calculate simple interest. Suppose the customer is a senior citizen. He is being offered 12% rate of interest for all other customers, the rate of interest is 10%.

14. Write a program using function to print the Fibonacci series.

15. Write a program using function to calculate compound interest given the principal, rate of interest and number of years.

16. Write a program to swap two integers using call by reference method of passing arguments to a function.

17. Write a program to create a list of numbers in the range 1 to 10. Then delete all the even numbers from the list and print the list.

18. Write a program to print index at which a particular value exists. If the value exists at multiple locations in the list, then print al the indices. Also, count the number of times that value is repeated in the list.

19. Write a program that creates a dictionary of radius of a circle and its circumference.

20. Write a program that has a class Person storing name and date of birth of a person. The program should subtract the date of birth from today's date to find out whether a person is eligible to vote or not.

21. Write a program that has classes such as student, course and department. Enroll a student in a course of a particular department.

22. Write a program that has an abstract class polygon. Derive two classes rectangle and triangle from polygon and write methods to get the details of their dimensions and hence calculate the area.

SQL(using MySQL)

Module -1

Getting started with MySQL: Components of SQL (DDL, DML, DCL, DQL), Using Databases: Creating Database, Show Database command, Use Command, Database ownership, Backing up databases and their content, restoring and destroying database.

Module -2

Basic SQL elements and Tables in MySQL, (Table creation rules), Performing operation on table data , Restructuring Tables in MySQL(Adding new columns, Dropping a column, Modify Column, Renaming Columns, Alter table command)

Module -3

Running Calculation on table data using Operators

Module -4

Joins and Views: Joining Multiple tables using inner join, outer join, cross join, equi join, self join.View creation and Destroying.

Recommended Books:

1. Herbert Shield : The complete Reference to Java, Tata McGraw Hill
2. Head First Java, O'Reilly Series
3. Ivan Bayross, Cynthia Bayross, "MySQL 5.1 for Professionals", SPD

Using SQL

List of Experiments:

1. Create database TOYSHOP and table TOY using SQL command of the following columns: Sno, Toy_name, Category, Cost, Quantity, Starting_Age and Ending_Age.

a. Take appropriate data types and constraints while creating the table.
b. Insert at least 5 data records into the TOY table.
c. Write a command to describe the structure of the table.
d. Show all records.
e. Modify the column Cost as Float.
f. Add one more column in the above table as Discount.
g. Rename the table column Cost to Price.
h. Drop the column Starting_Age.
i. Drop the constraint in the field Sno.
j. Delete the records from the table.

2. **Create a table MEMBER under SOCIETY database using SQL command of the following columns: mem_code, mem_name, mem_add, mem_ph, no_of_bk, no_of_iss.**

a. Take appropriate data types and constraints while creating the table.
b. Add new field F_no_mem of numeric type and width is 3.
c. Insert at least 6 records.
d. Add the following constraints:
   PRIMARY KEY and NOT NULL on the field mem_code.
e. Show the structure of the table.
f. List the record of the table.
g. Drop the primary key.
h. Delete the column mem_add.
i. Delete one row.
j. Display the records from the table.

3. **Create a table STUDENTS using SQL command of the following columns: No, Name, Age, Dept, DateOfAdm, Fee and Sex.**

a. Take appropriate data types and constraints while creating the table.
b. To insert 5/6 records into the table.
c. To show all information about the students of History department.
d. To list the names of female students who are in Hindi department.
e. To list the names of all students with their date of admission in ascending order.
f. To display student's name, fee, age for male students only.
g. To count the numbers of students with age<23.
h. Modify the rows for computer department's fees by increasing Rs. 100.
i. To insert a new row in the STUDENT table with the following data:
   9, 'Zaheer', 36, 'computer', '12-Mar-95', 230, 'M'.
j. To display the No and Name of students whose name started with alphabet 'R'.

4. **Create a table SALARY using SQL command of the following columns: SNo, Name, Basic, Department, DateOfAppointment, Age and Sex.**
a. Take appropriate data types and constraints while creating the table.

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b. To insert 5/6 records into the table.

c. List the names of employees who are more than 35 years old.

d. Display the report, listing Name, Basic, Department and Annual Salary.

e. To count the number of employees who is either working in Personnel or Computer Department.

f. To insert a new row in the STUDENT table with the following data:
   11, 'VIJAY', 29300, 'Finance', '2008-07-13', 38, 'M'.

g. To find the maximum and minimum salary of an employee.

h. To display the name of employee name who's Annual Salary is not in between 15000 and 25000.

i. To display Name and Annual Salary of an employee who's SNo are 3, 5 and 7.

j. To display the SNo, Name and Annual Salary whose Name's second character is an alphabet 'a'.

5. **Create a table MASTER using SQL command of the following columns: No, Name, Age, Department, DateOfJoin, Salary and Sex.**

   a. Take appropriate data types and constraints while creating the table.

   b. To insert 5/6 records into the table.

   c. To show all information about History department.

   d. To list the names of female teachers who are in Maths department.

   e. To list names of all teachers with their date of join in ascending order.

   f. To display teacher's name, salary, age for male teacher only.

   g. To count the number of teachers with age >25.

   h. To list the master's information that is only in Computer and Maths department.

   i. To show the masters who joined in the year 2008.

   j. Update the salary by Rs. 3000 for male teachers.

6. **Create a table PRODUCT_MASTER using SQL command of the following columns: ProductNo, Description, ProfitPerCent, UnitMeasure, QtyOnHand, ReorderLevel, SellPrice and CostPrice.**

   a. Take appropriate data types and constraints while creating the table.

   b. To Insert 5/6 records into the table.

   c. List the products whose selling price is greater than 500 and less than or equal to 750.

   d. Calculate the average price of all the products.

   e. Find all the products whose QtyOnHand is less than reorder level.

   f. Determine the maximum and minimum price for the product prices.

   g. Listing of products whose selling price is more than 500 with the new selling price calculated as original selling price plus 15%.

   h. Printing the description and total quantity sold for each product.

   i. Finding the value of each product sold.

   j. Finding the non-moving products i.e. products not being sold.

7. **Create two tables named EMP_MASTER and BRANCH_MASTER using SQL command of the following columns:**

EMP_MASTER: Emp_No, Fname, Mname, Lname, Dept, Desig, Branch_No.
BRANCH_MASTER: Name, Branch_No.
   a. Take appropriate data types and constraints while creating the table.
   b. To Insert 5/6 records into the table.
   c. List the employee details with branch names to which they belong.
   d. List the employee details of only those employees who belong to the Administration department along with branch names to which they belong.
   e. List the employee details along with the contact details using Left Outer Join.
   f. List the employee details along with the contact details using Right Outer Join.
   g. Retrieve the employees holding the department.
   h. Listing the names of all employees having 'a' as the second letter in their names.
   i. Delete the records from both the table having Emp_No= 'E1234'
   j. Create a view V1 to display the details of Emp_No, Dept, Desig, Branch_No.

8. **Create a table CLIENT_MASTER using SQL command of the following columns: Client_No, Name, City, Pincode, State, BalDue with necessary data types and constraints while creating the table.**
   a. Insert at least 6 records into the table.
   b. Find out the names of all clients.
   c. List all the clients who are lived in Mumbai.
   d. Change the city of Client_No 'C00005' to 'Bangalore'.
   e. Change the Baldue of Client_No 'C00001' to Rs. 1000.
   f. Delete from Client_Master where the column state holds the value 'Tamil Nadu'.
   g. Add a column called 'Telephone' of data type 'number' and size ='10' to the Client_Master table.
   h. To list names of all clients with their Pincode in ascending order.
   i. Create a view V2 to display the details of Client Master.
   j. Destroy the table Client_Master along with its data.

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