




Board of Studies in Computer Science

Curriculum Structure and Syllabus for III and IV Semesters

Bachelor of Computer Applications

Choice Based Credit System


2024 - 25 onwards


Ashraf








ನೀತಿ ನಿರ್ದೇಶಕರು ಮತ್ತು
ಸದಸ್ಯರ ಸಮ್ಮೇಳನ
ಅಧ್ಯಕ್ಷರು
Jalagatta
10th Floor, W
Ramesh

Bachelor of Computer Applications

BOS in Computer Science Committee Members

| | | |
|-----|---|-------------|
| 1. | Dr. Kusuma Kumari B.M MCA Coordinator & Assistant Professor Department of Studies and Research in Computer Applications Tumkur University, Tumakuru | Chairperson |
| 2. | Dr. Ramani. R Assistant Professor and HOD Department of Computer Science University College of Science Tumkur University, Tumakuru | Member |
| 3. | Dr. Chandrali Baishya Associate Professor Department of Studies and Research in Mathematics Tumkur University, Tumakuru | Member |
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| 7 | Dr. Manjunath S Assistant Professor, Department of Computer Science Y.E.R Government First Grade College, Pavagada. | Member |
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| 10 | Dr. Sumathi R Gowda Assistant Professor Department of Computer Science, Karnataka State Open University, Muktha Gangotri, Mysore. | Member |
| 11. | Dr. Haridas S. Associate Professor Department of Computer Science Government First Grade College, Tumkur. | Member |

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SEMESTER – III

| Sl. No | Paper | Title of the Paper | Instruction Hrs. per Week | No. of Credits | Duration of the Exam. | Marks | | |
|--------------------------------------|------------|-------------------------------------|---------------------------|----------------|-----------------------|---------------------|--------------------|------------|
| | | | | | | Internal Assessment | Semester End Exam. | Total |
| 1 | BCAT 301 | Operating System Concepts and Linux | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 2 | BCAP 302 | Linux lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 3 | BCAT 303 | Database Management System | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 4 | BCAP 304 | Database Management System Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 5 | BCAT 305 | Python Programming | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 6 | BCAP 306 | Python Programming Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| Elective – 1 (Choose any one) | | | | | | | | |
| 7 | BCAT 307 A | System Software | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| | BCAT 307 B | Computer Architecture | | | | | | |
| | BCAT 307 C | Mobile Application Development | | | | | | |
| | BCAT 307 D | Probability and Statistics | | | | | | |
| TOTAL | | | | 21 | | | | 550 |

NOTE:

Theory: 1 Hr. = 1 Credit Practical: 2 Hrs. = 1 Credit

BCAT: BCA Core Paper Theory

BCAP: BCA Core Paper Practical

SEMESTER – IV

| Sl. No | Paper | Title of the Paper | Instruction Hrs. per Week | No. of Credits | Duration of the Exam. | Marks | | |
|--------------------------------------|------------|--------------------------------------|---------------------------|----------------|-----------------------|---------------------|--------------------|------------|
| | | | | | | Internal Assessment | Semester End Exam. | Total |
| 1 | BCAT 401 | Computer Networks | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 2 | BCAP 402 | Computer Networks Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 3 | BCAT 403 | Analysis and Design of Algorithm | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 4 | BCAP 404 | Analysis and Design of Algorithm Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| 5 | BCAT 405 | Web Technologies | 4 | 4 | 3 Hrs. | 20 | 80 | 100 |
| 6 | BCAP 406 | Web Technologies Lab | 4 | 2 | 3 Hrs. | 10 | 40 | 50 |
| Elective – 2 (Choose any one) | | | | | | | | |
| 7 | BCAT 407 A | Cloud Computing | 3 | 3 | 3 Hrs. | 20 | 80 | 100 |
| | BCAT 407 B | Cyber Security | | | | | | |
| | BCAT 407 C | Mobile Computing | | | | | | |
| | BCAT 407 D | Internet of Things | | | | | | |
| TOTAL | | | | 21 | | | | 550 |

NOTE:

Theory: 1 Hr. = 1 Credit

Practical: 2 Hrs. = 1 Credit

BCAT: BCA Core Paper Theory

BCAP: BCA Core Paper Practical

Internal Assessment Marks for Theory and Practical

| Internal Assessment Marks Allotment for Theory | |
|---|-----------|
| Internal Test 1 | 05 |
| Internal Test 2 | 05 |
| Assignment | 05 |
| Seminar/Quiz | 05 |
| TOTAL | 20 |

| Internal Assessment Marks Allotment for Practical | |
|--|-----------|
| Internal Test | 05 |
| Record and Attendance | 05 |
| TOTAL | 10 |

Evaluation Scheme for Lab Examination

| Assessment Criteria | |
|----------------------------|-----------------|
| Writing 2 Programs | 10 |
| Execution of 2 Programs | 20 |
| Viva | 10 |
| Total | 40 Marks |

| Third Semester | | | |
|--|----------|-----------|----|
| Subject Name: Operating System Concepts and Linux | | | |
| Subject code | BCAT 301 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. To understand the fundamental concepts and techniques of Operating Systems
2. To study the concepts in process management and concurrency control mechanisms
3. To understand the concepts in memory managements and deadlocks
4. To study on file management and storage structures
5. To familiarize Linux commands and shell programming

COURSE OUTCOMES:

At the end of the course students will be able to:

1. An ability to understand basic concepts of operating system.
2. An ability to describe process management, scheduling and concurrency control mechanisms.
3. An ability to analyze memory management and deadlocks.
4. An ability to compare various file systems and its operating systems examples
5. Ability to write Shell Programming using Linux commands

| | | |
|---------------|---|-----------------|
| Unit 1 | Introduction to Operating System | Hours 10 |
| | Definition - System Components - Operating System Services - System Calls and its types - Types of Operating System in various computing environments – Operating System Structure – Open-source Operating Systems. | |
| Unit 2 | Process Management and Deadlock | Hours 12 |
| | <p>Process Management: Process Concepts - Process definition - Process State - Process Control Block - Threads. Process Scheduling – Basic Concepts - Scheduling Criteria - Scheduling Algorithms (FCFS, SJF, Priority, Round- Robin)</p> <p>Thread – Overview – Benefits - User & Kernel Threads and Multithreading Models.</p> <p>Deadlocks –Characterization - Necessary Conditions - Resource Allocation graph - Detection (Single Instance and Multiple Instance) - Recovery (Process Termination and Resource Preemption).</p> | |
| Unit 3 | Memory, File and Disk Management | Hours 16 |
| | <p>Swapping - Contiguous Memory Allocation- Memory Protection, Memory Allocation - Fragmentation and Paging.</p> <p>Segmentation- Basic Method – Hardware - Protection and Sharing – Fragmentation – Demand Paging- Basic Concepts. Page Replacement algorithms (FIFO and LRU)</p> <p>File Management: File Concepts - Attributes – Operations – Types – Structure -</p> | |

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|---------------|---|-----------------|
| | Internal File Structure - Access Methods: Sequential – Direct – Indexed - Directory Structures – Single – level - Two-level - Tree Structured - Allocation Methods– Contiguous – Linked – Indexed - Free Space Management: Bit Vector - Linked List – Counting - Grouping. Disk Management- Disk Scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN). | |
| Unit 4 | Introduction To Linux and Linux Utilities | Hours 12 |
| | A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin. Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio | |
| Unit 5 | Shell Programming | Hours 10 |
| | Shell meaning & types; Introduction to shell scripting, shell variables, exporting shell variables, Escape mechanisms, Shell meta characters, read command, conditional statements, looping and case statements, expr statement, command line arguments, sleep and basename commands, Bourne Shell Commands, string handling, arrays, shell functions, shell programs to automate system tasks. | |

TEXT BOOKS:

1. Abraham Silberschatz, Greg Gagne, Peter Galvin. Operating Systems Principles. John Wiley Publications. 2006. 7th Edition.
2. The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.

REFERENCE BOOKS:

1. Andrew S Tanenbaum, Modern Operating Systems, Prentice Hall of India Learning. 2009. 3rd Edition.
2. Gary Nutt, Operating Systems. Pearson Education. 3rd edition.
3. D.M. Dhamdhare, Operating Systems: A Concept-based Approach, Tata McGraw-Hill Education-2012 ,3rd edition
4. Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

| Third Semester | | | |
|--------------------------------|----------|-----------|----|
| Subject Name: Linux Lab | | | |
| Subject code | BCAP 302 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

PART A

1. Study of Unix/Linux general purpose utility command list: man, who, cat, cd, cp, ps, ls, mv, rm, mkdir, rmdir, echo, more, date, time, kill, history, chmod, chown, finger, pwd, cal, logout, shutdown.
2. Write shell script to perform integer arithmetic operations.
3. Write a shell script that displays a list of all the files in the current directory.
4. Write a shell script to count lines, words & characters in its input. Without using wc command.
5. Write a shell program to find out reverse string of the given string and check the given string is palindrome or not.
6. Write a shell program to find out factorial of the given number.
7. Write a shell script to find out whether the given number is prime number or not.
8. Write a shell script to compute GCD & LCM of two numbers.
9. Write a shell script to print file names in directory showing date of creation & serial no. of file.
10. Write a shell script that delete all lines containing a specified word.

PART B

1. Write a shell program to concatenate to two strings given as input and display the resultant string along with its string length.
2. If the second filename exists, then the contents of the first filename should be appended to it. If the second file name does not exist then create a new file with the contents of the first file.
3. Write a shell script that computes the gross salary of a employee according to the following
 - 1) if basic salary is <1500 then HRA 10% of the basic and DA =90% of the basic.
 - 2) if basic salary is >=1500 then HRA 500 and DA =98% of the basic.
4. Write a shell script that accepts a file name, starting and ending line numbers as arguments and displays all the

lines between the given line numbers.

5. Write a shell script to convert binary to decimal and decimal to binary
6. Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
7. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
8. Write a shell script which reads the contents in a text file and removes all the blank spaces in them and redirects the output to a file.
9. Write a shell script that, given a file name as the argument will write the even numbered line to a file with name evenfile and odd numbered lines to a file called oddfile.
10. Write a shell script that counts English language articles (a, an, the) in a given text file.

| Third Semester | | | |
|---|----------|-----------|----|
| Subject Name: Database Management System | | | |
| Subject code | BCAT 303 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. To understand the basic concepts and the applications of database systems.
2. To understand the design of database.
3. To understand the relational database design principles
4. To Master the basics of SQL and construct queries using SQL
5. To become familiar with the basic issues of transaction processing and concurrency control

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Explain the various database concepts and the need for database systems.
2. Identify and define database objects, enforce integrity constraints on a database using DBMS.
3. Demonstrate a Data model and Schemas in RDBMS.
4. Identify entities and relationships and draw ER diagram for a given real-world problem.
5. Convert an ER diagram to a database schema and deduce it to the desired normal form.
6. Formulate queries in Relational Algebra, Structured Query Language (SQL) for database manipulation.
7. Explain the transaction processing and concurrency control techniques.

| | | |
|---------------|--|-----------------|
| Unit 1 | Database Architecture | Hours 10 |
| | Introduction to Database system applications, Characteristics and Purpose of database approach, People associated with Database system, Data models, Database schema, Database architecture, Data independence, Database languages, interfaces, and classification of DBMS. | |
| Unit 2 | E-R Model Concepts | Hours 12 |
| | Entity-Relationship modeling: E – R Model Concepts: Entity, Entity types, Entity sets, Attributes, Types of attributes, key attribute, and domain of an attribute. Relationships between the entities. Relationship types, roles and structural constraints, degree and cardinality ratio of a relationship. Weak entity types, E -R diagram. | |
| Unit 3 | Relational Data Model | Hours 16 |
| | Relational model concepts. Characteristics of relations, Relational model constraints: Domain constrains, key constraints, primary & foreign key constraints, integrity constraints and null values. Relational Algebra: Selection, projection, set operations, renaming, Joins, Division, Relational calculus: Tuple relational Calculus, Domain relational | |

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|---------------|---|-----------------|
| | calculus. Introduction to SQL: Overview of SQL, Data types, DDL, DML, DCL, TCL, Structure of SQL queries, Nested Sub queries, Joins, Views, Index and Triggers, Introduction to PL/SQL & programming of above operations in PL/SQL. | |
| Unit 4 | Data Normalization | Hours 12 |
| | Anomalies in relational database design, Decomposition, Functional dependencies, Normalization: First normal form, Second normal form, Third normal form, Boyce-Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, Join dependencies and Fifth normal form | |
| Unit 5 | Query Processing Transaction Management | Hours 10 |
| | Introduction to Transaction Processing, single user & multiuser systems, Transactions: read & write operations, Need of concurrency control: The lost update problem, Dirty read problem, Types of failures, Transaction states, Desirable properties (ACID properties) of Transactions, Concurrency Control Techniques: Locks and Time stamp Ordering. | |

TEXT BOOKS:

1. Fundamentals of Database Systems, Ramez Elamassri, Shankant B. Navathe, 7th Edition, Pearson, 2015.
2. Database Systems Concepts, Abraham Silberschatz, Henry Korth, S.Sudarshan, 6th Edition, McGraw Hill, 2010.

REFERENCE BOOKS:

1. An Introduction to Database Systems, Bipin Desai, Galgotia Publications, 2010.
2. Introduction to Database System, C J Date, Pearson, 1999.
3. Database Management Systems, Raghu Rama Krishnan and Johannes Gehrke, 3rd Edition, McGraw Hill, 2002

| Third Semester | | | |
|---|----------|-----------|----|
| Subject Name: Database Management System Lab | | | |
| Subject code | BCAP 304 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

PART A

1. Execute DDL Commands

Consider the table:

STUDENT (regno number, name varchar2, dob date, marks number)

- a) Create the above table with suitable constraints.
- b) Remove the existing attribute marks from the table.
- c) Change the data type of regno from number to varchar2.
- d) Add a new attribute phno to the existing table.
- e) Insert 5 tuples into the table.
- f) Display the tuples in table

2. Execute DML Commands

Consider the table:

LIBRARY (bid number, title varchar2, author varchar2, publisher varchar2, year_of_pub number, price number)

- a) create the above table.
- b) Enter 5 tuples into the table.
- c) Display all the tuples from the table.
- d) Display different publishers from table.
- e) Update price of all books with 5% GST amount.
- f) Delete the details of book published by a specific Author.
- e) Arrange the tuples in the alphabetical order of book title.
- f) List the details of all books whose price range between 100 rs and 300 rs.

3. Execute DQL and group functions

Consider the table EMPLOYEE (EmpNo, EmpName, Dept, Salary, DOJ, Branch)

Perform the following operations:

- a) Create the table
- b) Insert 5 tuples into the table
- c) Retrieve average salary of all employee
- d) Retrieve number of employees
- e) Retrieve distinct number of employee
- f) Retrieve total salary of employee group by employee name and count similar names
- g) Display details of employees whose salary is greater than 50000.

4. Demonstrate the use of TCL and DCL Commands:

TCL:

1. Create a table **accounts** (**account_id, account_holder_name, balance**)
2. Insert some sample data into the accounts table.
3. Start a transaction and perform the following operations:
 - Debit 1000 from account_id 1.
 - Credit 1000 to account_id 2.
4. Use the COMMIT command to save the changes.
5. Start a new transaction and perform the following operations:
 - Debit 500 from account_id 1.
 - Credit 500 to account_id 3.
6. Use the ROLLBACK command to undo the changes.
7. Create the save point and execute ROLLBACK TO previously created save point.

DCL:

1. Create a new user called user1 with a password.
2. Grant SELECT, INSERT, and UPDATE privileges on the accounts table to user1.
3. Login as user1 and perform the following operations:
 - Select data from the accounts table.
 - Insert a new row into the accounts table.
 - Update an existing row in the accounts table.
4. Revoke the INSERT privilege from user1.
5. Login as user1 and try to insert a new row into the accounts table.

5. Implement the Nested Queries.

An INVENTORY database has the following table.

ITEMS (itemcode number, name varchar2, price number)

PURCHASE (itemcode number, qty number)

- a) Create the tables with the above attributes.
- b) Enter 5 tuples into the tables.
- c) List the items purchased.
- d) List the items which are not purchased by anyone.

6. Implement Join operations in SQL

The COMPANY database consists of the tables:

EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo)

DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate)

Create tables, Insert 5 tuples each and perform the following

- a) Give a 10 percent raise in salary for all employees working in the 'Research' Department.
- b) Retrieve the name of each employee Controlled by department number 5 (use EXISTS operator).
- c) Retrieve the name of each dept and number of employees working in each department which has at least 2 employees
- d) Retrieve the name of employees and their department name (using NATURAL JOIN)

- e) Perform EQUI join operation on the given tables.
- f) Perform NON-EQUI join operation on the given tables.
- g) Perform OUTER join operations on the given tables.

7. Create the following tables:

Passenger (PassportID, Name, Age, Sex, Address) and

Reservation(PNRno, Journey Date, No_of_seats, Address, ContactNo.)

Query the tables using ANY, ALL, IN, Exists, NOT EXISTS, UNION, INTERSECT etc.,

- 1. Display unique PNR_NO of all passengers
- 2. Display all the names of male passengers.
- 3. Display the ticket numbers and names of all the passengers.
- 4. Find the ticket numbers of the passengers whose name start with 'r' and ends with 'h'.
- 5. Find the names of Passengers whose age is between 30 and 45.
- 6. Display all the passengers names beginning with 'A'.
- 7. Display the sorted list of Passengers names

8. Create views for a particular table

The RAILWAY RESERVATION SYSTEM database consists of the tables:

TRAIN(TrainNo, TrainName, StartPlace, Destination)

AVAILABILITY(TrainNo, Class, StartPlace, Destination, No_of_seats)

- a) Create view sleeper to display train no, start place, destination which have sleeper class and perform the following
 - insert new record
 - update destination='Manglore' where train no='RJD16'
 - delete a record which have train no='KKE55'
- b) Create view details to display train no, train name, class
- c) Create view total_seats to display train number, start place, use count function to no of seats, group by start place and perform the following
 - insert new record
 - update start place='Hubli' where train no='JNS8'
 - delete last row of the view
- d) Rename view sleeper to class
- e) Delete view details

PART B

- 1. Write PL/SQL program to enter any two numbers and find out their sum, difference, product, quotient and remainder.
- 2. Write PL/SQL procedure to compute factorial of a number using recursion
- 3. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor in PL/SQL to select the five highest paid employees from the table.
- 4. Write PL/SQL program to increase the salary for the employees of a particular department and enter the no of records updated, date, time, deptno and name of the person who increased the salary into another table called cursor_ret.

5. Create a row level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on the CUSTOMERS table. This trigger will display the salary difference between the old & new Salary on UPDATE operation and display the new or old salary for INSERT and DELETE operations, respectively.
CUSTOMERS(ID, NAME, AGE, ADDRESS, SALARY)
6. Given the table MOVIE (MID, MTitle, Language, Director, Year) write a function in PL/SQL to find the total number of Movies in the table.
7. Given the Table CUSTOMERS (CID, CName, Address) write a PL/SQL program which asks for customer ID, if the user enters invalid ID then the exception **invalid_id** is raised.
8. Write a PL/SQL program to demonstrate Packages.

| Third Semester | | | |
|---|----------|-----------|----|
| Subject Name: Python Programming | | | |
| Subject Code | BCAT 305 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. To introduce programming concepts using python
2. To use python programming to solve problems of different domains

COURSE OUTCOMES:

After completing this course satisfactorily, a student will be able to:

1. Explain the basic concepts of Python Programming.
2. Demonstrate proficiency in the handling of loops and creation of functions.
3. Identify the methods to create and manipulate lists, tuples and dictionaries.
4. Discover the commonly used operations involving file handling.
5. Interpret the concepts of Object-Oriented Programming as used in Python.
6. Develop the emerging applications of relevant fields using Python.

| | | |
|---------------|---|-----------------|
| Unit 1 | Python Basics | Hours 10 |
| | <p>Introduction to Features and Applications of Python; Python Versions; Installation of Python; Python Command Line mode and Python IDEs; Simple Python Program.</p> <p>Python Basics: Identifiers; Keywords; Statements and Expressions; Variables; Operators; Precedence and Association; Data Types; Indentation; Comments; Built-in Functions- Console Input and Console Output, Type Conversions; Python Libraries; Importing Libraries with Examples.</p> <p>Python Control Flow: Types of Control Flow; Control Flow Statements- if, else, elif, while loop, break, continue statements, for loop Statement; range () and exit () functions.</p> | |
| Unit 2 | Functions, Strings, Exception Handling and Multithreading | Hours 13 |
| | <p>Python Functions: Types of Functions; Function Definition- Syntax, Function Calling, Passing Parameters/arguments, the return statement; Default Parameters; Command line Arguments; Key Word Arguments; Recursive Functions; Scope and Lifetime of Variables in Functions.</p> <p>Strings: Creating and Storing Strings; Accessing String Characters; the str() function; Operations on Strings- Concatenation, Comparison, Slicing and Joining, Traversing; Format Specifiers; Escape Sequences; Raw and Unicode Strings; Python String methods.</p> <p>Exception Handling: Types of Errors; Exceptions; Exception Handling using try, except and finally.</p> <p>Multithreading: creating a thread, synchronizing threads, multithreaded priority queue</p> | |

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| | Modules: Importing module, Creating and exporting modules, Math module, Random module, Time module | |
| Unit 3 | Python Data Structure | Hours 8 |
| | <p>Lists: Creating Lists; Operations on Lists; Built-in Functions on Lists; Implementation of Stacks and Queues using Lists; Nested Lists.</p> <p>Dictionaries: Creating Dictionaries; Operations on Dictionaries; Built-in Functions on Dictionaries; Dictionary Methods; Populating and Traversing Dictionaries.</p> <p>Tuples and Sets: Creating Tuples; Operations on Tuples; Built-in Functions on Tuples; Tuple Methods; Creating Sets; Operations on Sets; Built-in Functions on Sets; Set Methods.</p> | |
| Unit 4 | OOPS, File Handling and Regular Expression | Hours 14 |
| | <p>Object Oriented Programming: Classes and Objects; Creating Classes and Objects; Constructor Method; Classes with Multiple Objects; Objects as Arguments; Objects as Return Values; Inheritance- Single and Multiple Inheritance, Multilevel and Multipath Inheritance; Encapsulation- Definition, Private Instance Variables; Polymorphism- Definition, Operator Overloading.</p> <p>File Handling: File Types; Operations on Files– Create, Open, Read, Write, Close Files; File Names and Paths; Format Operator.</p> <p>Regular Expressions – Concept of regular expression, various types of regular expressions, using match function.</p> | |
| Unit 5 | SQLite, GUI and Visualization | Hours 15 |
| | <p>Python SQLite: The SQLite3 module; SQLite Methods- connect, cursor, execute, close; Connect to Database; Create Table; Operations on Tables- Insert, Select, Update, Delete and Drop Records.</p> <p>GU Interface: The tkinter Module; Window and Widgets; Layout Management- pack, grid and place.</p> <p>Data Analysis: NumPy- Introduction to NumPy, Array Creation using NumPy, Operations on Arrays; Pandas- Introduction to Pandas, Series and DataFrames, Creating DataFrames from Excel Sheet and .csv file, Dictionary and Tuples. Operations on DataFrames.</p> <p>Data Visualization: Introduction to Data Visualization; Matplotlib Library; Different Types of Charts using Pyplot- Line chart, Bar chart and Histogram and Pie chart.</p> | |

TEXT BOOKS:

1. Introduction to Python Programming, Gowrishankar S et al., CRC Press, 2019.
2. Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python Programming Language, Fabio Nelli, Apress®, 2015

REFERENCE BOOKS:

1. Think Python How to Think Like a Computer Scientist, Allen Downey et al., 2nd Edition,
2. Green Tea Press. Freely available online @ <https://www.greenteapress.com/thinkpython/thinkCSpy.pdf>, 2015.
3. Advance Core Python Programming, MeenuKohli, BPB Publications, 2021.
4. Core PYTHON Applications Programming, Wesley J. Chun, 3rd Edition, Prentice Hall, 2012.

5. Automate the Boring Stuff, Al Sweigart, No Starch Press, Inc, 2015.
6. Data Structures and Program Design Using Python, D Malhotra et al., Mercury Learning and Information LLC, 2021.
7. <http://www.ibiblio.org/g2swap/byteofpython/read/>
8. <https://docs.python.org/3/tutorial/index.html>

| Third Semester | | | |
|---|----------|-----------|----|
| Subject Name: Python Programming Lab | | | |
| Subject Code | BCAP 306 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

PART A

1. Write Python programs to demonstrate the following:
 - a) input()
 - b) print()
 - c) 'sep' attribute
 - d) 'end' attribute
 - e) replacement Operator ({ })
2. Check if a number belongs to the Fibonacci Sequence
3. Solve Quadratic Equations
4. Find the sum of n natural numbers
5. Display Multiplication Tables.
6. Check if a given number is a Prime Number or not
7. Implement a sequential search
8. Create a calculator program
9. Explore string functions
10. Implement Selection Sort
11. Implement Stack
12. Read and write into a file

PART B

1. To find word and lines in command line Arguments
2. Demonstrate use of advanced regular expressions for data validation.
3. Demonstrate use of List
4. Demonstrate use of Dictionaries
5. Create SQLite Database and Perform CRUD Operations on Tables
6. Create a simple Students application form using Tkinter module and store in database.
7. Demonstrate Exceptions in Python
8. Drawing Line chart and Bar chart using Matplotlib
9. Drawing Histogram and Pie chart using Matplotlib
10. Create Array using NumPy and Perform Operations on Array.
11. Create DataFrame from Excel sheet using Pandas and Perform Operations on DataFrames

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| Third Semester | | | |
| Elective - 1 | | | |
| Subject Name: System Software | | | |
| Subject code | BCAT 307 A | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. Understand the role and structure of system software and differentiate it from application software.
2. Explore language processors, their functions, and development tools used in language processing.
3. Gain knowledge of internal data structures like search and allocation data structures used in language processing.
4. Identify various software tools such as editors, debug monitors, and user interface tools that assist in software development.
5. Comprehend the concepts and design of assemblers, including single-pass and two-pass assembler mechanisms.

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Explain the fundamental concepts of system software including language processing activities and language processor tools.
2. Describe and apply various data structures used in language processing, such as search and allocation structures.
3. Demonstrate the use of software tools like editors, debuggers, and programming environments in software development.
4. Understand the elements and structure of assemblers, including design and implementation of single-pass and two-pass assemblers.
5. Analyze macro definitions and expansions, and design a macro processor with advanced features.

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| Unit 1 | Introduction to System Software and software tools | Hours 10 |
| | Language Processors: Introduction, Language Processing Activities, Fundamentals of Language Processing & Language, Specification, Language Processor Development Tools. Data Structures for Language Processing: Search Data structures, Allocation Data Structures, Software Tools: Software Tools for Program Development, Editors, | |

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| | Debug Monitors, Programming Environments, User Interfaces. | |
| Unit 2 | Assemblers | Hours 8 |
| | Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Structure of Assemblers, Design of a Two Pass Assembler, A single pass Assembler for IBM PC. | |
| Unit 3 | Macros and Macro Processors | Hours 10 |
| | Macro Definition and Call, Macro Expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a Macro Preprocessor. | |
| Unit 4 | Interpreters and Introduction of Compilers | Hours 9 |
| | Interpreters: Use and overview of interpreters, Pure and impure interpreters, Phases of the Compiler, Introduction of scanning and parsing, Aspects of compilation. | |
| Unit 5 | Linkers and Loaders | 8 Hours |
| | Introduction to linkers, Relocation and Linking Concepts, Design of a Linker, Self-Relocating Programs, A Linker for MS-DOS, Linking for Overlays and Loaders. | |

TEXT BOOK:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Second Revised Edition, Tata McGraw-Hill, 1999.

REFERENCE BOOKS:

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000.
2. Santanu Chattopadhyay, "System Software", Prentice-Hall India, 2007

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| Third Semester | | | |
| Elective – 1 | | | |
| Subject Name: Computer Architecture | | | |
| Subject code | BCAT 307 B | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. This course introduces the students to the fundamental concepts of digital computer organization, design and architecture.
2. It aims to develop a basic understanding of the building blocks of the computer system and highlights how these blocks are organized together to architect a digital computer system.

COURSE OUTCOMES:

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

1. Design and Simplify Combinational and sequential circuits using basic building blocks.
2. Represent data in binary form, convert numeric data between different number systems and perform arithmetic operations in binary.
3. Explain instruction cycle, pipelining and interrupts.
4. Explain data communication between CPU, memory and I/O devices.
5. Simulate the design of a basic computer using a software tool.

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| Unit 1 | Digital Logic Circuits | Hours 8 |
| | Logic Gates, Truth Tables, Boolean Algebra, Digital Circuits, Combinational Circuits, Introduction to Sequential Circuits, Circuit Simplification using Karnaugh Map, Don't Care Conditions, Flip-Flops, Characteristic Tables, Excitation Table. | |
| Unit 2 | Digital Components (Fundamental building blocks) | Hours 10 |
| | Designing of combinational circuits- Half Adder, Full Adder, Decoders, Encoders, Multiplexers, Registers and Memory (RAM, ROM and their types), Arithmetic Microoperations, Binary Adder, Binary Adder-Subtractor. | |
| Unit 3 | Data Representation and Basic Computer Arithmetic | Hours 8 |

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| | Number System, r and (r-1)'s Complements, data representation and arithmetic operations. | |
| Unit 4 | Basic Computer Organization and Design | Hours 8 |
| | Bus organization, Micro programmed vs Hardwired Control, Instruction Codes, Instruction Format, Instruction Cycle, Instruction pipelining, Memory Reference, Register Reference and Input Output Instructions, Program Interrupt and Interrupt Cycle. | |
| Unit 5 | Processors | Hours 11 |
| | General register organization, Stack Organization, Addressing Modes, Overview of Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC), Multicore processor and Graphics Processing Unit (GPU) Memory hierarchy (main, cache and auxiliary memory), Input-Output Interface, Modes of Transfer: Programmed I/O, Interrupt initiated I/O, Direct memory access. | |

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy. "Computer Organization and Design: The Hardware/Software interface", 5th edition, Elsevier, 2012.
2. Mano, M. Computer System Architecture, 3rd edition, Pearson Education, 1993.

REFERENCE BOOKS:

1. Mano, M. Digital Design, Pearson Education Asia, 1995.
2. Null, L., & Lobur, J. The Essentials of Computer Organization and Architecture. 5th edition. (Reprint) Jones and Bartlett Learning, 2018.
3. Stallings, W. Computer Organization and Architecture Designing for Performance 8th edition, Prentice Hall of India, 2010.

| Third Semester | | | |
|---|------------|-----------|----|
| Subject Name: Mobile Application Development | | | |
| Subject code | BCAT 307 C | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. To provide foundational understanding of the Android development environment, including the setup of Android Studio, AVDs, and essential tools for building applications.
2. To teach the structure and core components of Android applications, such as activities, services, intents, and permissions, with emphasis on Android app design principles.
3. To enable hands-on experience with Android APIs, UI/UX components, and data handling techniques using SQLite, Content Providers, and Web APIs for real-world deployment.

COURSE OUTCOMES:

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

1. Develop and deploy basic Android applications using Android Studio with proper setup of layouts, permissions, and manifest settings.
2. Design responsive and user-friendly Android user interfaces, implement animations, and manage multiple device configurations and resources.
3. Integrate core Android APIs, including database management, data sharing, and networking features, to create fully functional mobile applications for real-world use.

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| Unit 1 | Android OS Design and Features | Hours 8 |
| | Introduction to Android development framework: Key SDK features, Installing and running applications using Android Studio ,Creating Android Virtual Devices (AVDs),Types of Android applications, Best practices in Android programming, Common Android tools, Building your first Android application | |
| Unit 2 | Introduction to Android development framework | Hours 10 |
| | Important Android terms, Understanding Application Context, Core components: Activities, Services, and Intents, Receiving and broadcasting intents, Android Manifest File and its main settings, Using Intents and Filters, Working with Permissions. | |
| Unit 3 | Android User Interface (UI) Design Essentials | Hours 10 |
| | UI screen elements overview, Designing layouts for different screen sizes | |

Bachelor of Computer Applications

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| | ,Working with various UI components, Using drawing tools and animations in UI, Managing Android application resources, Testing and publishing Android apps, Using preferences and handling multiple resource types | |
| Unit 4 | Using Common Android APIs | Hours 10 |
| | Data and storage APIs in Android, Using SQLite database, Sharing data between apps with Content Providers, Basics of Android Networking APIs, Using Web APIs in Android apps, Deploying applications to the real world | |
| Unit 5 | Consuming Web Services | Hours 7 |
| | Consuming Web Services Using HTTP-Consuming JSON Services- Creating Your Own Services - Binding Activities to Services -Understanding Threading. | |

TEXTBOOKS:

1. Lauren Darcey & Shane Conder, Android Wireless Application Development, Pearson Education, 2nd Ed. (2011).
2. Reto Meier, Professional Android 2 Application Development, Wiley India Pvt. Ltd.

REFERENCE BOOKS:

1. Barry Burd, Android Application Development All-in-One for Dummies, Edition I.
2. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2013.

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| Third Semester | | | |
| Elective – 1 | | | |
| Subject Name: Probability and Statistics | | | |
| Subject code | BCAT 307 D | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. This course is designed to introduce the historical development of statistics- presentation of data descriptive measures and fitting mathematical curves to the data.
2. This course also introduces measurement of the relationship of quantitative and qualitative data and the concept of probability.
3. This course will enable students to understand and summarize the data, understand and apply the descriptive measures and probability for data analysis, implement theoretical concepts of descriptive measures and probability, study the relationship between variables.

COURSE OUTCOMES:

After completing this course satisfactorily, a student will be able to:

1. Demonstrate the history of statistics Identify the type of data and present the data in various forms and summarize it using descriptive statistics.
2. Understand and apply the statistical concept of correlation, association, regression analysis and infer its results.
3. Understand and apply the concept of theory and its applications.

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| Unit 1 | Introduction and Analysis of Univariate data | Hours 10 |
| | Basic statistical concepts: Origin and development of Statistics- Scope-limitations and misuse of statistics. Types of data: primary and secondary data-quantitative and qualitative data. Scales of Measurement: nominal ordinal-ratio and interval. Discrete and continuous data variables. Construction of frequency distribution, stem and leaf display. Presentation of data by tables: construction of frequency distributions for discrete and continuous data. Graphical presentation of data -histograms and cumulative frequency curves. Measure of central tendency—Arithmetic mean, median and mode—their properties Partition values—quartiles, deciles and percentiles. Measures of dispersion—Range, quartile deviation and standard deviation and their relative measures. Skewness—concept and measures, Kurtosis—concept. | |
| Unit 2 | Correlation and Regression | Hours 13 |
| | Correlation: Scatter plot- Karl Pearson coefficient of correlation- Spearman's rank correlation coefficient- multiple and partial correlations (for 3 variates only). Regression: Concept of errors Principles of Least Square- Simple linear regression and its properties. | |

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| Unit 3 | Basics of Probability | Hours 8 |
| | Basic terminology-random experiment, sample space, event, mutually exclusive events, equally likely events. Definition of probability –Classical, empirical and axiomatic approaches. properties of probability. Theorems on probability- conditional probability and independent events- Laws of total probability- Baye’s theorem and its applications. | |
| Unit 4 | Random variables and Probability distributions | Hours 15 |
| | Definition of a random variable—discrete and continuous random variables— probability mass function and probability density function. Distribution function and its properties. Mean and variance of a random variable. Definition of a bivariate probability distribution and marginal probability functions. Discrete probability distributions—Binomial and Poisson distributions Continuous distributions—Normal distribution—computation of probabilities. | |
| Unit 5 | Applied Statistics | Hours 14 |
| | Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations. Test of significance for small samples: t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes. | |

TEXT BOOKS:

1. S.C. Gupta and V.K. Kapoor - Fundamentals of Mathematical Statistics- 12th ed.- Sultan Chand & Sons- New Delhi- 2020.
2. P. Mukhopadhyay.- Mathematical Statistics-3rd ed.- Books and Allied (P) Ltd- Kolkata2018.

REFERENCE BOOKS:

1. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
2. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
3. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
4. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

| Fourth Semester | | | |
|--|----------|-----------|----|
| Subject Name: Computer Networks | | | |
| Subject code | BCAT 401 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. Fundamentals of data communication networks.
2. Software and hardware interfaces
3. Application of various physical components and protocols
4. Communication challenges and remedies in the networks.

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Define various data communication components in networking.
2. Describe networking with reference to different types of models and topologies..
3. Understand the need for Network and various layers of OSI and TCP/IP reference model.
4. Explain various Data Communications media.
5. Describe the physical layer functions and components
6. Identify the different types of network topologies and Switching methods.
7. Describe various Data link Layer Protocols.
8. Identify the different types of network devices and their functions within a network.

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| Unit 1 | Introduction | Hours 12 |
| | Introduction: Computer Network: Definition, Goals, Structure; Broadcast and Point-To- Point Networks; Network Topology and their various Types; Types of Network, Network software, Design issues for the layers, Connection-oriented vs. Connectionless service, Applications of Computer network, Protocols and Standards, The OSI Reference Model, The TCP/IP Protocol suite, Comparison between OSI and TCP/IP Reference model. | |
| Unit 2 | Physical Layer | Hours 14 |
| | Physical Layer: Functions of Physical Layer, Analog signals, Digital signals, Transmission Impairment, Data Rate Limits, and Performance. Data Transmission Media: Guided Transmission Media, Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Wireless Transmission, Electromagnetic Spectrum, Radio Transmission, Microwave Transmission, Infrared Transmission, Light Transmission, Digital Modulation and Multiplexing, Public Switched Telephone Networks. Switching: Circuit switching, Message switching & Packet switching | |
| Unit 3 | Data Link Layer | Hours 12 |
| | Data Link Layer: Functions of Data Link Layer, Data Link Control: Framing, Flow and Error Control, Error Detection and Correction, High-Level Data Link Control (HDLC) & point-to-Point protocol(PPP), Channel Allocation Problem, Multiple Access: Radom Access(ALOHA, CSMA, CSMA/CD, CSMA/CA), | |

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| | Controlled Access(Reservation, Polling, Token Passing), Channelization(FDMA, TDMA, CDMA), Wired LAN: Ethernet Standards and FDDI. | |
| Unit 4 | Transport layer: | Hours 12 |
| | Transport Layer: Functions of Transport Layer, Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & De-multiplexing, Crash Recovery, User Datagram Protocol (UDP): User Datagram, UDP Operations, Uses of UDP, RPC, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocol, Go Back-N(GBN), Selective Repeat(SR). | |
| Unit 5 | Application Layer | Hours10 |
| | Application layer: Functions of Application layer, Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPS, TELNET, FTP, SMTP, POP, IIMAP | |

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition
2. William Stallings, Data and Computer Communications, 7th Edition, PHI.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, -Computer Networks: A Systems Approachll, Morgan Kaufmann Publishers, Fifth Edition, 2011.
2. Brijendrasingh, Data Communication and Computer Networks, PHI.
3. Andrew S Tanenbaum, David. J. Wetherall, -Computer Networks, Pearson Education, 5th Edition,
4. Kurose and Ross, Computer Networking- A Top-Down approach, Pearson, 5th edition
5. Douglas E.Comer, "Internetworking with TCP / IP – Principles, Protocols and Architectures, Fourth Edition, Prentice – Hall of India Private Limited, 2002.
6. <http://highered.mheducation.com/sites/0072967757/index.html>

| Third Semester | | | |
|--|----------|-----------|----|
| Subject Name: Computer Networks Lab | | | |
| Subject code | BCAP 402 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

PART A

1. List the essential **hardware components** needed for a basic computer system used in networking.
2. Explain and demonstrate the steps to **create a cross-over cable** using a clamping tool and RJ-45 connectors.
3. Identify and explain the function of at least five networking devices (e.g., router, switch, hub, modem, access point).
4. Create a diagram that illustrates how NAT works between a private LAN and the internet.
5. Compare the process of network configuration with and without simulation tools (e.g., using Cisco Packet Tracer vs. real hardware).
6. Describe the steps to assign a static IP address to a Windows/Linux machine.
7. Demonstrate how to troubleshoot a network using these commands in a lab setup.
8. Explain how CRC detects transmission errors in network communication.
9. What is a default route in networking? Why is it important?

PART B

1. Choose an open-source simulator (e.g., Cisco Packet Tracer, GNS3, NS2, NS3). Explain the installation steps
2. List the steps for enabling file sharing and setting **permissions** in Windows.
3. Implement connecting two nodes using network simulator
4. Implement connecting three nodes considering one node as a central node using network simulator
5. Design and implement a **bus topology** and analyze the packet flow.
6. Simulate a **star topology** using a switch as the central device and test connectivity among all nodes.
7. Create a **ring topology** network. Demonstrate token passing or packet routing in the simulation.
8. Simulate a **wireless LAN** setup including access point and wireless clients. Configure IP and test connectivity.
9. Build a **hybrid topology** by combining star, bus, and ring using multiple routers and nodes. Assign IP addresses and verify full network connectivity.

| Fourth Semester | | | |
|--|----------|-----------|----|
| Subject Name: Analysis and Design of Algorithms | | | |
| Subject code | BCAT 403 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. Understand algorithmic problem-solving techniques and learn how to design efficient algorithms.
2. Analyse the time and space complexity of algorithms using asymptotic notations.
3. Apply various algorithm design strategies such as brute force, divide and conquer, greedy method, dynamic programming, backtracking, and branch and bound to solve problems.
4. Study graph algorithms such as shortest path, minimum spanning tree, and graph traversals.
5. Understand the concept of NP-completeness and explore problems that are computationally hard.
6. Develop the ability to write and evaluate algorithmic solutions in terms of correctness, efficiency, and applicability.

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Analyze the time and space complexity of algorithms using asymptotic notations.
2. Apply divide and conquer and greedy techniques to design and analyze algorithms for real-world problems
3. Implement dynamic programming and backtracking techniques to solve optimization and decision problems.
4. Solve graph-related problems using algorithms like DFS, BFS, shortest paths, and minimum spanning trees.
5. Understand and identify problems that belong to P, NP, and NP-Complete classes.
6. Evaluate algorithmic solutions based on efficiency, correctness, and applicability in different problem domains.

| | Introduction | 10 Hours |
|---------------|---|-----------------|
| Unit 1 | Introduction: What is an Algorithm? It's Properties. Algorithm Specification- using natural language, using Pseudo code convention, Fundamentals of Algorithmic Problem solving, Analysis Framework Time efficiency and space efficiency, Worst-case, Best-case and Average case efficiency. | |

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| | <p>Performance Analysis: Estimating Space complexity and Time complexity of algorithms.</p> <p>Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ) with examples, Basic efficiency classes, Mathematical analysis of Non-Recursive and Recursive Algorithms with Examples.</p> <p>Brute force design technique: Selection sort, sequential search, string matching algorithm with complexity Analysis.</p> | |
| Unit 2 | Divide and Conquer | 15 Hours |
| | <p>Divide and Conquer: General method, Recurrence equation for divide and conquer, solving it using Master's theorem. Divide and Conquer algorithms and complexity Analysis of Finding the maximum & minimum, Binary search, Merge sort, Quick sort.</p> <p>Decrease and Conquer Approach: Introduction, Insertion sort, Graph searching algorithms, Topological Sorting. It's efficiency analysis.</p> | |
| Unit 3 | Greedy Technique | 15 Hours |
| | <p>Greedy Method: General method, Coin Change Problem, Knapsack Problem, solving Job sequencing with deadlines Problems.</p> <p>Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm with performance analysis.</p> <p>Single source shortest paths: Dijkstra's Algorithm.</p> <p>Optimal Tree problem: Huffman Trees and Codes.</p> <p>Transform and Conquer Approach: Introduction, Heaps and Heap Sort.</p> | |
| Unit 4 | Dynamic Programming | 10 Hours |
| | <p>Dynamic Programming: General method with Examples, Multistage Graphs.</p> <p>Transitive Closure: Warshall's Algorithm. All Pairs Shortest Paths: Floyd's Algorithm, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem.</p> <p>Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching Harspool's algorithm.</p> | |
| Unit 5 | Backtracking | 10 Hours |
| | <p>Backtracking: General method, solution using back tracking to N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles Problems.</p> <p>Branch and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem</p> <p>NP-Complete and NP-Hard problems: Basic concepts, non- deterministic</p> | |

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| algorithms, P, NP, NP-Complete, and NP-Hard classes. |
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TEXT BOOK:

1. Introduction to the Design and Analysis of Algorithms, By Anany Levitin, 3rd Edition (Indian), 2017, Pearson.

REFERENCE BOOKS:

1. Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

| Fourth Semester | | | |
|---|----------|-----------|----|
| Subject Name: Analysis and Design of Algorithm Lab | | | |
| Subject code | BCAP 404 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

Instructions:

1. Develop programs to solve computational problems using suitable algorithm design strategy.
2. Compare algorithm design strategies by developing equivalent programs and observing running times for analysis (Empirical).
3. Make use of suitable integrated development tools to develop programs
4. Choose appropriate algorithm design techniques to develop solution to the computational and complex problems.
5. Demonstrate and present the development of program, its execution and running time(s) and record the results/inferences.

PART A

1. Sort a given set of n integer elements using Selection Sort method and compute its time complexity. Run the program for varied values of $n > 5000$ and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator. Demonstrate using C how the brute force method works along with its time complexity analysis: worst case, average case and best case.
2. Design and implement C Program to solve 0/1 Knapsack problem using Greedy method.
3. Design and implement C Program to find shortest paths to other vertices from a given vertex in a weighted connected graph, using Dijkstra's algorithm.
4. Design and implement C Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
5. To find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
6. Design and implement C Program to Solve All-Pairs Shortest Paths problem using Floyd's algorithm.
7. Design and implement C Program to find the transitive closure using Warshal's algorithm.

PART B

1. Design and implement C Program to Solve Travelling Sales Person problem using Dynamic programming.
2. Design and implement C Program to obtain the Topological ordering of vertices in a given digraph.
3. Design and implement C Program to Solve 0/1 Knapsack problem using Dynamic Programming method.
4. Design and implement C Program to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution.
5. Design and implement C Program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.
6. Design and implement C Program for N Queen's problem using Backtracking.

| Fourth Semester | | | |
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| Subject Name: Web Technologies | | | |
| Subject Code | BCAT 405 | CIE Marks | 20 |
| No of Hours/Week: | 4 | SEE Marks | 80 |
| Total Hours: | 60 | Credits | 4 |

COURSE OBJECTIVES:

1. To provide a foundational understanding of web architecture, protocols, and server setup.
2. To enable students to design and develop interactive web pages using HTML, HTML5, and XML.
3. To introduce client-side scripting through JavaScript for dynamic web functionalities.
4. To develop aesthetic and responsive web interfaces using advanced CSS techniques.
5. To impart server-side programming skills using PHP, including form handling, session management, and database operations.

COURSE OUTCOMES:

After completing this course satisfactorily, a student will be able to:

1. Explain the architecture of the web and set up web servers on UNIX/Linux platforms.
2. Design well-structured and semantically rich web pages using HTML5 and XML technologies.
3. Develop interactive and validated front-end applications using JavaScript and DOM manipulation.
4. Apply CSS3 features to enhance the visual appeal, layout, and responsiveness of web applications.
5. Create dynamic server-side scripts using PHP for processing forms, managing sessions, and connecting to databases.

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| Unit 1 | Introduction to Web | 10 Hours |
| | Introduction, What is Web, Web Protocols (HTTP, HTTPS) and programs, Secure Connections (SSL/TLS), application and development tools, Web Browsers: Architecture and Features, Web Servers: Definition and Types (Apache, Nginx, etc.), Setting up UNIX and Linux web servers, Logging users, dynamic IP. Web Design: Web site design principles, planning the site and navigation. | |
| Unit 2 | HTML and XML | 12 Hours |
| | Introduction, Basics, Elements, Attributes, Comments, Formatting Text and Content Hyperlinks Links, Images, Tables, Lists, Block, Frames, HTML Meta Tags, HTML Forms, Form Elements, Various Input Elements. | |
| | HTML 5: Introduction to HTML5, New Elements, HTML5 Semantics, Storage API, Multimedia and Canvas, Storage API and Geolocation API, HTML5 Form Features Migration Strategies from HTML to HTML5 XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, Parsing XML using DOM, Basics of XHTML | |
| Unit 3 | JavaScript | 8 Hours |
| | Introduction to Client-Side Scripting, Purpose of JavaScript, Basic Syntax, Variables, | |

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| | Operators, Control Structures, and Loops, Functions, Arrays, Array Methods, Strings, String Methods, Regular Expression, Event Handling and HTML Form Validation, Debugging and Best Practices | |
| Unit 4 | Cascading Style Sheets | 10 Hours |
| | Introduction, Basic Syntax, Colors, backgrounds, Border, Margin, Padding, Height, Width, BOX Model, Other basic style elements. Layouts, Positions of Forms and Navigation Menus, Pseudo class, and elements, 2D and 3D transitions, Animations, CSS Grid and Flexbox Layouts, Responsiveness. CSS 3.0: Rounded Corners, Border Images, Multi background, Multi columns, Shadow, Gradients, Web Fonts and Media types | |
| Unit 5 | Server-Side Scripting with PHP: | 20 Hours |
| | Introduction to PHP, Basic Syntax, Variables, data types, Operators, Strings, Constants, Arrays, control structures, Functions, OOP in PHP: Classes and Objects, Properties and Methods, Constructors and Destructors, Access Modifiers, Inheritance and Overriding, Interfaces and Abstract Classes. Superglobals, PHP Form Handling, Validations, File Uploads, Cookies, Sessions, Error Handling. Connecting to Database, CRUD operations with Database, Prepared Statements and Bound Parameters, Limiting Data, Get Last ID, Example application. | |

TEXT BOOKS:

1. Kogent Learning Solutions Inc., Web Technologies Black Book, Dreamtech Press, 2009.
2. P.J.Deitel, H.M.Deitel, Internet and World Wide Web: How to program, Third Edition, Pearson publication.
3. U. K. Roy, Web Technologies, First Edition, Oxford Higher Education

REFERENCE BOOKS:

1. PHP: A Beginner's Guide, Vikram Vaswani, McGraw-Hill Edition.
2. Learning PHP, MySQL, Javascript & CSS: A Step-by-Step Guide to Creating Dynamic Websites, Robin Nixon, O'Reilly.

| Fourth Semester | | | |
|---|----------|-----------|----|
| Subject Name: Web Technologies Lab | | | |
| Subject Code | BCAP 406 | CIE Marks | 10 |
| No of Hours/Week: | 4 | SEE Marks | 40 |
| Total Hours: | 60 | Credits | 2 |

LIST OF LAB PROGRAMS

PART A

1. Design web pages for your college containing a description of the courses, departments, faculties, library etc, use href, list tags.
2. Create your class timetable using table tag.
3. Create user Student feedback form (use textbox, text area, checkbox, radio button, select box etc.)
4. Create a web page using frame. Divide the page into two parts with Navigation links on left hand side of page (width=20%) and content page on right hand side of page (width = 80%). On clicking the navigation Links corresponding content must be shown on the right-hand side.
5. Design a web page of your hometown with an attractive background color, text color, an Image, font etc. (use internal CSS).
6. Use External, Internal, and Inline CSS to format college web page that you created.
7. Develop simple calculator for addition, subtraction, multiplication and division operation using JavaScript
8. Create HTML Page that contains form with fields Name, Email, Mobile No, Gender, Favorite Color and a button now write a JavaScript code to combine and display the information in textbox when the button is clicked. Include form validation
9. Use regular expression for validation in Feedback Form.

PART B

1. Write a PHP script to check if number is prime or not.
2. Create a simple HTML form and accept the user's name and display the name through PHP echo statement.
3. Write PHP script to obtain factorial of a number using function
4. Write PHP script to demonstrate string, date and math function
5. Create HTML page that contain textbox, submit reset button. Write php program to display this information and also store into text file.
6. Create EMP table with emp_no. emp name, designation and salary. Write a program to read employee information from EMP table and display all this information in php page.
7. Create customer table in mysql with cust_no, cust_name, item purchased, and mob_no, insert 10 records into it.
8. Write a php script to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
9. Design and develop a dynamic menu driven web application using PHP & MySQL that

enables students to apply for degree courses online through application registration and login. The application should collect personal and academic details, support photo & marks cards uploads, allow course selection, store the information in a database, and generate a PDF copy of the submitted application.

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| Fourth Semester | | | |
| Elective – 2 | | | |
| Subject Name: Cloud Computing | | | |
| Subject code | BCAT 407 A | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 3 | Credits | 3 |

COURSE OBJECTIVES:

1. Understand the fundamentals of cloud computing including cloud models (public, private, hybrid) and key building blocks.
2. Gain insight into virtualization concepts, types, benefits, and how virtualization supports cloud infrastructure.
3. Learn how to set up a private cloud using open-source tools and plugins, including cloud provisioning and tool integrations.
4. Understand the relationship between IoT and Cloud Computing, and how they integrate in real-world applications.

COURSE OUTCOMES:

At the end of the course students will be able to:

1. Explain the fundamentals of cloud computing, virtualization concepts, and different types of cloud environments (public, private, hybrid).
2. Set up and configure a private cloud using open-source tools, and integrate tools like Docker and Nagios.
3. Differentiate between Cloud Computing, IoT, and Fog Computing, and describe their roles in modern IT infrastructures.
4. Demonstrate how to connect IoT devices to the cloud, manage cloud storage, and handle data communication protocols and APIs.
5. Analyze real-time IoT-cloud applications including device-to-cloud communication, data normalization, and infrastructure management.

| | | |
|---------------|---|----------------|
| | Introduction to Cloud | 8 Hours |
| Unit 1 | Virtualization concepts, Types of Virtualization & its benefits, Introduction to Various Virtualization OS, HA/DR using Virtualization, Moving VMs, Cloud Fundamentals, Cloud Building Blocks, Understanding Public & Private cloud environments, Private Cloud Environment, Public Cloud Environment, Managing Hybrid Cloud environment. | |
| Unit 2 | The Cloud Setup | 8 Hours |

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| | Setting up your own Cloud: Build private cloud using open source tools, Understanding various cloud plugins, Setting up your own cloud environment, Auto-provisioning, Custom images, Integrating tools like Nagios, Integration of Public and Private cloud, Micro services using Docker | |
| Unit 3 | IoT and the Cloud | 8 Hours |
| | Introduction to cloud computing, Difference between Cloud Computing and IoT, Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT. Living on the Edge, An Abstract Edge Architecture Model, Connecting devices at the edge and to the cloud | |
| Unit 4 | Connecting Things to Cloud | 8 Hours |
| | Various Real time applications of IoT, Connecting IoT to cloud, Cloud Storage for Iot. Cloud-to-Device Connectivity, Device Ingress/Egress, Data Normalization and Protocol Translation, Infrastructure, APIs, The Topology of the Cloud. | |
| Unit 5 | Challenge in Integration of Things with Cloud | 10 Hours |
| | Security, Scalability, Reliability, Performance, Mobility, Resource Optimization & cost efficiency, Cloud data management, cloud data monitoring, Cloud data Exchange, Infrastructure Configuration & reconfiguration, IoT Overarching Challenges. | |

TEXT BOOKS:

1. Biron, J., & Follett, J. (2016). Foundational elements of an iot solution. O'Reilly Media, Incorporated
2. Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). (2010). Cloud computing: Principles and paradigms (Vol. 87). John Wiley & Sons.

REFERENCE BOOK:

1. Hwang, K., Dongarra, J., & Fox, G. C. (2013). Distributed and cloud computing: from parallel processing to the internet of things. Morgan kaufmann.

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| Fourth Semester | | | |
| Elective - 2 | | | |
| Subject Name: Cyber Security | | | |
| Subject code | BCAT 407 B | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. This course introduces the students to the fundamental concept of Cyber security and issues and challenges associated with it.
2. It aims to develop a basic understanding of the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

COURSE OUTCOMES:

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

1. After completion of this course, students would be able to understand the concept of Cyber security and issues and challenges associated with it.
2. After completion of this course, students would be able to understand the concept of Cyber security and issues and challenges associated with it.
3. On completion of this course, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.
4. After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

| | | |
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| Unit 1 | Introduction to Cyber security | 10 Hours |
| | Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security. | |
| Unit 2 | Cyber-crime and Cyber law | 10 Hours |

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| | Classification of cybercrimes, Common cybercrimes- cyber-crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, | |
| Unit 3 | Social Media Overview and Security | 10 Hours |
| | Introduction to Social networks Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content. | |
| Unit 4 | E- Commerce and Digital Payments | 8 Hours |
| | Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Advantage of e-commerce, Survey of popular e-commerce sites. Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. | |
| Unit 5 | Security | 7 Hours |
| | End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions. | |

TEXT BOOKS:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011).
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)

REFERENCE BOOKS:

1. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
2. Fundamentals of Network Security by E. Maiwald, McGraw Hill.
3. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

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| Fourth Semester | | | |
| Elective – 2 | | | |
| Subject Name: Mobile Computing | | | |
| Subject code | BCAT 407 C | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. To introduce the field of mobile communication and focuses on digital data transfer.
2. To address how mobile phone system works.
3. To understand the technology in wireless local area networks.
4. To focuses on mobility influencing applications, security, or IP networks

COURSE OUTCOMES:

1. An ability to understand the field of mobile communication.
2. An ability to understand how mobile phone system works
3. This course aims to understand the technology in wireless local area networks and its latest trends.

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| Unit 1 | Introduction | 09 Hours |
| | Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA- Different Generations of Wireless Networks- 1G, 2G, 3G, 4G,5G. | |
| Unit 2 | Mobile Telecommunication System | 09 Hours |
| | Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security. | |
| Unit 3 | Mobile Network Layer | 09 Hours |
| | Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security | |
| Unit 4 | Mobile Transport and Application Layer | 10 Hours |
| | Traditional TCP, Classical TCP Improvements: Indirect TCP-Snooping TCP, Mobile TCP-Fast retransmit/fast recovery- Transmission /time-out freezing- Selective retransmission-Transaction oriented TCP-Wireless Application Protocol (WAP) –Architecture – XML – WML Script – Applications | |
| Unit 5 | Mobile Platforms and Applications | 08 Hours |

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|--|---|
| | Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues. |
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TEXT BOOKS:

1. Jochen Schiller, —Mobile Communications, PHI, Second Edition, 2003.

2. Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012

REFERENCE BOOKS:

1. Dharma Prakash Agarwal, Qing and An Zeng, —Introduction to Wireless and Mobile systems, Thomson Asia Pvt Ltd, 2005.

2. Android Developers: <http://developer.android.com/index.html>

3. Apple Developer: <https://developer.apple.com/>

4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, —Principles of Mobile Computing, Springer, 2003.

5. William. C.Y.Lee —Mobile Cellular Telecommunications-Analog and Digital Systems, Second Edition, Tata McGraw Hill Edition ,2006.

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|---|------------|-----------|----|
| Fourth Semester | | | |
| Elective – 2 | | | |
| Subject Name: Internet of Things | | | |
| Subject code | BCAT 407 D | CIE Marks | 20 |
| No of Hours/Week: | 3 | SEE Marks | 80 |
| Total Hours: | 45 | Credits | 3 |

COURSE OBJECTIVES:

1. To understand the concepts of Internet of Things and the application of IoT.
2. To Determine the Market perspective of IoT.
3. To Understand the vision of IoT from a global context

COURSE OUTCOME:

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

1. Use of Devices, Gateways and Data Management in IoT.
2. Design IoT applications in different domain and be able to analyze their performance
3. Implement basic IoT applications on embedded platform.

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| Unit 1 | IoT & Web Technology | 10 Hours |
| | The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics. | |
| Unit 2 | M2M to IoT | 10 Hours |
| | A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, The international driven global value chain and global information monopolies.M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. | |
| Unit 3 | IoT Architecture | 8 Hours |
| | Introduction, State of the art, Architecture, Reference Model- | |

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| | Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. | |
| Unit 4 | IoT Applications for Value Creations | 10 Hours |
| | Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth. | |
| Unit 5 | IoT Privacy, Security and Governance | 7 Hours |
| | Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security. | |

TEXT BOOK:

1. Vijay Madiseti and ArshdeepBahga, "Internet of Things: (A Hands-on Approach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.

REFERENCE BOOKS:

1. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", Pearson Education 2015.
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications 2013, 1st Edition.
3. Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley 2014.
4. CunoPfister, "Getting Started with the Internet of Things", O'Reilly Media 2011.

**Question Paper Pattern for Semester End Examination (SEE)
(Common for III and IV Semester)
SUBJECT NAME**

Time: 3 Hours

Max. Marks: 80

Instruction to Candidate: Answer all the Sections

SECTION A

I. Answer any ten of the following questions (10X2 = 20)

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

SECTION B

II. Answer any five of the following questions (5X5 = 25)

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.
- 19.

SECTION C

III. Answer any five of the following questions (5X7 = 35)

- 20.
- 21.
- 22.
- 23.
- 24.
- 25.
- 26.

