Guru Nanak Dev Engineering College, Ludhiana

Department of Computer Science and Engineering

Syllabus

(Revised Course Outcomes w.e.f. 31st August 2023)

B. Tech. Computer Science and Engineering (2018 Batch Onwards)

Subject Code: PCCS-101

Subject Name: Object Oriented Programming

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 3rd	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Explain the principles of object oriented programming and procedure oriented programming.
CO2	Design the object-oriented programs using classes and objects to enhance code reusability.
CO3	Apply the concept of control structures, functions, arrays and strings to develop object- oriented programs.
CO4	Implement polymorphism and inheritance in object-oriented programming paradigm.
CO5	Develop programs based on the dynamic memory management and exception handling.
CO6	Make use of file handling in the development of programs.

Detailed Contents:

Part-A

Object-Oriented ProgrammingConcepts: Introduction, Comparison between procedural programming paradigm and object-oriented programming paradigm, Features of object-oriented programming: Encapsulation, Class, Object, Abstraction, Data hiding, polymorphism, and Inheritance. Introduction of object oriented design. **[3 Hours]**

Data Types, Operators, and Control Structures: Basic data types, Derived data types, Keywords, Identifiers, Constants and variables, Type casting, Operators, and Operator precedence.

Control Structures: if statement, switch-case, for, while and do-while loops, break and continue statement. **[6 Hours]**

Classes and Objects: Implementation of a class, Creating class objects, Operations on objects, Relationship among objects, Accessing class members, Access specifiers, Constructor and destructor, Types of constructor, Static members, Empty classes, Nested classes, Local classes, Abstract classes, Container classes. **[5 Hours]**

Functions, Arrays, and String Handling: Function components, Default arguments, Passing parameters, Function prototyping, Call by value, Call by reference, Return by reference, Inline functions, Friend functions, Static functions, Recursion, Array declaration, Types of arrays, Array of objects, String handling. **[6 Hours]**

Part-B

Polymorphism and Type Conversion: Introduction, Concept of binding – Early binding and late binding, Virtual functions, Pure virtual functions, Operator Overloading, Rules for overloading operators, Overloading of various operators, Function overloading, Constructor overloading, Type conversion – Basic type to class type, Class type to basic type, Class type to another class type. **[6 Hours]**

Inheritance: Introduction, defining derived classes, Types of inheritance, Ambiguity in multiple and multipath inheritance, Virtual base class, Objects slicing, Overriding member functions, Object composition and delegation. **[5 Hours]**

Dynamic Memory Management using Pointers: Declaring and initializing pointers, Accessing data through pointers, Pointer arithmetic, Memory allocation –Static and Dynamic, Dynamic memory management using new and delete operators, Pointer to an object, this pointer, Pointer related problems – Dangling/wild pointers, Null pointer assignment, Memory leak and Allocation failures. **[5 Hours]**

Exceptions Handling: Review of traditional error handling, Basics of exception handling, Exception handling mechanism, Throwing mechanism, Catching mechanism, Rethrowing an exception, Specifying exceptions. **[2 Hours]**

Files Handling: File streams, Hierarchy of file stream classes, Error handling during file operations, Reading/writing of files, Accessing records randomly, Updating files. **[2 Hours]**

Text Books

1. R. Lafore, "Object Oriented Programming in C++", Waite Group.
2. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.
3. P YashavantKanetkar, "Let Us C++", BPB Publications.
4. Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley.

Reference Books

1. Herbert Schildt, "The Complete Reference to C++ Language", McGraw Hill-Osborne.
2. B.F.Lippman, "C++ Primer", Addison Wesley.
3. Farrell, "Object Oriented using C++", Cengage Learning.
4. Barbara Liskov, Program Development in Java, Addison-Wesley.

Books and online learning material

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill.
   http://www.mldcollege.com/panel/programs/Object%20Oriented%20Programming%20with%20C -Bal%20-%20E.Balagurusamy.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106101208/1 Accessed on August, 20, 2019
2. https://nptel.ac.in/courses/106101208/18 Accessed on August, 20, 2019
3. https://nptel.ac.in/courses/106101208/20 Accessed on August, 20, 2019
4. https://nptel.ac.in/courses/106101208/21 Accessed on August, 20, 2019
5. https://nptel.ac.in/courses/106101208/23 Accessed on August, 20, 2019
6. https://nptel.ac.in/courses/106101208/25 Accessed on August, 20, 2019

Subject Code: PCCS-102

Subject Name: Computer Networks

Programme: B.Tech. CSE	**L:** 3 **T:** 0 **P:** 0
Semester: 3	**Teaching Hours:** 38
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 40%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Computer System fundamentals.

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Explain the concepts of network types, topologies, Bandwidth utilization, OSI and TCP/IP reference models.
CO2	Apply data rate limit methods and switching techniques for utilization of transmission media
CO3	Utilize error detection and correction techniques, flow control, error control and multiple access protocols for reliable transmission of frames over network.
CO4	Make use of functions of network layer i.e. logical addressing, routing and congestion control mechanisms for transmission of packets from source to destination
CO5	Analyze network design issues, services of transport protocols and connection management for process to process delivery of entire message.
CO6	Interpret the functions offered by session layer, presentation layer and use of application layer protocols.

Detailed Contents:

Part-A

Data Communication Components: Representation of data and data flow, Various Network Topologies, Protocols and Standards, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing- Frequency division, Time

division and Wave division, Concepts on spread spectrum, OSI model, TCP/IP reference model and their comparison. **[6 Hours]**

Physical Layer: Concept of analog and digital systems, Transmission Media, Transmission impairments and Data rate limits- Nyquist formula, Shannon formula, Switching- Circuit, Message

and Packet switching. **[7 Hours] Data Link Layer and Medium Access Sub Layer**: Error Detection and Error Correction-Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols-Stop and Wait, Go back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols- Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA.

[7 Hours]

Part-B

Network Layer: Logical addressing- IPV4, IPV6; Address mapping- ARP, RARP, BOOTP and DHCP–Delivery, Routing algorithms, Congestion control policies, Leaky bucket and token bucket

algorithms. **[6 Hours]**

Transport Layer: Design issues, Elements of transport Protocols- Connection establishment and release, Process to Process Communication, User Datagram Protocol (UDP), Transmission

Control Protocol (TCP), flow control. **[6 Hours]**

Session, Presentation and Application Layer: Session Layer- Design issue, remote procedure call. Presentation Layer- Design issue, Data compression techniques. Application Layer- Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP,

SNMP. **[6 Hours]**

Text Books

1. Andrew S. Tanenbaum, “Computer Networks”, Pearson Education.
2. Behrouz A. Forouzan, “Data Communication &Networking”, Tata McGraw Hill.

Reference Books

1. Douglas E. Comer, “Internetworking with TCP/IP”, Volume-I, Prentice Hall, India.
2. W. Stallings, “Data and Computer Communication”, Prentice Hall of India.

3. James F. Kurose and Keith W. Ross, “Computer Networking”, Pearson Education.

Books and online learning material

1. An Introduction to Computer Networks by Peter L Dordal, Department of Computer Science, Loyola University Chicago.

   http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106105081/ Accessed on May. 15, 2019
2. https://nptel.ac.in/courses/106105081/2 Accessed on May. 15, 2019
3. https://nptel.ac.in/courses/106105081/5 Accessed on May. 15, 2019
4. https://nptel.ac.in/courses/106105081/16 Accessed on May. 15, 2019
5. https://nptel.ac.in/courses/106105081/31 Accessed on May. 15, 2019

Subject Code: ESCS-101

Subject Name: Digital Electronics

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 3	**Teaching Hours: 3**6
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 50%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: NIL

Additional Material Allowed in ESE: [Scientific Calculator or NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply the structure of number systems in digital design.
CO2	Minimize the Boolean expressions in SOP and POS form using K-maps.
CO3	Use basic principles of digital logic gates to design digital circuits.
CO4	Implement combinational logic circuits using Boolean algebra and logic gates.
CO5	Analyze Synchronous and Asynchronous sequential circuits using Flip Flops, registers and Counters.
CO6	Apply the knowledge of real-world applications of PLDs in industries

Detailed Contents:

Part-A

Number Systems: Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's, rth's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII – conversion from one code to another. **[5 Hours]**

Boolean Algebra: Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization. **[5 Hours]**

Logic GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations. Study of logic families like RTL, DTL, DCTL, TTL, MOS, CMOS, ECL and their characteristics. **[5 Hours]**

Combinational Circuits: Design procedure – Adders, Subtractors, Serial adder/Subtractor, Parallel

adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX. **[6 Hours]**

Part-B

Sequential Circuits: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops. Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter, Ring Counters. Classification of sequential circuits-Moore and Mealy, Design of Synchronous machines: state diagram, Circuit implementation. Shift registers. **[6 Hours] Signal Conversions:** Analog & Digital signals. A/D and D/A conversion techniques (Weighted type, R-2R Ladder type, Counter Type, Dual Slope type, Successive Approximation type). **[4 Hours]**

Introduction to Design with PLDs: Introduction to programmable logic devices- Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA) **[5 Hours]**

Text Books

1. M. Morris Mano, “Digital Design”, Prentice Hall of India Pvt. Ltd./Pearson Education (Singapore) Pvt. Ltd., New Delhi.
2. John F.Wakerly, “Digital Design”, Pearson/PHI.
3. John M. Yarbrough, “Digital Logic Applications and Design”, Thomson Learning.
4. Charles H.Roth., “Fundamentals of Logic Design”, Thomson Learning.
5. A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI.

Reference Books

1. Donald P. Leach and Albert Paul Malvino, “Digital Principles and Applications”, TMH.
2. William H. Gothmann, “Digital Electronics”, PHI.
3. A. K. Maini, “Digital Electronics: Principles, Devices and Applications, Wiley, 2007.

E-Books and online learning material

1. Web packages for HDL, GHDL, FreeHDL
2. PSpices and NGSpice
3. Xcircuit and Scilab
4. NPTEL website and IITs virtual laboratory

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/117106086/32 Accessed on May 19, 2019
2. https://nptel.ac.in/courses/108105113/ Accessed on May 19, 2019
3. https://www.coursera.org/learn/digital-systems Accessed on May 19, 2019

Subject Code: BSCS-101

Subject Name: Mathematics III

Programme: B.Tech.(CSE**)**	**L:** 3 **T:** 1 **P:** 0
Semester: 3	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 90%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of partial differentiation, probability and statistics.

Additional material allowed in ESE: Scientific calculator, log tables, probability distribution tables, statistical tables or NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply the concept of matrices to solve the system of linear equations.
CO2	Understand the basic functions of complex variables , analytic functions and find the derivative of functions of complex variable
CO3	Acquire the basic knowledge, essential to evaluate integration of functions of complex variables.
CO4	Analyze probability spaces, random variables and different probability distribution.
CO5	Determine the best fit curve for the given statistical data.
CO6	Apply statistical methods for analyzing experimental data.

Detailed Contents:

Part-A

Differential calculus of complex variables: Separation of elementary functions of complex variables, Cauchy-Riemann equations, analytic functions, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, harmonic functions, finding harmonic conjugate. **[8 Hours]**

Integral Calculus of functions of complex variables: Complex integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof) Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Mobius transformations and their

properties. **[8 Hours] Linear Systems:** Gauss's elimination method and Gauss's Jordan method **[3 Hours]**

Part-B

Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines and second degree parabolas **[5 Hours]**

Probability Distributions: Probbility spaces, Discrete random variables, Poisson and binomial distribution. Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. **[8 Hours]**

Statistics: Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small sample test for single mean and difference of means, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. **[8 Hours]**

Textbooks:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Reference books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
3. S. Ross, A First Course in Probability, Pearson Education India.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill

Subject Code: HSMCS-101

Subject Name: Human values and Professional Ethics

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 3	**Teaching Hours:** 38
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Discriminate between valuable and superficial in the life.
2	Encourages students to discover what they consider valuable.
3	Understand the value required to be a good human being and apply these values in real life.
4	Evaluate and modify the behavior.
5	Understand fundamental and organizational duties and protect individual and social rights.
6	Know about professional behavior, values and guiding principles.

Detailed Contents:

Part-A

Ethics and values: Importance of Ethics and values, Difference between moral, ethics and values,Nature of Values, The Structure of Value Relations , Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, caring , Sharing , Honesty, Courage, Valuing time Cooperation, Commitment, Empathy, Self confidence, Challenges in the work place, spirituality. **[8 Hours]**

Value education: Need for value education, Basic guidelines, Self Exploration, Values in family and Harmony in existence, Values across cultures. **[6 Hours]**

Personality and behavior development: God and scientific attitude, positive thinking, Integrity and discipline, punctuality, Aware of self destructive habits, Association and

cooperation, Doing best, motivation Theories and Case study, Johari Window, Leadership Styles and Theories, Win- Win policy, SWOT Analysis **[6 Hours]**

Part-B

Human rights: Definition, Fundamental rights and duties, Regional, national and Universal protection of human rights, human rights and vulnerable groups. **[5 Hours]**

Professional ethics: Introduction, Objectives and types of professional ethics, Personal vs. Professional Ethics. Ethics in Profession, Ethics for employees, Rights of an Employee, Whistle-blower Policy, Code of Conduct, code of ethics, global issues (Technology revolution, international trade, globalization, environmental ethics, war ethics and intellectual property rights). **[8 Hours]**

Engineering Ethics: Scope and approach, Steps to Deal with Issues, Types of Inquiries, Moral Dilemma, Steps to Solve Dilemma, Engineering as Social Experimentation, Engineers as responsible experimenters. **[5 Hours]**

Text Books

1. John Berry, Janek, Pandey; Poortinga, Ype 'Handbook of Cross-cultural Psychology', Boston.
2. R.S Naagarazan , "Professional Ethics and Human Values", New Age Publisher.
3. P.L. Dhar, R.R. Gaur, 'Science and Humanism', Common Wealth Publishers.
4. Tanu Shukla, Anupam Yadav , Gajendra Singh Chauhan, "Human Values and Professional Ethics", First edition, 2017.
5. M. Govindrajran, S. Natrajan & V.S. Senthil Kumar, "Engineering Ethics (including Human Values)", Prentice Hall of India Ltd.
6. Premvir Kapoor, "Professional Ethics and Human Values", Khanna Publishing.

Reference Books

1. E.G. Seebauer& Robert L. Berry, 'Fundamentals of Ethics for Scientists & Engineers', Oxford University Press.
2. R.R. Gaur , R Sangal, G P Bagria, "A Foundation Course in Human Values and Professionals Ethics", Excel Publishers.
3. Vaishali R Khosla, Kavita Bhagat, "Human Values And Professional Ethics", Technical Publications.

E-Books and online learning material

1. Human values and Professional Ethics

https://crescent.education/wp-content/uploads/2018/12/Crescent-human-values-professional-ethics.pdf

2. Professional Ethics and Human Values

   Noteshttps://www.academia.edu/8844628/Professional_Ethics_and_Human_Values_

   Notes

3. Engineering Ethics Tutorial

   https://www.tutorialspoint.com/engineering_ethics/ind

   ex.htm

4. Professional Ethics and Values in Engineering

https://www.srecwarangal.ac.in/cse-downloads/peve-unit-1.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/109104068/30 Accessed on June 27, 2019
2. https://www.youtube.com/watch?v=3-UEi_djb7w Accessed on June 27, 2019
3. https://www.youtube.com/watch?v=VVsrsOaEcFQ Accessed on June 27, 2019
4. https://www.youtube.com/watch?v=-iJIrYreix0 Accessed on June 27, 2019

Subject Code: LPCCS-101

Subject Name: Object Oriented Programming Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 4
Semester: 3	**Teaching Hours:** 42
Theory/Practical: Practical	**Credits:** 2
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Apply control structures, arrays and strings to develop programs.
CO2	Design object-oriented programs using classes, objects, constructors, destructors along with various types of functions.
CO3	Develop programs using overloading and virtual functions in polymorphism.
CO4	Demonstrate the reusability aspect of object-oriented programming using Inheritance.
CO5	Create programs using exception handling and file handling.
CO6	Develop projects using object oriented programming for real time requirements.

[Control statements]

1. Demonstrate the use of conditional control statements like if, if-else, if-else ladder, nested if-else, and switch-case statement.
2. Illustrate the use of loop control statements like for, while, and do-while.
3. Write a program to demonstrate the use of break and continue statement.

[Arrays and Strings]

4. Demonstrate the use of one dimensional and two dimensional arrays by using suitable programs.
5. Illustrate the use of various string handling functions.

[Classes and Objects]

6. Program to illustrate the concept of classes and object.
7. Program to illustrate the concept of nesting of member functions.

8. Program to show the working of static members (static functions and static variables) in a class.
9. Program to demonstrate the use of friend functions.

[Constructors and Destructors]

10. Program to illustrate the concept of default constructor, parameterized constructor, and copy constructor.
11. Program to illustrate the concept of destructors.

[Polymorphism]

12. Program to demonstrate the concept of operator overloading
13. Program to illustrate the concept of function overloading and constructor overloading.
14. Program to illustrate the concept of virtual functions and pure virtual functions.

[Inheritance]

15. Program to illustrate the concept of inheritance.
16. Program to illustrate the concept of ambiguity in multiple inheritance.
17. Program to illustrate the order of execution of constructors and destructors in inheritance.
18. Program to demonstrate the concept of function overriding.

[Exception handling]

19. Program to illustrate the exception handling mechanism.

[File handling]

20. Program to illustrate the concept of file pointers.
21. Program to perform read and write operations on a file.

Any one project Banking

System Project

Description: The BANKING SYSTEM project has account class with data members like account number, name, deposit, withdraw amount and type of account. Customer data is stored in a binary file. A customer can deposit and withdraw amount in his account. User can create, modify and delete account.

Library Management System Project

The LIBRARY MANAGEMENT SYSTEM project has book and student class with data members like book no, bookname, authorname. Books record is stored in a binary file. A student can issue book and deposit it within 15 days. Student is allowed to issue only one book. Student Records are stored in binary file. Administrator can add, modify or delete record.

Reference Material

Manuals available in Lab

Subject Code: LPCCS-102

Subject Name: Computer Networks Laboratory

Programme: B.Tech. CSE	**L:** 0 **T:** 0 **P:** 2
Semester: 3	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 01
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Computer System.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Configure protocols concerning various network technologies over different mediums and layers.
CO2	Apply the knowledge of different network components, transmission mediums and tools to solve various problems of communication.
CO3	Design and develop different network design and logical models of networking to solve network related problems
CO4	Utilize knowledge of modern network simulation tools to propose solution for efficient working of networks for real world problems
CO5	Make use of various troubleshooting methods to overcome networking problems.
CO6	Function in multidisciplinary teams through groups while working in different network environments with the help of resource sharing

Special Instruction related to resources requirement: Except practical number 10.

Sr.No.	Name of Practical
1.	Familiarization with networking components, transmission media, tools and devices: LAN Adapters, Hubs, Switches, Routers etc.
2.	Study of various LAN topologies and their creation using network devices, cables and

	computers, Preparing straight and cross cables.
3.	Configuration of TCP/IP Protocols in Windows and Linux.
4.	Implementation of resource (file, printer, etc.) sharing.
5.	Designing and implementing class A, B and C networks.
6.	Subnet planning and its implementation.
7.	To configure dynamic IP address for a computer connected to a LAN.
8.	Use of commands like ping, ipconfig for trouble shooting network related problems.
9.	Develop a program to compute the Hamming Distance between any two code words.
10.	To configure proxy server, Familiarization with network simulation tools.

Reference Material

Manuals available in

Subject Code: LESCS-101

Subject Name: Digital Electronics Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:**2
Semester: 3	**Teaching Hours: 24**
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Implement logic gates using integrated circuits and verify their truth tables.
CO2	Inspect arithmetic operations through integrated circuits using combinational circuits.
CO3	Construct basic combinational circuits to verify their functionalities.
CO4	Apply the design procedures to design basic combinational circuits.
CO5	Perform the functionalities of Flip Flops on ICs.
CO6	Implement Synchronous and Asynchronous counters using IC's.

Resources required: Digital Trainer Board, ICs, connecting wires.

S. No.	Name of Practical
1.	Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates using various IC’s.
2.	Realization of OR, AND, NOT and XOR functions using universal gates IC’s 7400 and 7402.

3.	Half adder / Full adder: Realization using basic and XOR gates IC's.
4.	Half subtractor / Full subtractor: Realization using IC's 7400 and 7402.
5.	Realization of IC7483 as Parallel adder/subtractor.
6.	4-Bit Binary-to-Gray and Gray-to-Binary Code Converter: Realization using basic, XOR gates and universal gates.
7.	4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
8.	Multiplexer: Truth-table verification and realization of half adder and full adder using IC74153 chip.
9.	Demultiplexer: Truth-table verification and realization of half subtractor and full subtractor using IC74139 chip.
10.	Flip Flops: Truth-table verification of JK master slave FF, T-type and D-type FF using IC7476 chip.
11.	Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 & IC7493 chip.
12.	Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 and IC74193 chip.

A mini project such as burglar alarm, fire alarm, traffic alert system etc.

Reference Material

Manuals available in Lab.

Subject Code: PRCS-101

Subject Name: Seminar and Technical Report Writing for Engineers

Programme: B.Tech. (CSE)	**L: 0 T: 0 P:** 2
Semester: 3	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: Nil	**Duration of End Semester Exam (ESE):**
Total Marks: 50	**Elective Status:** Compulsory

Additional Material Allowed in ESE: NA

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Illustrate the basic components of technical report writing.
CO2	Utilize various communication skills to present the technical work.
CO3	Make use of Latex concepts to prepare technical reports and documents.
CO4	Adapt the ethics of copyrights and infringement.
CO5	Implement the unique qualities of technical reference and citation styles.
CO6	Follow the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks.

Part-A

Technical report: Importance of technical report, Structure of technical report, Planning the report, Diagrams, graphs, tables and mathematics, Citing and referencing, References to diagrams, graphs, tables
and equations, Originality and plagiarism, Finalizing the report and proofreading.[**2 Hours**]

Presentation Skills: Plan, structure and prepare presentation, Voice and body language, Conversational style, Rules for effective speaking, Enhancing improvising skills, Managing a challenging audience, Using
visuals and metaphors to make presentation more inspiring. **[2 Hours]**

Latex: Installation of the software LaTeX, Latex compilation, Creating a document- preamble of a document, Basic formatting- abstract, paragraphs and newlines, Headers and footers, spacing, hyphenation, Bold, italics and underlining text, Paragraph alignment and indentation, Lists- Unordered, ordered, nested **[3 Hours]**

Part-B

Tables: The tabular environment, Tables with fixed length, Combining rows and columns, Multi-page tables, Positioning tables, Captions, labels and references, Line width and cell padding, colors, Sideways tables, Table with legend. **[3 Hours]**

Figures: Insertion, Changing the image size and rotating the picture, captions, lists of figures and tables, Captions, labels and references, Wrapping text around figures, Subfigures, Wide figures in two-column documents. **[3 Hours]**

References: Bibliography management in LaTeX, Creating a .bib file, citation styles, citation of references in the text. **[2 Hours]**

Text Books

7. John Seely. The Oxford Guide to Effective Writing and Speaking. Oxford University Press.
8. Frank Mittelbach , Michel Goossens, Johannes Braams, David Carlisle, Chris Rowley, "The LaTeX Companion (Tools and Techniques for Computer Typesetting)", Addison-Wesley.
9. Stefan Kottwitz, "LaTeX Beginner's Guide", PACKT.

Reference Books

1. Davies J.W., "Communication for Engineering Students", Longman.
2. Van Emden J., "Effective communication for Science and Technology", Palgrave.
3. Van Emden J., "A Handbook of Writing for Engineers", Macmillan.
4. Van Emden J. and Easteal J., "Technical Writing and Speaking, an Introduction", McGraw-Hill.
5. Pfeiffer W.S., "Pocket Guide to Technical Writing", Prentice Hall.
6. Eisenberg A., "Effective Technical Communication", McGraw-Hill.

E-Books and online learning material

1. AH Basson & TW von Backström, "Guide for Writing Technical Reports",3rd Edition, Stellenbosch University",2007 Accessed on Feb 23, 2019

2. "Introduction to LaTex", http://home.iitk.ac.in/~kalpant/docs/intro_latex.pdf Accessed on Feb 23, 2019

Online Courses and Video Lectures

1. "Technical Report Writing for engineers", https://www.futurelearn.com/courses/technicalreport-writing- for-engineers. Accessed on April 26th 2019.
2. "Technical Writing", https://www.coursera.org/learn/technical-writing. Accessed on April 26th 2019.

Subject Code: PCCS-103

Subject Name: Discrete Mathematics

Programme: B.Tech. (CSE)	**L:** 3 **T:** 1 **P: 0**
Semester: 4	**Teaching Hours:** 35
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 90%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Familiarization with sequences and series, sets, functions and derivatives.

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply sets, relations and functions to solve problems.
CO2	Construct mathematical proofs to verify the correctness of an argument using prepositional logic, predicate logic and truth tables.
CO3	Apply counting techniques and combinatorics to determine discrete probability.
CO4	Solve problems involving recurrence relations and generating functions.
CO5	Prove elementary properties of algebraic structures in analysis and interpretation of data to provide valid conclusions.
CO6	Make use of graphs and trees to model real world problems.

Detailed Contents:

Part-A

Fundamentals of Sets, Relations and Functions: Sets – Operations on sets, Subsets, Types of sets, Ordered pairs, Proofs of general identities of sets, Classes of sets and partitions, Countable and uncountable sets. Relations –Representations of relations, Types of relations, Composition of relations, Closure properties of relations, Equivalence relations, Compatibility relations, Partial order relations. Functions – Introduction and types of functions, Sum and product of functions, Hashing functions, Recursively defined functions. [**7 Hours**]

Prepositional and Predicate Logic: Prepositions and compound prepositions, Logical connectives, Truth tables, Logical implication and logical equivalence, Normal forms– Conjunctive and

Disjunctive, Validity of well-formed formula, Propositional inference rules–Modus ponens and modus tollens. Predicate logic,

Universal and existential quantification, Limitations of propositional and predicate logic.**[3 Hours]**

Combinatorial Mathematics: Basic counting principles, Permutations and combinations, Pigeonhole principle, Inclusion and exclusion principle, Recurrence relations – Solving homogeneous and non-

homogeneous recurrence relations, Sequences, Generating function.**[7 Hours]**

Part-B

Algebraic Structures and Morphism : Algebraic structures with one binary operation, Properties of an operation, Congruence relation , Semi groups, Monoids, Groups, Substructures, Cyclic groups, Cosets, Normal subgroups, Dihedral groups, Permutation Groups. Homomorphism and isomorphism of groups, Applications of groups. Algebraic structures with two binary operation, Rings – Introduction, Abelian ring, Ring with unity, Multiplicative inverse, Subrings, Homomorphism of rings. Integral Domain, Ideals. **[8 Hours]**

Boolean Algebra: Boolean algebra, Boolean sub-algebra, Boolean rings, Application of Boolean algebra (Logic implications, Logic gates, Karnaugh-map). **[2 Hours]**

Graphs and Trees: Graphs – Definition, degree, Connectivity, path, cycle, Directed and undirected, Sub Graph, Bi-connected component and Articulation points. Eulerian chains and cycles, Hamiltonian chains and cycles, Shortest paths algorithms – Dijkstra'salgorithm, Warshall's algorithm. Rooted trees, Spanning tree algorithms – Kruskal's algorithm, Prim's algorithm. Graph coloring, Map Coloring, Chromatic number, Planar graphs, Euler's formula, Isomorphism and homomorphism of graphs, Applications of graph theory.

[8 Hours]

Text Books

1. S. Lipschutz and M.Lipson, "Schaum's Outline of Discrete Mathematics", Tata McGraw Hill.
2. A. Doerr and K. Levarseur, "Applied Discrete Structures for Computer Science", Pearson Education, Inc.
3. K.H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill.

Reference Books

1. C.L. Liu , " Elements of Discrete Mathematics" , Tata McGraw Hill.
2. Susanna S. Epp, Discrete Mathematics with Applications, Wadsworth Publishing Co. Inc.

E-Books and online learning material

1. Discrete Mathematics and its applications by Kenneth H. Rosen
https://mathcs.clarku.edu/~djoyce/ma114/Rosen6E.pdf 6th Edition Accessed on Feb. 27, 2019

2. Discrete Mathematics: An Open Introduction by Oscar Levin
https://open.umn.edu/opentextbooks/textbooks/discrete-mathematics-an-open-introduction Accessed on Feb. 27, 2019

3. A Course in Discrete Structures by Rafael Pass Wei-Lung Dustin Tseng
https://www.cs.cornell.edu/~rafael/discmath.pdf Accessed on Feb. 27, 2019 **Online Courses and Video Lectures**

1 https://nptel.ac.in/courses/106106094 Accessed on Feb. 27, 2019

2. https://nptel.ac.in/courses/111107058 Accessed on Feb. 27, 2019

3. https://nptel.ac.in/courses/111104026 Accessed on Feb. 27, 2019

4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for- computer-science-fall-2010/video-lectures Accessed on Feb. 27, 2019

Subject Code: PCCS-104

Subject Name: Computer Architecture and Microprocessors

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 4	**Teaching Hours:** 38
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Digital Circuit and Logic Design

Additional Material Allowed in ESE: NIL

On Completion of the course, the student will have the ability to:

CO1	Explain the binary number system and its representations in computer system.
CO2	Implement Arithmetic, Logical and Shift micro operations using Register Transfer Language.
CO3	Describe the structure and organization of basic computer using instruction set architecture.
CO4	Elaborate instruction formats, RISC and CISC architectures and addressing modes.
CO5	Solve basic binary math operations through programming of 8085 microprocessor.
CO6	Make use of memory mapped and I/O mapped interfacing in microprocessor applications.

Detailed Contents

Part-A

Data Representation: Data types, Complements, Fixed point representation, Floating point representation, Error detection and correction. **[3 Hours]**

Register Transfer and Micro-operations: Addition, Subtraction, Multiplication and division algorithms and hardware, Register transfer language and operations, Arithmetic micro-operations, Logic micro-operations, Shift micro-operations, Arithmetic logic shift unit. **[4 Hours]**

Computer Organization and Design: Instruction codes, Computer registers, Computer instructions, Timing and control, Instruction cycle, Memory reference instructions, Input/ Output and interrupts, Design and working of a complete basic computer, Control functions, Design of accumulator logic. **[4 Hours]**

Central Processing Unit and Input-Output Organization: General register organization, Stack organization, Addressing modes, RISC and CISC architecture, I/O interface, Asynchronous data transfer, Modes of transfer, Priority interrupt, DMA, I/O processor. **[4 Hours]**

Memory Organization: Memory hierarchy, Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management hardware. [**4 Hours]**

Part-B

Microprocessor Architecture: Introduction to microprocessors, 8085 microprocessor architecture – Bus structure, Register organization. [**5 Hours] Programming with 8085:** Addressing modes, Instruction classification, Instruction formats, Data transfer operations, Arithmetic operations, Logical operations, Branch operations, Stack and subroutine operations, looping, counting and indexing operations. [**5 Hours]**

Interfacing: Memory and I/O mapped I/O, Programmable interfaces – 8255 programmable peripheral interface, 8259 interrupt controller, and 8237 DMA controller. [**5 Hours]**

Microprocessor Applications: Interfacing of keyboards and seven segment LED display, Study of traffic light system, stepper motor controller. [**4 Hours]**

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Education.
2. William Stallings, "Computer Organization and Architecture", Pearson Education.
3. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with 8085", Penram International Publication.

Reference Books:

1. B. Ram, "Microprocessors and Microcomputers", Dhanpat Rai Publications.
2. K. Vani, "Computer Architecture with MIPS", Notion Press.
3. A.P. Mathur, "Introduction to Microprocessors", Tata McGrawHill.
4. P.K. Ghosh and P.R. Sridhar, "0000 To 8085: Introduction to Microprocessors for Engineers and Scientists", PHI Learning.

Books and online learning material:

1. Computer Architecture by Wikipedia
   https://en.wikipedia.org/wiki/Computer_architecture Accessed on Feb 22, 2019
2. Computer Architecture by Princeton University
   https://www.coursera.org/learn/comparch Accessed on Feb 22, 2019

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=4TzMyXmzL8M Accessed on Feb 22, 2019.

2.https://www.youtube.com/watch?v=So9SR3qpWsM Accessed on Feb 20, 2019

Subject Code: PCCS-105

Subject Name: Operating Systems

Programme: B.Tech. (CSE**)**	**L:** 3 **T: 1 P:** 0
Semester: 4	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Basic knowledge of computer fundamentals and computer system architecture.

Additional Material Allowed in ESE:

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the types and functions of operating systems
CO2	Evaluate different scheduling Techniques and list resources involved in process creation and management
CO3	Discuss inter-process communication, deadlock prevention, avoidance, detection and recovery techniques.
CO4	Comprehend the mechanisms used in memory management
CO5	Apply file management mechanisms for efficiency and performance.
CO6	Make use of disk scheduling algorithms

Detailed Contents:

Part - A

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. **[5 Hours]**

Process management: Concept of processes and threads, Definition, Process and Program, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads. **[4 Hours]**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling. **[6 Hours]**

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware

Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphore **[4 Hours]**

Part - B

Deadlocks: Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock prevention and avoidance, Deadlock detection and recovery. **[4 Hours]**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging, Segmentation. **[6 Hours]**

File Management: Concept of File, Access methods, File types, File operation, Directory structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **[4 Hours]**

Secondary Storage: Disk structure**,** Disk scheduling – FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, Disk Management, Disk Formatting, Boot blocks, Bad blocks. **[4 Hours]**

Text Books

1. A Silberschatz and Peter B. Galvin, "Operating System Concepts" Addison Wesley.
2. GaryNutt, "Operating Systems Concepts", Pearson Education Ltd.

Reference Books

1. Dhamdhere, "Systems Programming & Operating Systems" Tata McGraw Hill.
2. Tanenbaum A. S "Operating System Design & Implementation" Pearson Education.
3. Bhatt and Chandra "An introduction to operating systems concepts & Practices" Prentice Hall of India Publication.

E-Books and online learning material

1. http://www.uobabylon.edu.iq/download/M.S%202013-2014/Operating_System_Concepts,_8th_Edition%5BA4%5D.pdf Accessed on Aug. 05, 2019
2. http://dinus.ac.id/repository/docs/ajar/Operating_System.pdf Accessed on Aug. 05, 2019

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106106144/ Accessed on Aug. 05, 2019
2. https://www.coursera.org/learn/os-power-user Accessed on Aug. 05, 2019

Subject Code: PCCS-106

Subject Name: Data Structures

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 4	**Teaching Hours:** 37
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 50%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Programming for Problem Solving and OOPS

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course outcomes (CO)
CO1	Identify the appropriate data structure to provide solution with reduced space and time complexity.
CO2	Implement the storage of linear data in arrays, linked list and hashing technique.
CO3	Utilize stacks for solving problems that works on the principle of recursion.
CO4	Make use of queues in solving problems having sequential processing.
CO5	Implement the concept of non-linear data structures-tree and graph in real world problems.
CO6	Analyse efficiency of different algorithms for searching and sorting.

Detailed Contents:

Part-A

Basic concepts: Concept of data type, Linear and non-linear data structures, Data structures versus data types, Operations on data structures, Algorithm complexity and Asymptotic notations. **[2 Hours]**

Arrays: Linear and multi-dimensional arrays and their representation, Operations on arrays, Sparse matrices and their storage. **[2 Hours]**

Stacks: Sequential representation of stacks, Operations on stacks, Application of stacks – parenthesis checker, Evaluation of postfix expressions, Conversion from infix to postfix, Conversion from infix to prefix representation, Tower of Hanoi problem, implementing recursive functions. **[5 Hours]**

Queues: Sequential representation of queue, Types of queue- Linear Queue, Circular Queue, Deque, Priority Queue, Operations on each types of Queues and their algorithms, Applications of Queues. **[4 Hours]**

Linked List: Definition and representation of Linked list, Types of Linked list- Linear linked list, Doubly linked list, Circular linked list and Header linked list and their operations, Application of linked lists, Garbage collection and compaction, Linked representation of Stack and Queues and their algorithm. **[6 Hours]**

Part-B

Trees: Basic terminology, Sequential and linked representations of trees, Different types of Trees- Binary Tree, Binary search tree, Threaded binary tree, AVL tree and B-tree. Operations on each of the trees. Application of Binary Trees. **[5 Hours]**

Graphs: Basic terminology, Representation of graphs – Adjacency matrix, Adjacency list. Operations on graph, Traversal of a graph – Breadth first search, Depth first search. Shortest path algorithms – Dijkstra's and Floyd. Minimum spanning tree – Prim and Kruskal. Applications of graphs. **[4 Hours]**

Heaps: Representing a heap in memory, Operations on heaps, Application of heap in implementing priority queue and Heap sort algorithm. **[2 Hours]**

Hashing and Hash Tables: Introduction to hash table, Hash functions, Concept of collision and its resolution using open addressing and separate chaining, Double hashing, Rehashing. **[2 Hours]**

Searching and Sorting: Linear and binary search techniques, Sorting methods – Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Shell sort and radix sort. Complexities of searching and sorting algorithms. **[5 Hours]**

Text Books

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw Hill.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Tata McGraw Hill.

Reference Books

1. Michael T. Goodrich, Roberto Tamassia, & David Mount, "Data Structures and Algorithms in C++", Wiley India.
2. Kruse, "Data Structures &ProgramDesign", Prentice Hall of India.
3. Y. Langsa, M.J. Augenstein, A.M. Tanenbaum, "Data structures using C and C++", Prentice Hall of India.
4. Vishal Goyal, LaliGoyal, Pawan Kumar, " Simplified Approach to Data Structures", Shroff Publications and Distributors

E-Books and online learning material

1. Data Structures and Algorithms: byGranville Barnett, and Luca Del Tongo.
https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf
2. Data Structures and Algorithms in JAVA :by Michael T. Goodrich and Roberto

Tamassiahttp://enos.itcollege.ee/~jpoial/algorithms/GT/Data%20Structures%20and%20Algorithms%20in%20Java%20Fourth%20Edition.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106102064/
2. https://nptel.ac.in/courses/106106133/
3. https://nptel.ac.in/courses/106106145/
4. https://www.youtube.com/watch?reload=9&v=YWnBbNj_G-U

Subject Code: PCCS-107

Subject Name: Software Engineering

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 1 **P:** 0
Semester:	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of System Analysis

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain software process models and fundamentals of software engineering to use suitable process model for a given scenario.
CO2	Analyse software requirements for designing SRS documents
CO3	Discuss project management including planning, cost estimation, scheduling and risk management
CO4	Apply software design strategies to translate SRS to software design.
CO5	Apply coding standards and testing techniques for a given software design.
CO6	Recognize the importance of software maintenance , PSP, Six Sigma and re-engineering

Detailed Contents:

Part-A

Introduction: Evolution and impact of software engineering, Software myths, Software application domains, Software crisis – Problem and causes. **[4 Hours]**

Software Process Models: Software process, Software process models – Waterfall model, Prototype model, Spiral model, Evolutionary model, RAD model, V-model and Component based model. **[4 Hours]**

Requirements Engineering: Feasibility study, Problem analysis, Requirement elicitation and specification, Functional and non-functional requirements, Software requirements specification document, Requirement validation and management. **[4 Hours]**

Project Management and Risk Analysis: Project planning, Cost estimation techniques– Size metrics, Empirical estimation, Heuristic estimation and analytical estimation, Project monitoring and control– Work breakdown structure, Activity chart, Gantt charts, PERT charts, Critical path method, Manpower
management, Risk management- Identification, Analysis, Planning and Monitoring.**[6 Hours]**

Part-B

Software Design: Modular design– Coupling, Cohesion and abstraction, Function oriented design– Data flow diagrams, Structure chart, Object oriented design–Objects and object classes, Relationships
between classes, User interface design. **[7 Hours]**

Coding & Testing: Coding standards and code reviews, Testing – Need of testing, Unit testing, Integration testing, System testing, White-Box testing, Black-box testing, Alpha, Beta and acceptance testing, Smoke testing, Sanity testing, Regression testing, Cyclometric Complexity. Verification and
validation. **[6 Hours]**

Maintenance and Re-engineering: Software maintenance, Software re-engineering, Reverse engineering, Forward engineering, PSP and Six sigma. **[5 Hours]**

Text Books

1. Roger S. Pressman R., "Software Engineering, A Practitioner's Approach", McGraw Hill International.
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall of India.

Reference Books

1. Ian Sommerville , Software Engineering, Addison-Wesley Publishing Company .
2. Jalote P., "An Integrated Approach to Software Engineering", Naros

E-Books and online learning material

1. https://nptel.ac.in/courses/Webcourse contents/IIT%20Kharagpur/Soft%20Engg/New_index1.html Accessed on March 1, 2019
2. https://nptel.ac.in/downloads/106105087/ Accessed on March 1, 2019

Online Courses and Video Lectures

https://onlinecourses.nptel.ac.in/noc18_cs43/preview Accessed on March 1, 2019

Subject Code: LPCCS-103

Subject Name: Computer Architecture and Microprocessors Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 4	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Computers.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Design half adder and full adder combinational circuits
CO2	Apply binary multiplication and mapping techniques of cache memory through simulation using GNUsim8085
CO3	Analyze the architecture of ALU, GNUsim8085 simulator and 8085 microprocessor
CO4	Implement data transfer and arithmetic instructions using GNUsim8085 simulator
CO5	Implement logical, stack and branch instructions using GNUsim8085 simulator
CO6	Examine the fundamentals of assembly language programming using GNUsim8085 simulator

Special Instruction related to resources requirement: GNUsim8085 simulator should be installed to perform 4 to 11 practicals.

Sr.No.	Name of Practical
1.	**Combinational Circuit:** To study Half Adder.

2.	**Combinational Circuit:** To study Full Adder (7483).
3.	**Register Transfer and Micro-operations:** Write a program for binary multiplication.
4.	**Memory Organisation:** Write programs to simulate the mapping techniques of Cache memory. a. Direct Mapped cache b. Associative Mapped cache c. Set Associative Mapped cache
5.	**Functional design of ALU:** Analyzing the architecture and design of ALU, study the working of ALU and examine its functionality.
6.	**Working of 8085 simulator GNUsim8085 :** Introduction to 8085 microprocessor, study of components of GNUsim8085 and step wise assembly program execution using it.
7.	**Complete instruction set of 8085 :** Representation of instruction in computer system, Types of instructions - control instructions, logical instructions, branching, arithmetic and data transfer instructions.
8.	**Data transfer instructions:** Assembly language code in GNUsim8085 to implement various data transfer instructions like MOV, MVI, LXI, LDA, STA, IN, OUT etc.
9.	**Arithmetic instructions:** Assembly language code in GNUsim8085 to implement various arithmetic instructions involving immediate addition, subtraction, increment, decrement operations.
10.	**Addition and subtraction using flag:** assembly language code in GNUsim8085 to add and subtract two 8 bit numbers stored in memory and also set various flags corresponding to the result.
11.	**Logical instructions:** Assembly language code in GNUsim8085 to implement various logical instructions involving comparing of memory and register contents, logical operations - AND, OR, XOR and rotate operations.
12.	**Stack and branch instructions:** Assembly language code in GNUsim8085 to implement

	various stack and branch instructions involving insertion and deletion of contents into stack, conditional and unconditional jump, call and return.

Reference Material

Manuals available in Lab.

Subject Code: LPCCS-104

Subject Name: Operating Systems Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 4	**Teaching Hours:** 26
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE): 2** hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Computers.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Utilize the concept of virtualization for creating a virtual machine and installing operating system on virtual machine
CO2	Create simulation of CPU scheduling algorithms, producer-consumer problem and deadlock avoidance algorithms.
CO3	Implement memory management schemes and page replacement schemes, disk scheduling and file management techniques
CO4	Explain features of windows and Linux operating system.
CO5	Execute Linux commands for performing operations
CO6	Write programs using different shells and shell programming.

Special Instruction related to resources requirement: Any programming language like C, C++, Java can be used to simulate the programs.

Sr.No.	Name of Practical
1.	Installation process of various Operating Systems.

2.	Virtualization, Installation of virtual machine software and installation of Operating System on virtual machine.
3.	Overview of single user systems, network operating system and multiuser system.
4.	Write a program for the simulation of following CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin d) Priority
5.	Write a program for the simulation of producer-consumer problem using semaphores.
6.	Write a program for the simulation of Banker's algorithm for the purpose of deadlock avoidance.
7.	Write a program for the simulation of following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit
8.	Write a program for the simulation of following page replacement algorithms a) FIFO b) LRU c) Optimal
9.	Write a program for the simulation of following disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
10.	Write a program for the simulation of following file allocation strategies a) Sequential b) Indexed c) Linked
11.	To study the features of Windows and Linux operating system.
12.	Execute various basic Linux commands, commands for files and directories, creating and viewing files, File comparisons, Disk related commands.
13.	Basics of Shell programming, various types of shell, Shell Programming in bash.
14.	Implement conditional statements, looping statement, case statements and functions in Shell programming

Reference Material

Manuals available in Lab.

Subject Code: LPCCS-105

Subject Name: Data Structures Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 4
Semester: 4	**Teaching Hours:** 40
Theory/Practical: Practical	**Credits:** 2
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Computers.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Implement arrays and perform different operations on one dimensional and multidimensional arrays.
CO2	Implement basic operations of stacks and use them to solve problems.
CO3	Implement basic operations of Queue and their applications.
CO4	Apply the concept of Linked list to solve given problem.
CO5	Represent trees and graphs using appropriate data structures and perform traversal operations on trees and graphs.
CO6	Implement different searching and sorting algorithms using relevant data structures

Special Instruction related to resources requirement: Any programming language like C, C++, can be used for the programs.

Sr.No.	Name of Practical
1.	Design, Develop and Implement a menu driven Program for the following Array operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element (ELEM) at a given valid Position (POS) d. Deleting an Element at a given valid Position(POS) e. Exit.
2.	Design, Develop and Implement a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack Display the status of Stack f. Exit
3.	Design, Develop and Implement a Program for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
4.	Design, Develop and Implement a Program for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of Hanoi problem with n disks
5.	Design, Develop and Implement a menu driven Program for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE

	e. Exit Support the program with appropriate functions for each of the above operations .
6.	Design, Develop and Implement a menu driven Program for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
7.	Design, Develop and Implement a menu driven Program for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue f. Exit
8.	Design, Develop and Implement a Program for the following operationson Singly Circular Linked List (SCLL) with header nodes a. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z)
9.	Design, Develop and Implement a menu driven Program for the following operations on Binary Search Tree (BST) of Integers a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message e. Exit
10.	Design, Develop and Implement a Program for the following operations on Graph(G) of Cities

	a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method
11.	Write a Program to finds the position of an element in an array using Linear Search Algorithm and Binary search Algorithm.
12.	Write a program to sort list using different sorting algorithms (bubble, selection, insertion, radix, merge and quick sort) and compare them.

Reference Material

Manuals available in Lab.

Subject Code: MCCS-101

Subject Name: Environmental Sciences

Programme: B.Tech. (CSE**)**	**L:** 2 **T: 0 P:** 0
Semester: 4	**Teaching Hours:** 28
Theory/Practical: Theory	**Credits:** 0
Internal Marks: 40 + 10*	**Percentage of Numerical/Design/Programming Problems:**
External Marks:	**Duration of End Semester Exam (ESE):**
Total Marks: 50	**Elective Status:** Compulsory

* 10 marks will be awarded based upon the performance in debates/seminar/field study related to the contemporary issues of the subject.

Prerequisites: NIL

Additional Material Allowed in ESE: NA

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Measure environmental variables and interpret results.
2	Evaluate local, regional and global environment topics related to resource use and management.
3	Propose solutions to environmental problems related to resource use and management.
4	Interpret the results of scientific studies of environmental problems.
5	Describe threats to global biodiversity, their implications and potential solutions.

Detailed Contents:

Natural resources: Renewable and non-renewable resources, Natural resources and associated problems, Forest resources- Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. **[3 Hours]**

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems, Food resources- World food problems, changes caused by agriculture and over gazing, effects of modern agriculture, Fertilizers- pesticides problems, water logging, sanity, case studies, Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies, Land Resources- Land as a resource, land degradation, man induced

landslides, soil erosion and desertification. **[4 Hours]**

Eco systems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers, decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, Food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems- Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries **[4 Hours]**

Biodiversity and its conservation: Introduction- Definition- genetics, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity- competitive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local level, India as a mega diversity nation, Hot spots of biodiversity, Threats to biodiversity- habitat loss, poaching of wildlife, man wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity- in-situ and ex-situ conservation of biodiversity. **[4 Hours]**

Environmental Pollution: Definition, causes, effects and control measures of – Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, Solid waste management- Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, case studies. **[4 Hours]**

Social issues and the Environment: From unsustainable to sustainable development, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people- its problems and concerns, case studies, Environmental Ethics- issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies, Environmental protection act, Air (prevention and control of pollution) act, Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act. [**5 Hours]**

Human population and the Environment: Population growth and variation among nations, Population explosion- family welfare program, Environment and human health, Human rights, value education, HIV/AIDS, Women and child welfare. **[4 Hours]**

Reference Books

1. Erach Barucha, “Textbook of Environmental studies”, UGC.
2. D.D. Mishra, “Fundamental concepts in Environmental Studies”, S Chand and Co Ltd.
3. K.C. Agarwal, “Environment Biology”, Nidi Publ. Ltd.
4. Cunnighan, “Principle of Environment Science”, W.P

Subject Code: PCCS-108

Subject Name: Artificial Intelligence

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5th	**Teaching Hours:** 38
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 60%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Course Status:** Compulsory

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Demonstrate the foundation of Artificial Intelligence and Agents.
CO2	Apply the principles of search strategies and game playing to solve problems.
CO3	Provide solution to complex problems using concept of knowledge representation, inference and planning.
CO4	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
CO5	Apply inductive learning algorithms for providing solution to prediction based problems.
CO6	Demonstrate and enrich knowledge of AI to understand existing systems.

Detailed Contents:

Part A

Introduction: Intelligence, Foundations of artificial intelligence (AI). History of AI, Agents and Environments, Rationality of Agents, Nature and Structure of Agents, Communication among Agents.

[3 Hours]

Problem Formulation and solution: Problem types, States and operators, State space, Uninformed Search Strategies, Informed Search Strategies– Best first search, A* algorithm, Heuristic functions, Iterative deepening A*(IDA), Small memory A*(SMA).

[5 Hours]

Game playing: Perfect Information game, Imperfect Information game, Evaluation function, Minimax algorithm, Alpha-beta pruning. **[3 Hours]**

Logical Reasoning: Inference in Propositional logic and First order Predicate logic, Resolution, Logical reasoning, Forward chaining, Backward chaining; Knowledge representation techniques: semantic networks, Frames. **[7 Hours]**

Part B

Planning: Basic representation of plans, Partial order planning, Planning in the blocks world, Hierarchical planning, Conditional planning, Representation of time, schedule and resource constraints, Measures, temporal constraints. **[5 Hours]**

Uncertainty: Basic probability, Bayes rule and its use, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making– Utility theory, Utility functions, Decision theoretic expert systems. **[5 Hours]**

Inductive learning: Decision trees, Rule based learning, Current-best-hypothesis search, Least commitment search, Neural networks, Reinforcement learning, Genetic algorithms. **[6 Hours]**

Applications: Areas of AI, Natural language processing, Case study of existing expert systems. **[4 Hours]**

Text Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India.

Reference Books

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill.
2. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University.

E-Books and online learning material

1. HandBook of Artificial Intelligence Edited by Avron Barr and Edward A. Feigenbaum, Computer Science Department, Stanford University.
   https://stacks.stanford.edu/file/druid:qn160ck3308/qn160ck3308.pdf

Online Courses and Video Lectures

1. https://www.coursera.org/courses?query=artificial%20intelligence
   Accessed on May 20,2020.
2. https://nptel.ac.in/courses/106/105/106105077/ Accessed on May20,2020.
3. https://nptel.ac.in/courses/106/102/106102220/ Accessed on May20,2020.
4. https://www.youtube.com/watch?v=bV4t4r3SGuI Accessed on May 20,2020.
5. https://www.youtube.com/watch?v=iF1tOCEXLXY Accessed on May20,2020.

Subject Code: PCCS-109

Subject Name: Database Management Systems

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 5	**Teaching Hours:40**
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Additional Material Allowed in ESE: Not Any

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Elaborate the basic principles of database management systems and NOSql Databases
CO2	Identify the data models for relevant problems to design its Entity-Relationship diagrams
CO3	Formulate Queries using Relational Formal Query Languages and SQL
CO4	Apply different normal forms to design the Database
CO5	Describe the file structure of Database Management System
CO6	Apply the principles of database transaction management, database recovery and security.

Detailed Contents:

Part-A

Introduction to Database Concepts: Introduction, Database systems versus file systems, Difference between Database and non-database system, Characteristics of Database Approach, Advantages and Disadvantages of Using DBMS. Data base users and administrators, Schemas and Instances, DBMS Architecture, components of a database system, Data Independence, Database Language and Interfaces, Classification of Database Management Systems. Introduction to NoSQL database. **[5 Hours]**

Entity Relationship Model: Data models, Entity types, Entity sets, Attributes and keys, Relationship types, Relationship sets, Roles and structural constraints, Weak entity types, Design choices for ER conceptual design, Comparison of Models. **[4 Hours]**

Relational Model: Relational model concepts, Constraints, Update operations, Transaction and dealing with constraint violations. Relational Algebra –Unary relational operations, Operations from Set theory,

Binary relational operations, DIVISION operation and additional relational operations. Relational Calculus – Tuple relational calculus and Domain relational calculus, Queries related to Relational Algebra and Relational Calculus. **[7 Hours]**

SQL: SQL Data Definition and data types, specifying constraints in SQL, Schema change statements, Basic queries in SQL, Set operations, Aggregate functions and views, Complex queries in SQL, Additional features of SQL. **[7 Hours]**

Part-B

Relational Database Design: Informal design guidelines for Relational Schemas, Functional dependencies, Inference rules for functional dependencies, Equivalence of set of functional dependencies, 2QMinimal cover, Normal forms based on primary keys– (1^{st}NF, 2^{nd}NF, 3^{rd}NF, 4^{th}NF and 5^{th}NF) Decomposition into normalized relations. Physical Database Design – File structures (Sequential files, Indexing, B tree). **[6 Hours]**

Transaction Management and Concurrency Control: Introduction to Transaction Processing, Transaction and System Concepts, need of concurrency control, ACID properties, Schedules, Characterizing schedules based on recoverability and serializability, Two - phase locking techniques for concurrency control. **[4 Hours]**

Database Recovery and Security: Need of recovery, Recovery concepts, Recovery techniques Deferred update, Immediate update, Shadow paging. Database security – Threats to databases, Control measures, Database security and DBA, Discretionary access control based on granting and revoking privileges, Mandatory access control, Introduction to Statistical Database Security, Encryption and decryption.

[7 Hours]

Text Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw Hill Education.
2. RamezElmasri, Shamkant B Navathe, "Fundamentals of Database Systems", Pearson Education.
3. Connolly, "Specifications of Database Systems: A Practical Approach to Design, Implementation and Management", Pearson India.
4. Alexis Leon, Mathews Leon, "Database Management Systems" Leon Press.
5. S.K. Singh, "Database Systems Concepts, Design and Applications, Pearson Education.
6. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Tata McGrawHill.

Reference Books

1. SQL,PL/SQL ,The programming language of oracle, Ivan Bayross BPB Publication
2. An introduction to database system by C.J.Date (Addison Welsey, Publishing house).
3. An introduction to Database Systems by Bipin C. Desai, Galgotia publications.
4. Prateek Bhatia, Database Management system, Kalayani Publishers

E-Books and online learning material

1. Database Management system. 2nd Ed.
https://ff.tu-sofia.bg/~bogi/knigi/BD/Database%20Management%20Systems.%202nd%20Ed.pdf

2. Fundamentals of Database Management Systems eBook.
https://circuitmix.com/free-download-fundamentals-of-database-management-systems-ebook/

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106/106/106106220/ Accessed on Jan22, 2020
2. https://www.youtube.com/watch?v=5TU7zH0Z8 Accessed on Jan 22, 2020
3. https://www.youtube.com/watch?v=Z2Zx2G02aI4 Accessed on Jan 22, 2020
4. https://www.youtube.com/watch?v=Kmp76uRHz9c Accessed on Jan 22, 2020
5. https://www.youtube.com/watch?v=QYd6ZjHpzBg Accessed on Jan 22, 2020

Subject Code: PCCS-110

Subject Name: Formal Language and Automata Theory

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 1 **P:** 0
Semester: 5	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 35%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Additional Material Allowed in ESE: Not Any

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Illustrate the usage of different types of finite machines and apply their transformation for different automata problems.
CO2	Explain the relationship among formal languages, classes and grammars with the help of Chomsky hierarchy.
CO3	Applying the concepts of regular grammars, context free grammars and finite automata for language recognition and its simplification.
CO4	Design pushdown automata based on its computational capabilities to recognize and generate context-free languages.
CO5	Apply the principles of Turing machines to design computational model for solving complex engineering problems.
CO6	Make use of capabilities of linear bounded automata in contrast to applicability Turing machines.

Detailed Contents:

Part-A

Finite Automata: Deterministic Finite Automata, Acceptance by Finite Automata, Transition systems, Non-Deterministic Finite Automata, Equivalence of DFA and NDFA, Moore and Mealy machines, Equivalence of Moore and Mealy machine, Minimization of Finite Automata, Applications and limitations of Finite Automata. **[6 Hours]**

Formal Languages: Basics of strings, Alphabets, grammar, Formal language, Chomsky classification of languages, Languages and their relation, Operations on languages, Closure properties of language classes. **[4 Hours]**

Regular Grammar: Regular grammars, Regular expressions, Algebraic method using Arden's theorem, Equivalence of Finite Automata and Regular expressions, Properties of regular languages, Pumping lemma. **[5 Hours]**

Context Free Language: Derivation, Ambiguity, Simplification of context free grammar, normal forms– Chomsky Normal Form, Greibach Normal Form, Pumping lemma. **[5 Hours]**

Part-B

Push Down Automata: Description and definition, Acceptance by Push Down Automata, Equivalence of Push Down Automata and context free grammars and languages. **[6 Hours]**

Turing Machine: Definition and Model, Representation of Turing Machine, Design of Turing Machine, Variants of Turing Machine, Decidability and recursively enumerable languages, Halting problem, Post correspondence problem. **[6 Hours]**

Context Sensitive Language: Context sensitive language, Model of linear bounded automata, Relation between linear bounded automata and context sensitive language. **[5 Hours]**

Text Books

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory,
2. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science", Third Edition, PHI
3. K.V.N. Sunitha, N. Kalyani, "Formal Languages and Automata Theory", McGraw-Hill.

Reference Books

1. Daniel, A.Cohen, "Introduction to Computer Theory", Wiley India Pvt. Ltd.
2. M. Sipser, "Introduction to the Theory of Computation", Second Edition, Cengage Learning.
3. M. A. Harrison, "Introduction to Formal Language Theory", Addison-Wesley
4. Peter Linz, "An Introduction to Formal Languages and Automata", Jones and Bartlett Publishers.

E-Books and online learning material

1. Jean-Eric Pin, "Mathematical Foundations of Automata Theory",Lecture notes LIAFA, Université Paris https://www.irif.fr/~jep//PDF/MPRI/MPRI.pdf
2. Michael Sipser, "Introduction to the Theory of Computation",Thomson Course Technology http://en.bookfi.net/book/1139836

3. Anil MaheshwariandMichielSmid, "Introduction to Theory of Computation", School of Computer Science, Carleton University, Ottawa Canada https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf
4. Michael Levet, "Theory of Computation", Lecture Notes,University of South Carolina-Columbia http://people.math.sc.edu/mlevet/Lecture_Notes.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106/104/106104028/ Accessed on May23, 2020
2. https://nptel.ac.in/courses/106/106/106106049/ Accessed on May23, 2020
3. https://nptel.ac.in/courses/106/104/106104148/ Accessed on May23, 2020

Subject Code: PCCS-111

Subject Name: Design and Analysis of Algorithms

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 1 **P:** 0
Semester: 5	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 90%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: Knowledge of Data Structures and Algorithms

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Explain divide and conquer techniques for designing algorithms
CO2	Analyze the resource utilization of an algorithm in terms of time and space for a given problem.
CO3	Apply greedy and dynamic programming approach for finding optimal solution of a given problem.
CO4	Use string matching algorithms for pattern matching.
CO5	Apply graph traversal techniques to search a node and find optimal path.
CO6	Use backtracking and NP completeness strategy to find solution.

Detailed Contents:

Part-A

Introduction: Algorithms, Algorithm Specification, Performance Analysis: Space complexity,Time complexity, Asymptotic Notations- Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), and Little-oh notation (o), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples. **[4 Hours]**

Divide and Conquer: General method, solving recurrences using recurrence trees, repeated substitution, statement of Master Theorem, applications – Binary search, Merge sort, Quick sort, Strassen's Matrix Multiplication, Finding the maximum and minimum. **[5 Hours]**

Greedy Algorithms: Greedy choice, optimal substructure property, minimum spanning trees-Prims and Kruskals, Dijkstra shortest path using arrays and heaps, fractional knapsack, Travelling salesperson problem and Huffman coding. **[5 Hours]**

Dynamic Programming: Introduction to dynamic programming and application of the algorithm to solve multistage graphs, edit distance, matrix chain multiplication, All pairs shortest path problem and Knapsack problem. **[5 Hours]**

Part-B

Backtracking: General method, N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles. **[4 Hours]**

Application of Graph Traversal Techniques: Representation of graphs, BFS (as a method for SSSP on unweighted graphs), DFS, connected components, topological sorting of DAGs, biconnected components, and strongly connected components in directed graphs. **[5 Hours]**

String Matching: Introduction, Brute Force algorithm, Rabin-Karp algorithm, KMP algorithm, Boyer-Moore algorithm. **[5 Hours]**

NP Completeness: classes NP, P, NP-complete, and polynomial time reductions, Introduction to approximation algorithms, Absolute approximations, E-approximations. **[7 Hours]**

Text Books:

1. Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, "Fundamentals of Computer Algorithms, Universities Press.
2. P. H. Dave, H. B. Dave, "Design and Analysis of Algorithms", Pearson Education.

Reference Books:

1. M. T. Goodrich and R. Tomassia, "Algorithm Design: Foundations, Analysis and Internet examples", John Wiley and sons.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford Univ. Press
3. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", Pearson Education.
4. R. Neapolitan and K. Naimipour, "Foundations of Algorithms", 4th edition, Jones and Bartlett Student edition.
5. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms, 3rd Edition", PHI

E-Books and online learning material:

1. Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, "Fundamentals of Computer Algorithms, 2nd Edition", Universities Press.

https://nasirmir.files.wordpress.com/2012/09/fundamentals-of-computer-algorithms-by-ellis horowitz-1984.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/content/storage/MP4/new/106106131/mod01lec01.mp4
2. https://nptel.ac.in/content/storage/MP4/new/106106131/mod01lec05.mp4
3. https://nptel.ac.in/content/storage/MP4/new/106106131/mod01lec06.mp4
4. https://nptel.ac.in/content/storage/MP4/new/106106131/mod02lec09.mp4

5. https://nptel.ac.in/content/storage/MP4/new/106106131/mod02lec13.mp4
6. https://nptel.ac.in/content/storage/MP4/new/106106131/mod03lec18.mp4
7. https://nptel.ac.in/content/storage/MP4/new/106106131/mod09lec44.mp4
8. https://nptel.ac.in/content/storage/MP4/new/106106131/mod10lec50.mp4

Subject Code: LPCCS-106

Subject Name: Artificial Intelligence Laboratory

Programme: B.Tech. (CSE**)**	**L:** 0 **T:** 0 **P:** 2
Semester: 5	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites:

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Write basic programs using fundamental python programming constructs.
CO2	Implement efficient uninformed search techniques to solve problems.
CO3	Implement informed search strategies by designing appropriate heuristic function.
CO4	Develop two player tic-tac-toe game by choosing appropriate game playing strategies.
CO5	Design Bayesian network to infer from the given data.
CO6	Develop systems to solve real-world problems using artificial intelligence frameworks and platforms.

List of Practicals:

1. Introduction to python Interpreter.
2. Programs to implement input output and control flow tools in python.
3. Programs to implement different Data Structures in Python.
4. Introduction to Standard Library, Virtual Environments and packages in Python.
5. Write a program to implement Breadth First search for water jug problem.
6. Write a program to implement Depth First search for water jug problem.
7. Write a Program to implement Best First Search.
8. Write a program to implement A*algorithm.
9. Write a Program to implement tic tac toe game for 0 and X.
10. Write a Program to construct a Bayesian network from given data.
11. Write a Program to infer from the Bayesian network

Project:

Students are required to develop an expert system for real life problems/games, Expert system; implement a production system, medical diagnosis expert system, agriculture expert system, troubleshooting of computer systems, and implementation of neural/fuzzy network.

Subject Code: LPCCS-107
Subject Name: Database Management Systems Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 5	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of Computers.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Construct a database by using DDL, DML with SQL constraints.
CO2	Formulate SQL queries using logical operators and SQL operators.
CO3	Write SQL queries for Relational Algebra.
CO4	Create views using group by ,having clause and SQL functions.
CO5	Design SQL queries while using joins, sub queries, nested queries and SQL operations.
CO6	Develop solutions using database concepts for real time requirements.

Special Instruction related to resources requirement: MY SQL,SQL Server, Oracle can be used for the queries.

List of Practicals:

1. Write the queries for Data Definition (create, drop, alter and rename) and Data Manipulation Language (select, insert, update and delete).
2. Write SQL queries using logical operators (,=etc).
3. Write SQL queries using SQL operators (between, and, or, in, like, null).
4. Write SQL query using character, number, date and group functions
5. Write SQL queries for Relational Algebra (union, intersect, and minus, etc.)
6. Write SQL queries for extracting data from more than one table (equi-Join, non-equi-join, outer join)
7. Write SQL queries for sub queries, nested queries. 8. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.

8. Queries (along with sub Queries) using any, all, in, exists, notexists, union, intersect, constraints. Example - Select the roll number and name of the student who secured fourth rank in the class.
9. Queries using aggregate functions (count, sum, avg, max and min), group by, having and creation and dropping of views.
10. Queries using conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date).
11. Write SQL queries to create views and also apply different operations on views.

Minor Project: By using standard database design rules, database has to be designed for a specific assigned problem to a group of two to three students. ER diagram related to project must also be prepared with an open source database tool like MYSQL workbench. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as have to give a presentation of the same.

Subject Code: LPCCS-108

Subject Name: Design and Analysis of Algorithms Laboratory

Programme: B.Tech. (CSE**)**	**L:** 0 **T:** 0 **P:** 2
Semester: 5	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Basic Programming

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Analyze the performance of Binary search, merge sort and quick sort algorithms using divide and conquer technique.
CO2	Solve and analyze the problems using greedy methods.
CO3	Apply the dynamic programming technique to solve real world problems such as knapsack and TSP.
CO4	Apply backtracking method to solve various problems. .
CO5	Apply graph traversal techniques to search a node and find optimal path.
CO6	Implement string matching algorithms for pattern matching.

List of Practicals:

1. Write a program to find out a roll number from college database using binary search algorithm.
2. Write a program to sort the class roll numbers of your class using merge sort algorithm and determine the time required to sort the elements.
3. Write a program to sort the university roll numbers of your class using Quick sort method and determine the time required to sort the elements.
4. Write a program to solve 0/1 knapsack using Greedy algorithm.
5. Write a program to find minimum cost to set the phone lines to connect all the cities of your state using Prim's algorithm.
6. Write a program to find the minimum cost of connecting all the engineering colleges in your state using Kruskal's algorithm.
7. Write a program to find minimum route for a newspaper distributer of your locality using Greedy algorithm.

8. Write a program to find shortest path from your home to college using Dijkstra's algorithm.
9. Write a program to find shortest path from your home to college using Bellman-Ford algorithm.
10. Write a program to solve 0/1 knapsack using dynamic programming.
11. Write a program to find the shortest path of the multistage graph using dynamic programming.
12. Write a program to find minimum distance between different cities of your state using FloydWarshall algorithm.
13. Write a program to find the solution to the 8 queen's problem using the backtracking.
14. Write a program to solve subset sum problem using Backtracking.
15. Write a program to use a queue to store the node and mark it as 'visited' until all its neighbours (vertices that are directly connected to it) are marked. Implement by using bfs algorithm for a graph.
16. Write a program to implement the dfs algorithm for a graph.
17. Write a program to match the pattern by using Brute Force algorithm, Rabin-Karp algorithm, KMP algorithm and Boyer-Moore algorithm.

Subject Code: PCCS-112

Subject Name: Compiler Design

Programme: B.Tech. (CSE)	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 38
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 40%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Course Status:** Compulsory

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the fundamental principles and phases of compiler.
CO2	Make use of lexical analysers to identify tokens.
CO3	Implement top down and bottom up parsers using syntax directed translation methods
CO4	Generate intermediate code representation using syntax trees and DAG.
CO5	Deduce machine code from the source code using code generator.
CO6	Apply optimization techniques to intermediate code using data flow analysis.

Detailed Contents:

Part A

Introduction to Compiler: Language Processors, The Structure of a Compiler, The Grouping of Phases into Passes, Applications of Compiler Technology, Programming Language Basics. [**3 Hours**]

Lexical Analysis: Role of lexical analyzer, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors, Input Buffering, Sentinels, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex, Finite Automata. [**5 Hours**]

Syntax Analysis: Introduction, Role of the parser, Context-Free Grammars (CFG), Writing a Grammar, Writing a Grammar, Top down parsing –Backtracking, LL(1), Recursive descent parsing, Non-recursive Predictive Parsing. Bottom-up parsing – Shift reduce parsing, LR parsers, SLR parser. Canonical LR parser, LALR parser, Introduction to The Parser Generator Yacc. [**6 Hours**]

Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax-Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. [**6 Hours**]

Part-B

Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-Statements, Intermediate Code for Procedures. [**6 Hours**]

Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code , Basic Blocks and Flow Graphs, Optimization of Basic Blocks, A Simple Code Generator, Peephole Optimization , Register Allocation and Assignment. [**6 Hours]**

Machine-Independent Optimizations: The Principal Sources of Optimization, Introduction to Data-Flow Analysis, Foundations of Data-Flow Analysis, Constant Propagation, Partial-Redundancy Elimination, Loops in Flow Graphs. [**6 Hours**]

Text Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Seth, Jeffrey D. Ullman, "Compilers, Principles, Techniques, & Tools", Second Edition, Pearson.

Reference Books:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools, Pearson Education Asia, 2003.
2. C. Fischer and R. LeBlanc., "Crafting a Compiler", Benjamin Cummings, 1991.
3. S. Chattopadhyay, "Compiler Design", PHI, 2011.
4. C. Holub., "Compiler Design in C", Prentice-Hall Inc., 1993.
5. Appel., "Modern Compiler Implementation in C: Basic Design", Cambridge Press,2004.

E-Books and online learning material:

1. https://nptel.ac.in/courses/106/104/106104123/
2. http://index-of.es/Varios-2/Compilers.pdf
3. http://hjemmesider.diku.dk/~torbenm/Basics/basics_lulu2.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/106/108/106108113/
2. https://nptel.ac.in/courses/106/104/106104072/
3. https://www.youtube.com/playlist?list=PLrjkTql3jnm-wW5XdvumCa1u9LjczipjA
4. https://www.youtube.com/watch?v=h1LSoF_kUzc
5. https://freevideolectures.com/course/3051/compiler-design

Subject Code: PCCS-113

Subject Name: Computer Graphics

Programme: B.Tech. (CSE)	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 25%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: NIL

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply the concepts of mathematical foundations and programming to solve diverse problems related to computer graphics
CO2	Compare and contrast various computer graphic algorithms and their suitability to real world problems.
CO3	Utilize models for transformation of 2D and 3D objects.
CO4	Identify the areas of computer graphics to apply advance algorithmic techniques for changing the formations of geometrical objects.
CO5	Apply algorithmic techniques for visualizing objects.
CO6	To use computer graphics concepts in the development of real world graphical applications.

Detailed Contents:

Part A

Introduction: Overview of computer graphics, Computer graphics applications, Different I/O devices with specialized graphics features, Elements of graphics. Graphic systems – Video display devices, Raster scan systems, Random scan systems. Video basics – Video controller, Raster-scan display processor. **[6 Hours]**

2D Primitives: Scan conversion basics, Algorithm for scan converting a point, Scan converting a line – Digital differential analyser algorithm, Bresenham's line algorithm. Scan converting circle – Bresenham's circle drawing algorithm, Midpoint circle drawing algorithm. Scan converting ellipse– Midpoint ellipse algorithm. Filling Techniques – Scan line polygon fill algorithm, Boundary-fill, Flood-fill. Anti-aliasing. **[6 Hours]**

2-D Transformations: Geometric and coordinate transformations. Geometric transformations – Scaling,Rotation, Translation, Reflection, Shear. Matrix representations, Homogeneous coordinates, Composite transformations. **[6 Hours]**

Part B

2D Viewing and Clipping: The viewing pipeline, Window-to-viewport transformation, Point clipping, Line clipping algorithms – Cohen-Sutherland, Liang-Barsky, Nicholl-Lee-Nicholl. Polygon clipping algorithms –Sutherland-Hodgeman, Weiler-Atherton. Curve and text clipping.**[5 Hours]**

3D Transformations and Viewing: 3D geometric transformations – Scaling, Rotation, Translation, Reflection, Shear. Composite transformations, 3D viewing, Viewing pipeline, Parallel projections, perspective projections, classifications of projections. **[5 Hours]**

Visible-Surface Detection: Classification of visible-surface detection algorithms. Techniques for efficient visible-surface algorithms–Back face detection, Depth-buffer method, A-buffer method, Scan-line method, Depth sorting method, BSP tree Method, Area-subdivision method, Octree Methods, Ray-casting method. **[4 Hours]**

Surface Rendering: Light sources, Surface lighting effects, Illumination models, Polygon rendering methods – Constant-intensity shading, Gouraud shading, Phong shading, Fast Phong shading. **[4 Hours]**

Text Books:

1. D. Hearn and M.P. Baker, "Computer Graphics", Second Edition, PHI/Pearson Education.
2. Zhigang Xiang, Roy Plastock, "Theory and Problems of Computer Graphics", Second Edition, Tata McGraw-Hill.
3. C. Foley, Van Dam, Feiner and Hughes, "Computer Graphics Principles & Practice", Second Edition, Pearson Education.
4. Amarendra N. Sinha, Arun D. Udai, "Computer Graphics", First Edition, Tata McGraw-Hill.
5. N. Krishnamurthy, "Introduction to Computer Graphics", First Edition, Tata McGraw-Hill.

Reference Books

1. Malay K. Pakhira, "Computer Graphics, Multimedia and Animation", Second Edition, PHI.
2. Rogers, Adams, "Mathematics Elements for Computer Graphics", Second Edition, Tata Mc-Graw Hill.

E-Books and online learning material

1. Notes for a Computer Graphics Programming Course by Steve Cunningham https://www.cs.csustan.edu/~rsc/NSF/Notes.pdf
2. https://www.tutorialspoint.com/computer_graphics/index.htm
3. https://www.javatpoint.com/computer-graphics-tutorial

4. https://www.geeksforgeeks.org/computer-graphics-2/
5. http://www.svecw.edu.in/Docs%5CCSECGLNotes2013.

Online Courses and Video Lectures

1. https://www.youtube.com/watch?v=fwzYuhduME4 Accessed on Feb 02, 2021
2. https://www.coursera.org/learn/interactive-computer-graphics Accessed on Feb 02, 2021
3. https://www.tutorialspoint.com/computer_graphics Accessed on Feb 02, 2021
4. https://nptel.ac.in/courses/106/106/106106090 Accessed on Feb 02, 2021

Subject Code: PCCS-114

Subject Name: Machine Learning

Programme: B.Tech. (CSE)	**L:**3 **T:**0 **P:**0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 03
Internal Marks:40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks:60	**Duration of End Semester Exam(ESE):** 3 Hours
Total Marks:100	**Course Status:** Compulsory

Prerequisites: Data Mining Techniques

On Completion of the course the student should be able to:

CO#	Course Outcomes(CO)
CO1	Explain well defined learning problems with hypothesis and version spaces.
CO2	Apply supervised and unsupervised machine learning techniques for practical implication.
CO3	Use decision trees to generalize patterns from the training data to make predictions on unseen data.
CO4	Elaborate the fundamental concepts of Artificial Neural Networks (ANNs) and their applications in machine learning.
CO5	Apply the concepts of Bayesian analysis from probability models and methods.
CO6	Explain the concept of genetic algorithm and learning the methodology to evaluate algorithm performance.

Detailed Contents

Part A

Introduction: Well defined learning problems, defining a learning system, perspectives and issues in machine learning, the concept learning task, concept learning as search, Find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, Inductive bias, probability theory. **[4 Hours]**

Supervised Learning: Basic methods: Distance based methods, Nearest- Neighbors, Decision Trees, Naive Bayes, and Linear models: Linear regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and kernel Methods. **[5 Hours]**

Unsupervised Learning: Clustering: k-means/ kernel k-means, Dimensionality Reduction: PCA and

kernel PCA, Matrix Factorization and Matrix Completion, Generative models (mixture models and latent factor models).**[5 Hours]**

Decision Tree Learning: Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Ensemble methods- Bagging, Gradient Boosting, Random Forest. **[5 Hours]**

Part B

Artificial Neural Networks: Introduction, Neural network representation, appropriate problems for neural network learning, perceptron, gradient descent and the delta rule, Adaline, Multilayer networks, Derivation of Back propagation rule, back propagation algorithm, Initialization, Training & Validation. **[5 Hours]**

Bayesian Learning: Introduction, Bayes theorem and concept learning, Maximum likelihood and least squared error hypothesis for predicting probabilities, minimum description length principle, Bayes optimal classifier, Naive Bayes classifier, Bayesian belief networks. **[6 Hours]**

Genetic Algorithms: Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning. **[3 Hours]**

Design and Analysis of Algorithms: Study of factors and responses related with experimentation, Hypothesis testing, performance analysis, Evaluation measures-bootstrapping & cross-validation, ROC curve. **[3 Hours]**

Textbooks:

1. Tom M. Mitchell, Machine Learning, McGraw Hill, First Edition.
2. Ethern Alpaydin, Introduction to Machine Learning, MIT Press, 3rd Edition.
3. Aditya Dwivedi, Machine Learning Textbook, Kindle Edition, Dec 2019.

Reference Books:

1. Chris Bishop, Pattern Recognition and Machine Learning, Springer.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2nd Edition

E-Books and Online Learning Material

1. Introduction to Machine Learning by Nils J. Nilsson
https://ai.stanford.edu/~nilsson/MLBOOK.pdf
2. Lecture Notes on Machine Learning by Sebastian Raschka
https://sebastianraschka.com/pdf/lecture-notes/stat479fs18/01_ml-overview_notes.pdf
3. https://www.tutorialspoint.com/machine_learning/machine_learning_tutorial.pdf

Online Courses and Video Lectures:

1.https://nptel.ac.in/courses/106106139/ Accessed on February 17, 2021
2.https://nptel.ac.in/courses/106106213/ Accessed on February 17, 2021

3. https://www.coursera.org/lecture/machine-learning/welcome-to-machine-learning-zcAuT
Accessed on February 17, 2021
4. https://www.udacity.com/course/intro-to-machine-learning-with-tensorflow-nanodegree--nd230
Accessed on February 17, 2021
5. https://www.cs.ox.ac.uk/people/nando.defreitas/machinelearning/
Accessed on February 17, 2021

Subject Code: PCCS-115

Subject Name: Cyber Security

Programme: B.Tech. CSE	**L:** 3 **T:** 0 **P:**0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 0%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hrs
Total Marks: 100	**Elective Status:** Compulsory

Prerequisites: NIL
Additional Material Allowed in ESE: NIL
On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply cyber security policies to implement security features.
CO2	Analyse the defences against network and system attacks in social media.
CO3	Discuss vulnerabilities critical to E-commerce security.
CO4	Highlight the security aspects of online payment systems.
CO5	Diagnose cyber security threats in context with social engineering.
CO6	Analyse information recovery and assurance issues.

Detailed Contents:

Part A

Introduction to Cyber Space: History of cyber space, Cyber Crime, Information Security, Computer Ethics and Security for users, Familiarization with secure web browser and guidelines to choose, Role of Antivirus, Guidelines for Secure password, Two-steps authentication, Introduction to Password Manager, Wi-Fi Security. **[7 Hours] Secure Social Media usage and security:** Best practices for safer Social Networking, Basic Security for Windows, User Account Password Smartphone Security, Android Security, IOS Security.

[6 Hours]

E-commerce Security: Familiarization: Online Banking Security, Mobile Banking Security, Security

of Debit and Credit Card, UPI Security. **[6 Hours]**

Part B

Micro ATM, e-wallet and POS Security: Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales (POS), Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance. **[5 Hours]**

Social Engineering, Threat Landscape and Techniques: Social Engineering, Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime, Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques, Firewall.

[6 Hours]

Information Recovery Tools: Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows, Various Case Studies. **[6 Hours]**

Text Books

1. William Easttom II, Computer Security Fundamentals, 4th edition, Pearson.
2. Sunit Belapure Nina Godbole, Cyber Security, 1st edition, Wiley.
3. Christopher Hadnagy, Social Engineering, The Science of Human Hacking, 2nd edition, John Wiley & Sons.
4. Thomas A. Johnson, Cyber Security, 1st edition, CNC Press.
5. Sanjib Sinha, Beginning Ethical Hacking, 1st edition, Apress.

Reference Books

1. Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Wile, 1st edition.
2. Jon Erickson, The art of Exploitation, Starch Press, 2nd edition.

E-Books and online learning material:

1. Cyber Attacks and Counter Measures: http://uou.ac.in/progdetail?pid=CEGCS-17Meilir Page-Jones: Fundamentals.
2. Introduction to Cyber Security available at http://uou.ac.in/foundation-course.
3. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17.
4. Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17.
5. https://www.cybersecurity.ox.ac.uk/resources/videos

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106/106/106106129/ Accessed on February 12, 2021
2. https://www.utep.edu/information-resources/iso/security-awareness/videos/security-awareness-videos.html Accessed on February 12, 2021
3. https://www.utep.edu/technologysupport/ServiceCatalog/SEC_EmailEncryption.html Accessed on February 12, 2021
4. https://nptel.ac.in/courses/106/105/106105031/ Accessed on February 12, 2021

Subject Code: LPCCS-109

Subject Name: Computer Graphics Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Fundamentals of computers and knowledge of any programming language like C/C++.

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Develop computer programs for elementary graphic operations.
CO2	Implement scan conversion algorithms for line drawing.
CO3	Write programs to implement circle and ellipse drawing algorithms.
CO4	Design programs to demonstrate geometric transformations on 2D and 3D objects.
CO5	Develop programs to demonstrate clipping and filling techniques for modifying an object.
CO6	Create interactive graphics applications using one or more graphics application programming interfaces.

Special Instruction related to resources requirement: Any programming language like C/C++ could be used for the programs.

List of Practicals:

1. Write a program for creating a simple two-dimensional shape of any object using lines, circle, etc.
2. Write a program to Draw a color cube and spin it using transformation matrices.
3. Implement the DDA algorithm for drawing line (programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants).
4. Write a program to input the line coordinates from the user to generate a line using Bresenham's Algorithm.
5. Write a program to generate a complete moving wheel using Midpoint circle drawing algorithm and DDA line drawing algorithm.
6. Write a program to draw an ellipse using the Midpoint ellipse generation algorithm for both the regions.
7. Write a program to draw any 2-D object and perform the transformations on it according to the input parameters from the user, namely: Translation, Rotation and Scaling.

8. Write a program to rotate a triangle about any one of its end coordinates.
9. Write program to draw a house like figure and perform the following operations.

a) Scaling about the origin followed by translation.

b) Scaling with reference to an arbitrary point.

10. Write a program to draw a 4×4 chessboard rotated 45˚ with the horizontal axis. Use Bresenham's algorithm to draw all the lines. Use seed fill algorithm to fill black squares of the rotated chessboard.
11. Write a program to perform clipping on a line against the clip window using any line clipping algorithm. The output must be twofold showing the before clipping and after clipping images.
12. Write a program to implement the Sutherland-Hodgeman Polygon Clipping algorithm for clipping any polygon.

Reference Material
Manuals available in Lab.

Subject Code: LPCCS-110

Subject Name: Machine Learning Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Knowledge of Python

On Completion of the laboratory course student should be able to:

CO#	Course Outcomes(CO)
CO1	Create programs for fundamental machine learning algorithms, including FIND-S and Candidate Elimination.
CO2	Implement neural networks and their applications in real-world problems.
CO3	Apply the Naïve Bayesian Classifier and Bayesian network to real-world scenarios.
CO4	Design experiments to test and evaluate supervised and unsupervised learning algorithms.
CO5	Develop skills in selecting appropriate datasets for experiments related to Locally Weighted Regression and patient risk prediction.
CO6	Build programming proficiency to implement genetic algorithms for hyperparameter optimization.

List of Practicals:

1. Write a program to demonstrate **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. Write a program for **Candidate Elimination algorithm** for finding the consistent version space based on a given set of training data samples. The training data is read from a .CSV file.
3. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
4. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Calculate the accuracy, precision, and recall for your data set.
6. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.

7. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using ***k*-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering.
8. Write a program to implement ***k*-Nearest Neighbour algorithm** to classify the iris data set. Print both correct and wrong predictions.
9. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.
10. Write a program to predict high risk patients based on variables (e.g. blood pressure, age etc.) and discriminate them from low risk patients.
11. Develop a genetic algorithm for optimization of hyper parameters in machine learning.

Resource Material:
Manuals available in Lab.

Subject Code: PECS-101

Subject Name: Software Project Management

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5th	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Course Status:** Elective

Prerequisites:

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply project management activities involved in software projects.
CO2	Estimate project cost, plan project and evaluate software project.
CO3	Analyse risks during project scheduling activities.
CO4	Design key strategies to monitor, control and quality assurance of software projects.
CO5	Develop effective organisational, leadership and change skills for managing projects, teams and stakeholders.
CO6	Utilize software project management tools to model real-world problems.

Detailed Contents:

Part-A

Introduction to Project Management: The characteristics of software projects, Objectives of project management: time, cost and quality, Basics of Project Management, Stakeholders, Stages of Project, The Feasibility Study, Cost-benefit Analysis, Planning, Project Execution, Project and Product Life Cycles, Project Management Knowledge areas, Project Management Tools & Techniques, Project success factors, role of project manager **[5 Hours]**

Project Evaluation and Planning: Activities in Software project management, Project evaluation – Cost benefit analysis, Cash flow forecasting, Cost benefit evaluation techniques, Risk evaluation. Project planning – Stepwise project planning, Software processes and process models. Project costing, COCOMO II, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb. **[6 Hours]**

Project Scheduling and Risk Management: Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management – Nature and types of risks, Risk planning and control, Risk assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques. **[6 Hours]**

Part-B

Monitoring and Control: Collecting data, Review techniques, Project termination review, Visualizing progress, Cost monitoring, Earned value analysis, Change control, Software Configuration Management (SCM), Managing contracts and acceptance. **[7 Hours]**

People Management: Introduction, Understanding behaviour, Organizational behaviour, Recruitment process, Motivation, The Oldman – Hackman Job Characteristics model, Stress, Health and safety.Working in teams, Decision making, Leadership, Organization and team structures. **[7 Hours]**

Software Quality Management: ISO Standards, Process capability models, Testing and software reliability, Quality plans, Test automation, Overview of project management tools. **[6 Hours]**

Text Books

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill.
2. Royce, “Software Project Management”, Pearson Education.
3. Robert K. Wysocki, “Effective Software Project Management”, Wiley.

Reference Books

1. Ian Sommerville, “Software Engineering”, Pearson Education.
2. R.S. Pressman, “Software Engineering: A Practitioner's Approach”, Tata McGraw Hill.
3. Kassem, “Software Engineering”, Cengage Learning

E-Books and online learning material:

1. Dwayne Phillips, “The Software Project Manager's Handbook: Principles That Work at Work”, Wiley-

IEEE Press, URL: https://ieeexplore.ieee.org/servlet/opac?bknumber=5989544

2. Mark Christensen; Richard H. Thayer, “The Project Manager's Guide to Software Engineering's Best Practices, Wiley-IEEE Press”,

URL: https://ieeexplore.ieee.org/servlet/opac?bknumber=5989224

3. Walker Royce, “Software Project Management: A Unified Framework”, Addison-Wesley

Professional", URL: https://dl.acm.org/doi/book/10.5555/1942096

Online Courses and Video Lectures

1. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs70/

2. https://nptel.ac.in/courses/106/105/106105182/

Subject Code: PECS-102

Subject Name: Software Testing and Quality Assurance

Programme: B.Tech. CSE	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Choose an appropriate software process models according to the given users requirements.
CO2	Apply various testing techniques to deliver a product free from bugs.
CO3	Apply testing methodologies, debugging tools and maintenance models to ensure accountability of software.
CO4	Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
CO5	Design software reliability measures to ensure quality of software in case of various faults and failure.
CO6	Conduct formal inspections, record and evaluate results of inspections.

Detailed Contents:

Part A

Introduction: Overview of Software Engineering, Software Process, Process Models, Overview of Project Management Process and its Phases**. [3 Hours]**

Testing principles and basic concepts: Testing Concepts: Purpose of Software Testing, Testing Principles, Goals of Testing, Testing aspects: Requirements, Test Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Planning for Verification and Validation, Software Inspections, Automated Static Analysis, Verification and Formal Methods, Levels of Testing White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing, Data Flow Testing Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning State Based Testing, Domain Testing **[9 Hours]**

Test planning and Execution: Test Plan, Test Management, Test Execution and Reporting, Test Specialist Skills, Tester's Workbench and Tool Categories, Test Maturity Model and Test Process Assessment, Debugging & Root Cause Analysis, Software Items, Component & Units, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Types of Testing Documentation, Verification Testing, Validation Testing, Integration Testing, System and Acceptance Testing, GUI Testing, Regression Testing, Selection, Minimization and Prioritization of Test Cases for Regression Testing, Creating Test Cases from Requirements and Use cases, Software Defects: Origins of Defects, Defect Classes, Defect Repository / Test Design, Defect Repository.

[7 Hours]

Part B

Quality Assurance: The software quality challenge, Meaning of software quality, Software quality factors , Software Quality Lessons Learned, The components of the software quality assurance system, Pre-project software quality components: Contract Review, Development and quality plans, SQA components in the project life cycle: Integrating quality activities in the project life cycle, Assuring the quality of software maintenance components, Assuring the quality of external participants' contributions, CASE tools, Software quality infrastructure components, Pareto Principles, Total Quality Management, Ishikawa's Seven Basic Tools **[9 Hours]**

Software Quality Assurance Management: Management components of software quality: Project progress control, Software quality metrics, Costs of software quality, Standards, certification and assessment: Quality management standards, SQA project process standards – IEEE software engineering standards, Management and its role in software quality assurance, The SQA unit and other actors in the SQA system, Inspection as an Up-Front Quality Technique, Software Audit Methods, Software Safety and Its Relation to Software Quality Assurance, SQA for Small Projects, Development Quality Assurance, Quality Management in IT, Introduction to ITIL, Software Quality Assurance Metrics, Software Benchmarks and Baselines. **[8 Hours]**

Text Books

1. Burnstein, "Practical Software Testing", Springer International Edition, ISBN 81-8128- 089-X
2. William E. Perry, " Effective Methods for Software Testing", Third edition, John Wiley and Sons, ISBN 9971-51-345-5
3. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance-Theory and Practice", Second edition, John Wiley & Sons, Inc., 2008, ISBN 978-0-471-78911-6

Reference Books

1. Fenton, Pfleeger, "Software Metrics: A Rigourous and practical Approach", Third edition, Thomson Brooks/Cole, ISBN 981-240-385-X.
2. Desikan, Ramesh, "Software Testing: principles and Practices", sixth edition, Pearson Education, ISBN 81-7758-121-X.
3. Anne Mette, Jonassen Hass, Guide to Advanced Software Testing, Second Edition, ARTECH HOUSE, INC., 2008, ISBN-13: 978-1-59693-285-2

4. Ian Molyneaux, The Art of Application Performance Testing, First edition, O'Reilly Media, Inc., 2009, ISBN: 978-0-596-52066-3
5. Jamie L. Mitchell, Rex Black, Advanced Software Testing—Vol. 3, 2nd Edition, Rocky Nook, 2015, ISBN: 978-1-937538-64-4
6. G. Gordon Schulmeyer, Handbook of Software Quality Assurance, Fourth Edition, ARTECH HOUSE, INC., 2008, ISBN-13: 978-1-59693-186-2

E-Books and online learning material

1. Software Testing and Quality Assurance, Theory and Practice by Kshirasagar Naik and Priyadarshi Tripathy.https://www.softwaretestinggenius.com/download/staqtpsn.pdf

Online Courses and Video Lectures

1. https://www.coursera.org/learn/introduction-software-testing
Accessed on December 26, 2020

2. https://www.coursera.org/specializations/software-testing-automation
Accessed on December 26, 2020.

3. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
Accessed on December 26, 2020.

Subject Code: PECS-105

Subject Name: Software Metrics

Programme: B.Tech CSE	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 40%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Knowledge of software engineering fundamentals.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Demonstrate software metrics used for measurements in software engineering.
CO2	Apply quality management system models for quality control and reliability assessment.
CO3	Make use of internal and external product attributes to check quality of software products.
CO4	Inspect component based systems through use of MOOD metrics.
CO5	Evaluate the quality level of software at run-time using dynamic metrics.
CO6	Control software quality through software quality control and assurance.

Detailed Contents:

Part-A

Software Metrics: Measurement in software engineering, software metrics, Metrics data collection and analysis. **[3 Hours]**

Complexity Metrics and Models: Lines of Code, Halstead's Software Science, Cyclomatic Complexity Syntactic Metrics, and An Example of Module Design Metrics in Practice. Object Oriented Projects: Object Oriented Concepts and Constructs, Productivity Metrics, Quality Management Metrics.

[7 Hours]

Estimate internal product attributes: Aspects of software size, length, functionality, and complexity, measuring structure, types of structural measures, control-flow structure, and modularity and information flow attributes, data structures. **[6 Hours]**

Estimate external product attributes: Modeling software quality, software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, importance of operational environment, and wider aspects of software reliability**.** **[3 Hours]**

Part-B

Component-based system: Metrics for object-oriented systems, Object-oriented analysis and design and its characteristics. **[3 Hours]**

MOOD metrics: Component-based metrics and its characteristics and various component-based suites. **[3 Hours]**

Dynamic Metrics: Runtime Software Metrics, Extent of Class Usage, Dynamic Coupling, Dynamic Cohesion, and Data Structure Metrics. [**5 Hours]**

Software Quality: Concepts of software quality, software quality control and software quality assurance, evolution of SQA, major SQA activities and issues, zero defect software. Software Quality Assurance: SQA techniques; Management review process, technical review process, walkthrough, software inspection process, configuration audits, and document verification. **[7 Hours]**

Text Books

1. Norman E-Fentor and Share Lawrence Pflieger, "Software Metrics: A Rigorous and Practical Approach", 2nd Edition, International Thomson Computer Press.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Pearson.

Reference Books

1. Gerald M. Weinberg, "Quality Software Management Volume 1: Systems Thinking", Dorset House Publishing.
2. Capers Jones, "Applied Software Measurement", 3rd Edition, Tata McGraw Hill.

E-Books and online learning material

1. "Software metrics for the curious developer", https://www.codacy.com/ebooks/guide-to-code-quality
2. "Software Metrics", https://people.ucalgary.ca/~far/Lectures/SENG421/PDF/SENG421-01.pdf

Online Courses and video lectures

1. "Software Engineering", https://nptel.ac.in/courses/106/101/106101061/
Accessed on August 24, 2021

Subject Code: PECS-107

Subject Name: Component Based Development

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Knowledge of software engineering fundamentals.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain Component Based Systems along with their Purpose and Scope
CO2	Apply Software Engineering Practices in Component Based Development.
CO3	Apply catalysis techniques for Defining Component Infrastructures.
CO4	Apply software metrics to measure the performance of Software Components.
CO5	Explain Software Component Project Management Processes and issues in its testing.
CO6	Explain the use of Component Technologies in Next Generation Software Components.

Detailed Contents:

Part-A

Component Definition: Definition of Software Component and its Elements. Component Models and Component Services: Concepts and Principles, COTS Myths and Other Lessons Learned in Component-Based Software Development, Roles for Component-Based Development, Common High-Risk Mistakes in Component-Based Software Engineering, CBSE Success Factors: Integrating Architecture, Process, and Organization. **[9 Hours]**

Software Engineering Practices: The Practice of Software Engineering, From Subroutines to Subsystems: Component-Based Software Development. The Design of Software Component Infrastructures: Software Components and the UML, Placing Software Components in Context, Business Components, Components and Connectors: Catalysis Techniques for Defining Component Infrastructures, An Open Process for Component-Based Development, Designing Models of Modularity, and Integration. **[9 Hours]**

Part-B

The Management of Component-Based Software Systems: Measurement and Metrics for Software Components, The Practical Reuse of Software Components, Selecting the Right COTS Software: Why

Requirements are Important, Software Component Project Management Processes, The Trouble with Testing Software Components, configuration Management and Component Libraries, The Evolution, Maintenance and Management of Component-Based Systems. **[9 Hours]**

Component Technologies: Overview of the CORBA Component Model, Transactional COM+: Designing Scalable Applications, The Enterprise JavaBeans Component Model, Choosing Between COM+, EJB, and CCM, Software Agents as Next Generation Software Components. **[9 Hours]**

Text Books

1. Katharine Whitehead, "Component-Based Development: Principles and Planning for Business Systems", 1st Edition, Addison-Wesley.
2. Don Box, "Essential COM", 1st Edition, Addison-Wesley.

Reference Books

1. George T. Heineman, William T. Councill", "Component-Based Software Engineering: Putting the Pieces Together", 1st Edition, Addison-Wesley Professional.
2. G Sudha Sadasioam, "Computer-based Technology", 1st Edition, Wiley India.

E-Books and online learning material

1. "Component-based software engineering", https://core.ac.uk/download/pdf/232274627.pdf

Online Courses and Video Lectures

1."Component based model in Software Engineering", https://www.youtube.com/watch?v=3ApdgLdYrDU Accessed on July 29, 2021
2. "Component Based Development", **https://www.youtube.com/watch?v=o6f1TG83fWI** Accessed on July 29, 2021

Subject Code: LPECS-101

Subject Name: Software Testing and Quality Assurance Laboratory

Programme: B.Tech. CSE	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Develop testing methodologies, debugging tools and maintenance models to ensure accountability of software.
CO2	Execute white box testing methods to test the individual units or components of the software system.
CO3	Implement white box testing to test data flow in every path through program's control flow.
CO4	Execute white box testing using code mutation testing technique.
CO5	Test the software by applying Black box testing techniques to deliver a product free from bugs.
CO6	Perform integration and regression testing using appropriate testing tools.

List of Practicals:

1. To Prepare Test Plan for the implemented system under test. The Test Plan shall be based on System Requirement Specification. The Test plan consists of following issues.
    a. Purpose of the test. /Location and schedule of the test.
    b. Test descriptions. /Pass and Fail Criteria.
2. To identify and narrate Test cases, Test scripts/procedures and Test incident report identifier for the system under test. Refer Use case analysis document to prepare mentioned/ identified test documents.
3. To perform Unit testing especially indicating the traced Independent data paths, control paths and Error handling paths. Prepare control flow graphs for the unit under test. Compute the cyclomatic complexity of the unit.
4. To perform Data Flow testing for the Program Segments by identifying the Definition-Use chain and

type of data flow anomaly.

5. To perform Mutation Analysis of the Program Segments along with mutant history, mutation score and type of mutation by using any Code analysis Tool / Mutation Testing Tool.
6. To perform Black-Box Testing for all the units contained in the architectural segments using Equivalence Partitioning, Boundary Value Analysis and Orthogonal Array testing methods. Study exploratory Testing for the Module under Test and merits/demerits of this technique.
7. To perform Regression Testing of the System under construction with Unit and Integration profiles by using any Functional Testing Tool.

Reference Material

Manuals available in Lab.

Subject Code: LPECS-103

Subject Name: Component Based Development Laboratory

Programme: B.Tech. CSE	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 01
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Knowledge of software engineering fundamentals.

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Model the documentation of software configuration management and risk management.
CO2	Explain the design process of software component infrastructure.
CO3	Analyze the cost effectiveness of COTS software.
CO4	Discover Test cases, Test scripts/procedures and Test incident of a system.
CO5	Apply knowledge of C++ server, CORBA and Javabeans to develop a component based model.
CO6	Develop any component based system.

List of Practicals

1. Preparation of software configuration management and risk management related documents.
2. Design software component infrastructure with the help of suitable tools.
3. Study different COTS software and find out which one is cost effective.
4. To identify and narrate Test cases, Test scripts/procedures and Test incident report identifier for the system under test.
5. Study Orbacus and install orbacus for C++ Server.
6. Execute various basic CORBA commands for declaring CORBA IDL Module, interface and operations.
7. Study and use different enterprise JAVA Beans Component Model.
8. Create a mini project by using any tool of Component Based Development.

Reference Material

Manuals available in Lab

Subject Code: PECS-106

Subject Name: Advanced Computer Networks

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Basics of computer networks

Additional Material Allowed in ESE: scientific calculator

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Implement switching and routing techniques to ease the communication problems over different geographical areas
CO2	Analyze network architectures to ensure the optimal network performance
CO3	Explain the evolution of Ethernet networks from half-duplex with CSMA/CD to full-duplex
CO4	Identify the challenges of Mobile Ad hoc Networks and vehicular ad hoc networks
CO5	Apply communication protocols to ensure the dependable, sequentially arranged, and error-checked transmission of a sequence of bytes
CO6	Analyze the functions and operations of the Medium Access Control (MAC) sublayer within the context of IEEE 802.11

Detailed Contents:

Part-A

Introduction: Basics, History of Internet, Requirements: perspectives, scalable connectivity, cost effective resource sharing, support for common services, manageability, network architecture: layering and protocols, Internet architecture, network performance: bandwidth, latency, high-speed networks, application performance needs. **[4 Hours]**

Internetworking: half and full duplex**,** Ethernet at physical layer: standard Ethernet, fast Ethernet, gigabit Ethernet, Ethernet cabling-straight-through, crossover and rolled cable, Data encapsulation. Ethernet at data link layer: CSMA, CSMA/CD and CSMA/CA.**[4 Hours]**

Wireless LANs: Introduction: architecture comparison, characteristics, access control. IEEE 802.11:architecture, MAC Sublayer, Physical layer. Bluetooth: architecture and its layers.**[3Hours]**

Switching: Switching andbridging: datagrams, virtual circuit switching, source routing, Switches: Basics, its function, types of switches, Spanning Tree Protocol (STP), Virtual LANs (VLANs): purpose, memberships, configuration, connection between switches, advantages, types of VLANs: static and dynamic. **[5 Hours]**

Part-B

TCP Protocols: Internet Protocol (IP): service model, global addresses, datagram forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error reporting (ICMP). ` **[5 Hours]**

Routing: Network as a graph, Distance Vector (RIP), Link state (OSPF), metrics. Inter-domain routing: routing policies, routing protocols (BGP), Intra-domain routing: routing policies, routing protocols (DVMRP). **[5 Hours]**

Transport Service and Protocols: User Datagram Protocol (UDP): header format, services, and applications, Transmission Control Protocol (TCP): transport service characteristics; transport protocol: features, segment, TCP connection. **[3 Hours]**

Wireless Ad hoc Networks: Mobile Ad hoc Networks (MANETs): features, advantages, routing in
MANETs, applications of MANETs, Recent trends in networks: green networking, social networks, software data networks and vehicular ad hoc networks (VANETs). **[3 Hours]**

Text Books:

1. L. L. Peterson, B. S. Davie, Computer Networks. A Systems Approach, Morgan Kaufmann Publishers Inc
2. B.A. Forouzan, Data Communications and Networking, Mc-Graw Hill Education
3. Andrew S. Tanenbaum, "Computer Networks", Pearson Education

Reference Books:

1. J. F. Kurose, K. W. Ross, Computer Networking. A Top-Down Approach, Addison Wesley Longman
2. G. Antoniou, F. van Harmelen, Semantic Web Primer, The MIT Press
3. J. Day, Pattterns in Network Architecture. A Return to Fundamentals, Prentice Hall
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Pearson Education.
5. W. Stallings, "Data and Computer Communication", Prentice Hall of India.

E-Books and online learning material

- An Introduction to Computer Networks by Peter L Dordal, Department of Computer Science, Loyola University Chicago.

http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdfAccessed on May 21, 2020

Online Courses and video lectures

https://swayam.gov.in/nd1_noc20_cs23/preview Accessed on May 21, 2020

https://nptel.ac.in/courses/106105081/ Accessed on May 21, 2020

https://nptel.ac.in/courses/106105081/2 Accessed on May 21, 2020

https://nptel.ac.in/courses/106105081/5 Accessed on May 21, 2020

https://nptel.ac.in/courses/106105081/16 Accessed on May 21, 2020

https://nptel.ac.in/courses/106105081/31 Accessed on May 21, 2020

Subject Code: PECS-108

Subject Name: Network Security and Cryptography

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 40%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3 hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: Scientific Calculator

On completion of the course the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks
CO2	Apply modern algebra and number theory to understanding of cryptographic algorithms
CO3	Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions.
CO4	Understand and analyze public-key cryptography, RSA and other public-key cryptosystems
CO5	Encryption and analyze the various symmetric encryption algorithms and asymmetric algorithms
CO6	Apply the knowledge of existing authentication protocols and key management techniques to provide security solutions.

Detailed Contents:

Part-A

Introduction to Security: Essentials of network security, Architecture, Security goals, cryptographic attacks: cryptanalytic, non-cryptanalytic attacks, active attack and passive attack, security Services and security mechanism, Fundamental Security design principles, Network security model, standards. **[5 Hours]**

Number Theory: Integer Arithmetic, Euclidean Algorithm, Extended Euclidean Algorithm, Modular Arithmetic, Matrices, Linear Congruence, Prime numbers, Fermat's and Eular's Theorem, Factorization, Chinese Remainder Theorem. **[6 Hours]**

Classical Encryption Techniques: Encryption, Decryption, Plaintext, Cipher text, Key range and Size, Symmetric cipher model, Substitution techniques: Mono-alphabetic ciphers (additive, Caesar,

Multiplicative, affine), polyalphabetic cipher (autokey, playfair, Hill Cipher) Transposition techniques (keyless, keyed, combined approaches) **[6 Hours]**

Part-B

Modern Symmetric-key Ciphers: Modern Block cipher, components of block cipher, two classes of product cipher, Feistal structure, Data Encryption Standard (DES). Modern stream ciphers, Advanced Encryption Standard (AES), Stream ciphers – RC4. **[5 Hours]**

Public Key Cryptography and RSA: Symmetric – Key vs Asymmetric-key cryptosystems, Principles of public key cryptosystems, RSA algorithm and its attacks, Diffie Hellman Key Exchange. **[4 Hours]**

Data Integrity and Authentication: Message: Hash function (SHA-I), Message Authentication (MD5), Digital Signature: services, attacks on digital signature, RSA Digital signature scheme. **[4 Hours]**

Internet Security Protocols: General structure of Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET), Email Security: Pretty Good Privacy (PGP), IP Security – Overview, IP security architecture modes, security protocols: Authentication header(AH) and Encapsulation security payload (ESP). **[6 Hours]**

Text Books:

1. William Stallings, “Cryptography and Network Security Principles and Practice”, Pearson Education, 6th Edition.
2. Behrouz A. Forouzan, “Cryptography & Network Security”, McGraw-Hill Education, 3rd Edition.
3. Atul Kahate, “Cryptography & Network Security”, Tata Mc Graw Hill, 3rd Edition.

Reference Books:

1. Wenbo Mao, “Modern Cryptography: Theory and Practice”, Hewlett-Packard Company.
2. William Stallings, "Network Security Essentials, Applications and Standards ", Pearson Education.
3. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, “Handbook of Applied Cryptography”, CRC Press.
4. Trappe & Washington, “Introduction to Cryptography with Coding Theory”, Prentice-Hall.

E-Books and online learning material

1. Modern Cryptography by P. Rogaway
   https://web.cs.ucdavis.edu/~rogaway/classes/227/winter00/
2. A Graduate Course in Applied Cryptography by Dan Boneh
3. Lecture Notes on Cryptography by S. Goldwasser and M. Bellare http://cseweb.ucsd.edu/~mihir/papers/gb.pdf

Online Courses and Video Lectures

1. https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/ Accessed on Feb. 16, 2021
2. https://nptel.ac.in/courses/106/105/106105031/ Accessed on Feb. 16, 2021
3. https://nptel.ac.in/courses/106/105/106105162/ Accessed on Feb. 16, 2021
4. https://www.slideshare.net/ayyakathir/cryptography-and-network-security-52030354 Accessed on Feb. 16, 2021
5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-videos/lecture-21-cryptography-hash-functions/ Accessed on Feb. 16, 2021
6. https://freevideolectures.com/course/3027/cryptography-and-network-security Accessed on Feb. 16, 2021
7. https://saweis.net/crypto.html Accessed on Feb. 16, 2021

Subject Code: PECS-113

Subject Name: Blockchain Technology

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems: NIL**
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the emerging concept of Blockchain Technology.
CO2	Describe the secure interaction mechanism within a blockchain system.
CO3	Evaluate various consensus algorithms used in blockchain system.
CO4	Demonstrate Ethereum network and understand smart contracts
CO5	Outline the hyperledger fabric and deal with digital ledger
CO6	Identify various research areas in blockchain technology.

Detailed Contents:

Part-A

Introduction to Cryptography: Need of Cryptography, Traditional and Modern techniques, Hash function, Distributed Hash Table, Digital Signatures, Symmetric and Asymmetric Key Cryptography, Zero Knowledge Proof, Double Spending problem. **[6 Hours]**

Introduction to Blockchain: Distributed Database, shortcomings of current transaction systems, distributed network, difference between blockchain and traditional database, evolution of blockchain. Bitcoin's Architecture, Blockchain Architecture: merkle root tree, gas limit, transactions and fee, nonce value, anonymity, reward, chain policy, miners, validators, types (private and public blockchains), Challenges to Blockchain Implementation, Features of Blockchain Network, Soft & Hard Fork. **[8 Hours]**

Distributed Consensus I: The mining mechanism, Two Generals Problem, Byzantine General problem and Fault Tolerance, Nakamoto consensus, Evaluation aspects Blockchain consensus protocols: Scalability, Throughput (TPS), Latency, Security, Fault Tolerance Rate, Energy Consumption. **[5 Hours]**

Part-B

Distributed Consensus II: Consensus Algorithms: Proof of Work, Proof of Stake, Delegated Proof of

Stake, Proof of Activity, Comparison among them. **[5 Hours]**

Ethereum: Public consortium blockchain: Introduction of Ethereum, Ethereum account, Ethereum network, Ethereum client, Ethereum gas, Ethereum virtual machine, Ethereum block, header, Ether, smart contracts. **[6 Hours]**

Blockchain use cases: Applications in finance: settlements, KYC, capital markets, insurance; supply chain: provenance of goods, visibility, trade supply chain finance, invoice management discounting; government: digital identity, land registration; medical information systems. **[6 Hours]**

Textbooks

1. Sam Gounder, 'Blockchain Technologies, Applications And Cryptocurrencies: Current Practice And Future Trends', World Scientific.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform.
3. Arvind N., Joseph B., Edward F., Andrew M., and Steven G., "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.

Reference Books

1. Henning Dendrich, 'Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations', CreateSpace Independent Publishing Platform.
2. Melanie Swan, 'Blockchain: Blueprint for a New Economy', O'Reilly Media, Inc., 1st edition.
3. Neeraj Kumar, N. Gayathri, Md. Arafatur Rahram and B. Balaguram, 'Blockchain, Big Data and Machine Learning: Trends and Applications', CRC Press, Taylor and Francis.

E-books and online learning material

1. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System, White Paper.
2. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.
3. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts.

Online lectures

1. "Introduction to Blockchain Technology and Applications", https://nptel.ac.in/courses/106/104/106104220/ Accessed on September 16, 2021
2. "Blockchain Architecture Design and use Cases", https://nptel.ac.in/courses/106/105/106105184/ Accessed on September 16, 2021

Subject Code: PECS-112

Subject Name: Internet of Things

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 15% Cloud
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Understand general concepts of Internet of Things (IoT).
CO2	Discriminate the functionality of IP and MAC addresses along-with the application layer protocols.
CO3	Illustration of the design principles for connected devices and web connectivity.
CO4	Analyze various M2M and IoT architectures.
CO5	Apply design concepts to IoT solutions.
CO6	Create IoT solutions using sensors, actuators, and Devices.

Detailed Contents:

Part-A

Introduction to Internet of Things (IoT): IoT Definition, IoT Vision, Smart and Hyper-connected Devices, Conceptual Framework, Architectural View, Technology behind IoT, Major Components of IoT System, Sources of IoT, Examples of IoT. **[6 Hours]**

IoT & M2M: Difference between IoT and Machine to Machine, M2M Architecture, SNMP protocol, IoT reference model, Lightweight M2M Communication Protocol, Domain model - information model, functional model, communication model. **[6 Hours]**

Design Principles for Web Connectivity: Constrained Application Protocol, JSON (Java Script Object Notation) Format, Tag Length Value Format, MIME (Multipurpose Internet Mail Extension) Type, Message Communication Protocols for Connected Devices, Web Connectivity for Connected Devices Network. **[6 Hours]**

Part-B

IoT Reference Architecture: Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment, Constraints affecting design of IoT,

Technical design Constraints. **[6 Hours]**

Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Environmental and Agriculture applications, Other IoT applications.

[6 Hours]

Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. **[6 Hours]**

Text Books

1. Davis Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry, "IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things", 5th Impression, CISCO Press.
2. Mayur Ramgir, "Internet of Things – Architecture, Implementation and Security", 1st Impression, Pearson India.
3. Raj Kamal, "Internet of Things – Architecture and Design Principles", 5th Reprint Edition, McGraw - Hill Education.
4. Arsheep Bahga, Vijay Madisetti, "Internet of Things – A Hands-On Approach", 3rd Impression, Universities Press.
5. Gaston C. Hillar, "Internet of Things with Python", 2nd Impression, PACKT Open Source Press.

Reference Books

1. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, "Internet of Things with Raspberry Pi and Arduino", 1st Impression, CRC Press.
2. Ashwin Pajankar, "Internet of Things with Arduino and Bolt", 2nd Impression, BPB Publications.

E-Books and online learning material

1. Donald Noris, "The Internet of Things", Mc Graw Hill Education, New York https://www.pdfdrive.com/download.pdf?id=176037121&h=c064c3b7014c0ed46f60e480e4a5b625 & u=cache&ext=pdf.
2. Aleksandr Kapitonov, Raivo Sell "Introduction to Internet of Things", Erasmus Education, Ritankar Sahu Publisher http://iot-open.eu/download/io1-introduction-to-the-iot/?wpdmdl=2702&_wpdmkey=6022469db61f3&refresh=6022469dbfe3a1612859037.

Online Courses and Video Lectures

1. "Introduction to Internet of Things**",**https://www.digimat.in/nptel/courses/video/106105166/L01.html. Accessed on September 4, 2021.
2. "Computer Networks and Internet Protocol", https://onlinecourses.nptel.ac.in/noc21_cs18/preview. Accessed on September 4, 2021.

Subject Code: LPECS-104

Subject Name: Network Security and Cryptography Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam(ESE):** 2 hours
Total Marks: 50	**Course Status:** Elective

Prerequisites: Computer Networks

On completion of the course the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Implement encryption and decryption techniques for providing security solutions.
CO2	Analyze the impact of public key cryptosystems for secure exchange of information
CO3	Design Network Security protocols for information exchange over unsecure network
CO4	Apply security principles for implementing authentication applications.
CO5	Testing and verification of cryptography aspects by integrating people, processes and technologies.
CO6	Develop secure network using cryptography and network security concepts.

Special Instruction related to resources requirement: Any programming language like C, C++, can be used for the programs.

List of Practicals:

1. Implement the following Symmetric key cipher techniques :
   a. Caesar Cipher
   b. Multiplicative Cipher
   c. Affine Cipher
   d. Playfair Cipher
   e. Hill Cipher
   f. Rail fence – Row & Column Transformation etc.
2. Implement Diffie-Hellman Key exchange algorithm.
3. Implement RSA Public Key algorithm.
4. Implement Stream cipher algorithm – RC4.
5. Mini Project related to cryptography and network security with the team of 2-4 members

Reference Material

Manuals available in Lab.

Subject Code: LPECS-106

Subject Name: Internet of Things laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Computer Networks

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Understand Internet of Things along-with its hardware and software components.
CO2	Interface I/O devices, sensors & communication modules.
CO3	Use wireless peripherals for exchange of data.
CO4	Understand the key features of Ad hoc and sensor networks
CO5	Analyze and evaluate protocols used in IoT and data received through sensors in IoT.
CO6	Develop real-time IoT based automation systems.

List of Practicals

1. Familiarization with Arduino/ Raspberry Pi and perform necessary software installation.
2. Demonstrate the communication modules like BLE, WIFI, XBEE.
3. Interfacing Arduino to Zigbee module.
4. Communicate between Arduino and Raspberry PI using any wireless medium.
5. Interface LED/ Buzzer with Arduino/ Raspberry Pi and write a program to turn ON/OFF LED for specific duration.
6. Interface DHT11/ DHT22 sensor with Arduino/ Raspberry Pi and write a program to print temperature and humidity readings.
7. Interface PI Camera with Arduino/ Raspberry Pi and write a program to start the camera and to place the clicked pictures on the desktop
8. Interface PIR Sensor with Arduino/ Raspberry Pi and write a program to check the motion of PIR sensor.
9. Setup a cloud platform to log the data.
10. Log Data using Raspberry PI and upload to the any cloud platform.

Mini Project: Students are required to prepare a mini project based on IoT system as per course contents.

Reference Material

Manuals available in Lab.

Subject Code: PECS-111

Subject Name: Statistics for Data Science

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 60%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3 hours
Total Marks: 100	**Course Status:** Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Make use of random variables and probability distributions to solve problems.
CO2	Classify probability distributions based on observed and expected frequency outcomes to solve numerical problems.
CO3	Apply sampling distributions to compute confidence intervals for the population parameters.
CO4	Develop solutions using correlation and regression analysis.
CO5	Perform hypothesis testing on population means, variances and proportions.
CO6	Use Statistical analysis to interpret the results in an applied context.

Detailed Contents:

PART A

Random Variables and Probability Distributions: Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables, Joint Distributions, Independent Random Variables, Change of Variables,
Probability Distributions of Functions of Random Variables, Convolutions, Conditional Distributions,
Applications to Geometric Probability. **[8 Hours]**

Special ProbabilityDistributions- Binomial Distribution, Normal Distribution, Poisson Distribution, The Central Limit Theorem, Multinomial Distribution, Hyper geometric Distribution, Uniform Distribution, Cauchy Distribution, Gamma Distribution, Beta Distribution, The Chi-Square Distribution, Student's t Distribution, F Distribution, Relationships Among Chi-Square, t, and F Distributions, Bivariate Normal
Distribution. **[10 Hours]**

Introduction to Statistics: Population and sample, parameters and statistics, Simple descriptive statistics - Mean, Median, Quantiles, percentiles, and quartiles, Variance and standard deviation, Standard errors of estimates, Interquartile range. **[5 Hours]**

PART B

Correlation: Definition of Correlation, Types of Correlation, Scatter Diagram Method, Karl Person's Correlation Coefficients, Correlation Coefficients for Bivariate frequency distribution, Probable error for Correlation Coefficients, Rank Correlation Co-efficient. **[3 Hours]**

Regression: Definition of Regression, Regression lines, Regression Coefficients, Properties of regression Coefficients, and Fitting of regression lines and estimation for Bivariate frequency distribution, Multiple Linear Regression. **[4 Hours]**

Testing of hypothesis: Meaning, Basic concepts, Flow diagram, Power of a hypothesis test, Important parametric tests,Types of hypothesis (null and alternate), Limitations of tests of hypothesis.
[3 Hours]

Statistical analysis: Parametric tests, Non-parametric tests, Students t-test, chi square test, analysis of variance (ANOVA). **[3 Hours]**

Text Books

1. C.R Kothari, "Research Methodology: Methods and Techniques", New age international.
2. S.P. Gupta, "Statistical Methods", S. Chand & company.

Reference Books

1. S.C. Gupta, V.K. Kapoor, "Fundamental of Applied Statistic", Sultan Chand Publication.
2. H.R. Vyas, "Business Statistics", B.S. Shah Prakashan.
3. Michael Baron, "Probability and Statistics for Computer Scientists", Chapman and Hall/CRC.
4. John Schiller, R. Alu Srinivasan, Murray Spiegel, "Probability and Statistics", McGraw-Hill Education.

E-Books and online learning material

1. Michael Baron, "Probability and Statistics for Computer Scientists", https://www.academia.edu/35869356/Probability_and_Statistics_for_Computer_Scientists.
2. John Schiller, R. Alu Srinivasan, Murray Spiegel, "Probability and Statistics", McGraw-Hill Education, https://www.academia.edu/35869356/Probability_and_Statistics_for_Computer_ Scientists.

Online Courses and Video Lectures

1. https://www.youtube.com/watch?v=VudrNXCYJt4

2. https://nptel.ac.in/content/storage2/MP4/111106112/mod03lec12.mp4
3. https://nptel.ac.in/content/storage2/MP4/111106112/mod04lec18.mp4
4. https://nptel.ac.in/content/storage2/MP4/111106112/mod04lec19.mp4
5. https://nptel.ac.in/content/storage2/MP4/111106112/mod04lec20.mp4
6. https://youtu.be/0AE_oSOXSC4
7. https://youtu.be/vGn6boqvmpw

Subject Code: PECS-114

Subject Name: Advanced Database Management Systems

Programme: B.Tech.(CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Basic Knowledge of Computer Fundamentals and Database Management Systems.
Additional Material Allowed in ESE: Nil
On completion of the course, the student will have the ability to:

CO1	Implement PL/SQL programming to classify mechanisms related to Cursor Management, Error Handling, Package and Triggers.
CO2	Illustrate the concept of object oriented database and have experience with object oriented modeling, design and implementation.
CO3	Administering a database by recommending and implementing procedures including database tuning, backup, query processing, query optimization and recovery.
CO4	Assess and apply database functions of distributed database.
CO5	Elaborate the basic principles of warehousing techniques by explaining its functionality.
CO6	Identify approaches of data mining tools and its associated problems.

Detailed Contents:

Part - A

Introduction to SQL Programming Techniques: Database Programming: Issues and Techniques, Embedded SQL, Dynamic SQL, Database Programming: Data Types, Variables, Constraints, Operators, Conditions, Loops, Strings, Arrays, Procedures, Functions, Cursors, Records, Exceptions, Triggers, Packages, Database Stored Procedures. **[5 Hours]**

Transaction Processing and Optimization: Transaction Processing Concepts, Concurrency Control Techniques, Timestamp ordering, Multiversion Concurrency Control Techniques, Validation (Optimistic) Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking. **[4 Hours]**

Query Processing and Optimization: Query Processing, Syntax Analyzer, Query decomposition, Query Optimization, Heuristic Query Optimization, Algorithms for SELECT and JOIN Operations, Algorithms for PROJECT and Set Operations, Implementing Aggregate Operations and OUTER

JOINS. Using Selectivity and Cost Estimation in Query Optimization. Semantic Query Optimization. **[5 Hours]**

Object-Oriented DBMS: Introduction Advanced Database Applications, Weakness of RDBMS, Storing Objects in Relational Database. Next- Generation Database Systems, OODBMS Perspectives, Persistence, Issues in OODBMS, Advantages and Disadvantages of OODBMS, Object- Oriented Database Design, Comparison of ORDBMS and OODBMS. **[4 Hours]**

Part - B

Distributed Databases and Client-Server Architectures: Distributed Database Concepts, Data Fragmentation, Replication, and Allocation techniques for Distributed Database Design. Types of Distributed Database Systems, Query Processing in Distributed Databases, Overview of Concurrency Control and Recovery in Distributed Databases. **[6 Hours]**

Overview of Data Warehousing and OLAP: Introduction, Characteristics of Data Warehouses, Data Modeling for Data Warehouses, Building a Data Warehouse, Typical Functionality of a Data Warehouse, Data Warehouse versus Views, Problems and Open Issues in Data Warehouses. **[5 Hours]**

Data Mining Concepts: Overview of Data Mining Technology, Association rules, Classification, Clustering, Approaches to Other Data Mining Problems, Application of Data Mining, Commercial Data Mining Tools. **[4 Hours]**

Emerging Database Technologies and Applications: Mobile Databases, Multimedia Databases, Geographical Information Systems (GIS), Genome Data Management. **[3 Hours]**

Text Books:

1. SQL,PL/SQL ,The programming language of oracle, Ivan Bayross, BPB Publication
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw Hill Education.
3. Connolly, "Specifications of Database Systems: A Practical Approach to Design, Implementation and Management", Pearson India.
4. Alexis Leon, Mathews Leon, "Database Management Systems", Leon Press.
5. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Tata McGraw.

Reference Books

1. SQL,PL/SQL ,The programming language of oracle, Ivan Bayross BPB Publication
2. An introduction to database system by C.J.Date (Addison Welsey, Publishing house).
3. An introduction to Database Systems by Bipin C. Desai, Galgotia publications.
4. Prateek Bhatia, Database Management system, Kalayani Publishers
5. S.K. Singh, "Database Systems Concepts, Design and Applications", Pearson Education.

E-Books and online learning material

1. Database Management system. 2nd Ed. http://fdjpkc.fudan.edu.cn/_upload/article/files/38/18/68cfc4494aa8a05490d9c94b84e8/37986de0-6e42-4a65-ad14-91d6d49e20cf.pdf
2. Fundamentals of Database Management Systems eBook. https://www.circuitmix.com/free-download-fundamentals-of-database-management-systems-ebook/

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106/106/106106093/ Accessed on Feb. 10, 2021
2. https://www.youtube.com/watch?v=075XblZxQts&list=PLV8vIYTIdSnadoY3-LdIJ8pzxgpdBVbHI Accessed on Feb. 10, 2021
3. https://www.youtube.com/watch?v=SdW5RKUboKc&list=PLSE8ODhjZXjasmrEd2_Yi1deeE360zv5O Accessed on Feb. 10, 2021
4. https://www.youtube.com/watch?v=hKljaVcCMgg&list=PLLANTs44t4TVFZ6i8fIu0wOBv3FVUMc89 Accessed on Feb. 10, 2021
5. https://www.youtube.com/watch?v=5qTtecS682A&list=PLir19lgiavA2XaNFoBIYdLtZWXfneVYW6 Accessed on Feb. 10, 2021

Subject Code: PECS-118

Subject Name: Big Data

Programme: B.Tech. (CSE)	L: 3 T: 0 P: 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Data Mining

Additional Material Allowed in ESE: NIL

On Completion of the course student should be able to:

CO#	Course Outcomes(CO)
CO1	Explain the structural concepts, analytics tools and drivers of big data ecosystem.
CO2	Apply Hadoop and MapReduce commands in big data distributed environment of Clusters.
CO3	Evaluate Hadoop distributed file system with Mapper and Reducer for big data management.
CO4	Compare different types of databases for big data application management
CO5	Classify business analytics and analytical methods in practice for helping decision making in businesses.
CO6	Utilize different analytical methods and case studies for the analysis of big data applications

Detailed Contents

Part-A

Introduction to Big Data: Big data overview, V's of big data, Data structures, State of the practice in analytics, Current analytical architecture, Drivers of big data, Big data ecosystem and a New Approach to Analytics, Key roles for the new big data ecosystem, Data at rest v/s data at motion, Examples of big data analytics tools. **[5 Hours]**

Apache Hadoop: Understanding distributed system and Hadoop, Comparing SQL databases and Hadoop, MapReduce building blocks of Hadoop –Name node, Data node, Secondary name node, Job-Tracker, Task-Tracker, Introducing and configuring Hadoop cluster – Local, Pseudo distributed mode, Fully distributed mode, Handling web-based Cluster, and Configuring XML files. **[7 Hours]**

Working with Hadoop: Interacting with HDFS, Steps to read and write into HDFS. Anatomy of MapReduce Program – Hadoop data type, Mapper and Reducer, Partitioner, Combiner, Reading and writing format, Word count with predefined Mapper and reducer. Introduction to with Hive and Spark. **[7 Hours]**

Part-B

Big Data Management: In-database Analytics – Introduction to NoSQL– Aggregate data models, Graph databases, Graph-less databases, Distribution models, Introduction to HBase, MongoDB, and Cassandra.**[7 Hours]**

Business Analytics: Decision making in business analytics, Business analytics in practice – Financial analytics, Healthcare analytics, Sport and web analytics. Categorization of analytics methods and models – Descriptive analytics, Predictive analytics, Perspective analytics. **[4 Hours]**

Analytical Methods and Case studies: Linear regression, Logistic regression, K-Means clustering, Decision tree classification. Case studies: Social data analytics, Recommendation engines, Customer analytics. **[5 Hours]**

Text Books

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly Media.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics", First Edition, Wiley.
3. Parag Kulkarni, Sarang Joshi,S.Brown, "Big Data Analytics", PHI Learning Pvt. Ltd.
4. Paul C. Zikopoulos, Chris Eaten, Dirk Deroos, "Understanding Big Data", McGraw Hill.

Reference Books

1. Chuck Lam, "Hadoop in Action", Reprint edition, Dreamtech Press
2. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC2, First Edition, Wiley Publications.
3. Jeffrey D. Camm, "Essentials of Business Analytics", First Edition, CENGAGE Learning.
4. Jared Dean, "Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners", First Edition, Wiley Publications.
5. Eric Siegel, Thomas H. Devanport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", First Edition, Wiley Publications.

E-Books and Online Learning Material

1. Lecture Notes on Big Data and Business Analytics by Ms. G. Sulakshana and Ms. G. Srilekha https://www.iare.ac.in/sites/default/files/NEW%20LECHURE%20NOTES.pdf
2. Online Book "Big Data- Principles and Paradigms" by Rajkumar Buyya http://dhoto.lecturer.pens.ac.id/lecture_notes/internet_of_things/Big%20Data%20Principles%20an d%20Paradigms.pdf

Online Courses and Video Lectures

1. "Big Data Computing", https://nptel.ac.in/courses/106/104/106104189 Accessed on July 20, 2021
2. "Introduction to Data Analytics", https://nptel.ac.in/courses/110/106/110106072/ Accessed on July 20, 2021

Subject Code: PECS-119

Subject Name: Data Science

Programme: B.Tech. (CSE)	**L: 3 T: 0 P: 0**
Semester: 8	**Teaching Hours**: 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE)**: 3 hrs
Total Marks: 100	**Course Status**: Elective

Prerequisites: Knowledge of basic programming and mathematical functions.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Analyze the need and usage of various facets of data.
CO2	Examine the steps for Data collection and Data Science process
CO3	Identify and apply various forms of representing data
CO4	Perform exploratory data analysis.
CO5	Understand and apply various visualization techniques
CO6	Demonstrate and enrich knowledge for various model validation techniques.

Detailed Contents:

PART-A

Introduction: Introduction to Data Science, Introduction to Big Data, Relationship between Big Data and Data Science, Benefits and uses of Data science and Big data. Data Structure: Structured vs Unstructured Data. Drivers of big data, Data Growth-issues and challenges, Data Science vs Business Intelligence**. [6 Hours]**

Data Collection and Data Science Process: Sources of Data, Data collection and APIs, Data Science Process: Goal setting, retrieving data, data preparation, data cleansing and transformation, exploratory data analysis, data visualization, Model building and performance evaluation, presentation. **[6 Hours]**

Data Representation: Various Forms of data, Text data, Graph-based data. Modern databases- text files, spreadsheets, SQL databases, NoSQL databases, Distributed databases, Live data streams, Image, Sensor and Network data. Dataset Terminology: Observations and variables, Discrete and Continuous variables, Quantitative and Qualitative variables, Dependent and Independent variables. **[8 Hours]**

PART-B

Data Exploration: Introduction and purpose of EDA (Exploratory Data Analysis), Descriptive statistics: mean, median and mode, variance and measures of variance: standard deviation, range, skewness, correlation, correlation. Handling anomalous values, missing values and outliers. **[9 Hours]**

Data Visualization: Purpose and techniques of Data visualization: Histograms, Box Plots, Scatterplots. Normal Distribution: meaning and its characteristics, concept of transformations, transformation functions: Power function, Exponential function, Polynomial function, Model building and variable selection, Dimensionality, Feature selection methods: forward selection and backward selection procedure, stepwise selection procedure. Concepts of overfitting and under-fitting. Model validation and comparison: Confusion matrix: accuracy, precision and recall**,** ROC Curve. **[9 Hours]**

Text Books

1. Sinan Ozdemir and Sunil Kakade, "Principles of Data Science", Second Edition, Packt Publishing.
2. Roger D. Peng and Elizabeth Matsui: "The Art of Data Science", Lean Publishing
3. Joel Grus, Data Science from Scratch, Second Edition, O'Reilly

Reference Books

1. Foster Provost & Tom Fawcett: "Data Science for Business" O'Reilly
2. Roger D. Peng, R Programming for Data Science

E-Books and Online learning material

Davy Cielen, Arno D.B. Meysman, Mohamed Ali, Introducing Data Science - Big Data, Machine Learning and More Using Python Tools, Manning Publications Co. http://bedford-computing.co.uk/learning/wp-content/uploads/2016/09/introducing-data-science-machine-learning-python.pdf

Online Courses and Video lectures

1. "Data Science for Engineers", https://nptel.ac.in/courses/106/106/106106179/
   Accessed on September 10, 2021
2. "Python for Data Science", https://nptel.ac.in/courses/106/106/106106212/
   Accessed on September 10, 2021
3. "Foundations of Data Science", https://www.youtube.com/watch?v=WEBUWYxaqLQ
   Accessed on September 10, 2021

Subject Code: LPECS-107

Subject Name: Advanced Database Management Systems Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T: 0 P:** 2
Semester: 6	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam(ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Implement PL/SQL techniques for providing solutions for arrays and strings.
CO2	Analyze the impact of PL/SQL loops and arrays for implementing solutions.
CO3	Design procedure oriented PL/SQL programs for relational operators.
CO4	Apply PL/SQL function principles for implementing programs.
CO5	Illustrate the use of records, cursors, triggers, exceptions and triggers for implementing programs.
CO6	Develop a project by applying various PL/SQL concepts.

List of Practicals:

1. Insert data to a table using character type variable
    a. Which will get the salary of an employee with particular id from emp table and display it on the screen.
    b. Which creates two variables in the outer block and assign their product to the third variable created in the inner block.
2. Write a PL/SQL procedure to calculate the incentive on a target achieved and display the message either the record updated or not.
3. Write PL/SQL code to count the number of employees in a particular department and check whether this department have any vacancies or not by using functions. Assume there are 45 vacancies in this department.
4. Write a PL/SQL procedure to accepts a BOOLEAN parameter and uses a CASE statement to print Unknown if the value of the parameter is NULL, Yes if it is TRUE, and No if it is FALSE.
    a. which use the relational operators to compare character values for equality or inequality.

5. Write a program in PL/SQL to update the salary of a specifc employee by 8% if the salary exceeds the mid range of the salary against this job and update up to mid range if the salary is less than the mid range of the salary, and display a suitable message.
6. Write a program in PL/SQL to print 1st n numbers with a difference of 3 and starting from 1.
    a. which uses FOR loop to insert ten rows into a database table.
    b. to demonstrate the use of 'WHILE loop'
    c. to demonstrate the use of 'Nested loop'
    d. to demonstrate the use of ' Labeling loop'
    e. to demonstrate the use of 'GOTO statement'
7. Write a program in PL/SQL to insert records from one table to another.
    a. Which uses a cursor to select the five highest paid employees from the emp table.
    b. that uses implicit cursor attributes to update the salary of employees in emp table.
    c. to illustrate the use of different types of Explicit cursors
    d. to illustrate the use of Triggers.
    e. to illustrate the use of Packages
    a. to handle exceptions
8. **Minor Project:** By using standard database design rules, a small database has to be designed for a specific assigned problem by a group of two to three students. Design meaningful Pl/SQL queries related to your project and execute them. Each must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as to give a presentation of the same.

Reference Material

Manuals available in Lab.

Subject Code: LPECS-109

Subject Name: Data Science Laboratory

Semester: 8	**Teaching Hours**: 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE)**: 2 hrs
Total Marks: 50	**Course Status**: Elective

Prerequisites: Fundamentals of database systems

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Understand concepts of R programming.
CO2	Make use of and demonstrate variables, data types and operations using R.
CO3	Explain and Perform mathematical constructs for better analysis of data.
CO4	Implement various visualization techniques for gaining more data insights.
CO5	Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.
CO6	Design and develop projects using Data Science tools and techniques.

List of Practicals

1. Introduction to R.
2. Programs to implement use of Variables and Data types in R.
3. Program to implement Arithmetic, Logical and Matrix operations in R.
4. Program to implement concept of Functions.
5. Program to implement control structures.
6. Program to Read and Write data from dataset.
7. To study and write program for using Linear Algebra for Data Science.
8. To study various libraries and packages for Data Visualization in R.
9. Write a program to find data distribution using box and scatter plot.
10. Write a program to find outliers using plot.
11. Write a program to plot Histogram and Bar chart on sample data.

Minor project:

Students are required to develop a project to use various Data Science constructs like box, scatter plot, Histogram, Dimensionality, Transformation to visualize sample dataset.

Reference Material

Manuals available in Lab.

Subject Code: PECS-116

Subject Name: Information Retrieval

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:**20%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Course Status:** Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain Information Retrieval (IR) systems and its role in web search
CO2	Compare the performance of simple and cross language Information retrieval models.
CO3	Evaluate information retrieval algorithms and give an account of the difficulties of evaluation
CO4	Explain the concept of Parallel Retrieval
CO5	Analyze the various aspects of distributed information retrieval and integration.
CO6	Develop the ability to design a complete IR system from scratch.

Detailed Contents:

Part A

Introduction: Introduction, History of IR, Components of IR, The IR Problem, The IR System, The Software Architecture of the IR System, The impact of the web on IR, The role of artificial intelligence (AI) in IR, IR Versus Web Search, Components of a Search engine. **[5 Hours] Basic IR Models:** Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity. **[5 Hours]**

Experimental Evaluation of IR: Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections. **[3 Hours]**

Retrieval Utilities, Indexing and Searching: Relevance feedback; clustering; Passage-Based Retrieval; N-Grams, Regression Analysis; Thesauri; Semantic Networks; Parsing, Searching Introduction; Inverted Files; Other indices for text; Boolean queries; Sequential searching; Structural queries; Compression. **[6 Hours]**

Part B

Cross Language Information Retrieval and Efficiency, Integrating Structured Data and Text: Introduction; Crossing the language barrier; Cross Language retrieval strategies; Cross language utilities. Duplicate Document Detection. Review of the relational model; a historical progression;

Information retrieval as a relational application; Semi-structured search using a relational schema. **[6 Hours]**

Parallel Information Retrieval and Distributed Information Retrieval: Parallel text scanning; parallel indexing; Clustering and classification; Large parallel systems; A theoretic model of distributed information retrieval; Web search; Result fusion; Other architectures. **[6 Hours]**

Multimedia IR: Introduction; data modeling; Query languages; Spatial access methods; A general multimedia indexing approach; One-dimensional time series; Two-dimensional color images. **[5 Hours]**

Text Books:

1. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search, ACM Press Books.
2. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, Addison Wesley.
3. Mark Levene, An Introduction to Search Engines and Web Navigation, Wiley.

Reference Books:

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press.
2. Ophir Frieder “Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series “, Springer.
3. Manu Konchady, “Building Search Applications: Lucene, Ling Pipe”,Gate Mustru Publishing.

E-Books and online learning material

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.

http://www.cs.utexas.edu/users/mooney/ir-course

Online Courses and video lectures

1. https://www.coursera.org/learn/text-retrieval
2. https://www.youtube.com/watch?v=sNlGHK1gz-I

Subject Code: PECS-120

Subject Name: Natural Language Processing

Programme: B.Tech. CSE	**L:** 3 **T:** 1 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Knowledge of regular languages and parsing

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply the knowledge of engineering to understand the computational properties of natural languages and to implement the algorithms for processing linguistic information.
CO2	Utilize the models and methods of statistical natural language processing for common nlp tasks such as speech recognition, machine translation, text classification, spell checking etc.
CO3	Understand the key concepts of morphology, syntactic analysis for implementing pos tagging algorithms and context free grammar for English language.
CO4	Identify and apply natural language processing algorithms to solve real world problems.
CO5	Understanding semantics and pragmatics of English language for processing.
CO6	Implement, and apply state-of-the-art techniques to novel problems involving natural language data.

Detailed Contents:

Part-A

Introduction: Introduction to natural language and speech processing, Steps for processing natural languages, Issues and challenges for processing of natural languages, Elements of information theory, Brief history of natural language processing. **[5 Hours]**

Morphological Analysis: Inflectional and Derivational morphology, Morphological parsing, Lexicon and Morphotactics, Finite state transducers, N-gram language models, N-gram smoothing, Entropy. **[7 Hours]**

Part-of-Speech Tagging: Word classes, Part-of-speech tagging, Tagsets, POS tagging Techniques – Rule-

based, Stochastic, Transformation-based. **[6 Hours]**

Part-B

Syntactic Analysis: Introduction to parsing, Basic parsing strategies, Top-down parsing, Bottom-up parsing, Dynamic programming – CYK parser, Issues in basic parsing methods, Earley algorithm, Parsing using Probabilistic Context Free Grammars. **[7 Hours]**

Semantic Analysis: Lexical semantics, Lexemes, Relations among lexemes and their senses, WordNet, Word Sense Disambiguation – Supervised and Un-supervised approaches. Information Extraction – Introduction to Named Entity Recognition and Relation Extraction. **[4 Hours]**

Pragmatics: Discourse, Discourse structure. Dialogue – Acts, structure, conversational agents. Language generation, Architecture for generation. **[4 Hours]**

Applications: Different application areas of natural language processing – Machine translation, Machine learning, Text categorisation and summarisation, Speech synthesis, Speech recognition, Optical character recognition, Database access, etc. **[3 Hours]**

Text Books:

1. D. Jurafsky and J. H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education.
2. J. Allen, "Natural Language Understanding", Second Edition, Addison Wesley.
3. Andrew Radford, Martin Atkinson, David Britain, Harald Clahsen, Andrew Spencer "Linguistics, An Introduction**"**, Second Edition, Cambridge University Press.

Reference Books:

1. T. Siddiqui and U.S. Tiwary, "Natural Languauge Processing and Information Retrieval", First Edition, Oxford University Press.
2. J. Handke, "The Structure of the Lexicon: Human Versus Machine (Natural Language Processing)", First Edition, Mouton de Gruyter.
3. Bharati, V. Chaitanya and R. Sangal, "Natural Language Processing: A Paninian Perspective", Third Edition, Prentice Hall of India.

E-Books and online learning material:

1. https://lecturenotes.in/subject/371/natural-language-processing-nlp
2. http://www.cs.virginia.edu/~kc2wc/teaching/NLP16/slides/01-intro.pdf

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/106/101/106101007/mod01lec01.mp4
2. https://nptel.ac.in/courses/106/101/106101007/mod01lec02.mp4
3. https://nptel.ac.in/courses/106/101/106101007/mod01lec03.mp4
4. https://nptel.ac.in/courses/106/101/106101007/mod01lec04.mp4
5. https://www.coursera.org/learn/language-processing

Subject Code: PECS-123
Subject Name: Human Computer Interaction

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO #	Course Outcomes (CO)
CO1	Examine the capabilities of both humans and computers from the viewpoint of human information processing
CO2	Understand the concept of computational theory and the classification of Ubiquitous Computing, Virtual Reality and Augmented Reality, Speech Recognition and Translation based on their efficiency
CO3	Apply an interactive design process and universal design principles to design HCI systems
CO4	Make use of HCI standards and guidelines for Model based evaluation
CO5	Analyze user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
CO6	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites and Mobile Application Development environment

Detailed Contents:

PART-A

Foundations of Human Computer Interaction: Introduction to HCI, The Human: I/O channels, Memory, Reasoning and Problem Solving; The Computer: Devices, Memory, Processing and Networks; Interaction: Models, Frameworks, Ergonomics, Styles, Elements, Interactivity and Paradigms. **[8 Hours]**

Design Process and Implementation: Interactive Design Basics: Process, Scenarios, Navigation, Screen Design, Iteration and Prototyping. HCI in Software Process: Software Life Cycle, Usability Engineering, Prototyping in Practice, Design Rationale. Design Rules: Principles, Standards, Guidelines, Rules. Evaluation Techniques: Universal Design. **[8 Hours]**

User and Task Model: Cognitive Models, Socio-Organizational Issues and Stakeholder Requirements, Analyzing Tasks, Dialog Notations and Design. **[6 Hours]**

PART-B

Web Interface Design: Hypertext, Multimedia, World Wide Web, Overlays, Inlays and Virtual Pages, Contextual Tools, Designing Process, Case Studies. **[5 Hours]**

User Interface Evaluation: Heuristic Evaluation, Evaluation with Users, Model-based Evaluation, Mobile Application Frameworks, Types of Mobile Applications, Mobile Design Architecture and its Elements. **[5 Hours]**

Computing Theories & Recent Trends: Groupware and Computer Supported Collaborative Work, Ubiquitous Computing, Virtual Reality and Augmented Reality, Speech Recognition and Translation. **[4 Hours]**

Text Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education.
2. Ben Shneiderman, Maxine Cohen, Catherine Plaisant, Steven M. Jacobs, "Designing the User Interface", 5th Edition, Pearson Education.
3. K. Meena, R. Sivakumar, "Human-Computer Interaction" PHI Learning, Delhi.
4. Shneiderman, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 5th Edition, Pearson Education India.

Reference Books

1. Brian Fling, "Mobile Design and Development", 1st Edition, O"Reilly Media Inc.
2. Bill Scott and Theresa Neil, "Designing Web Interfaces", 1st Edition, O"Reilly.
3. Dr. Samit Bhattacharya, "Human-Computer Interaction: User-Centric Computing for Design", 1st Edition, McGraw-Hill.

E-Books and online learning material

1. Human Computer Interaction
https://www.researchgate.net/publication/224927543_HumanComputer_Interaction/link/02e7e51a84759ab04d000000/download
2. HCI - Fundamentals and Practice http://www.ittoday.info/Excerpts/HCI.pdf
3. HCI – An Overview http://www.ee.cityu.edu.hk/~hcso/ee4213_ch1.pdf

Online Courses and Video Lectures

1. "Human-Computer Interaction", https://nptel.ac.in/courses/106/103/106103115/ Accessed on July 9, 2021
2. "Introduction to Human Computer Interaction", https://nptel.ac.in/courses/106/106/106106177/ Accessed on July 9, 2021
3. "Human-Computer Interaction" https://swayam.gov.in/nd1_noc19_cs86/preview Accessed on July 9, 2021

Subject Code: PECS-124

Subject Name: Deep Learning

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Course Status:** Elective

Prerequisite: complete knowledge of Clustering, Classification and Graphical Models

CO#	Course Outcomes(CO)
CO1	Explain key concepts and terminologies related to deep learning.
CO2	Implement feedforward, Convolutional and Recurrent Neural Network architectures.
CO3	Apply techniques to optimize hyperparameters for improving model performance and efficiency.
CO4	Explain the usage of CNN architecture to extract features from input data.
CO5	Understand the functioning and training algorithm for RBMs and their application in Generative Modelling.
CO6	Develop skills to evaluate various advanced learning approaches and select suitable technique for use cases.

Detailed Contents:

PART-A

Introduction: Deep Learning definition, why Deep Learning, history of Deep Learning, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Convergence theorem for Perceptron Learning Algorithm. **[5 Hours]**

Feedforward Networks: Multilayer Perceptron, Representation power of Feedforward Neural Networks, Backpropagation Gradient Descent, Empirical Risk Minimization, autoencoders. **[4 Hours]**

Deep Neural Networks: Difficulty of training deep neural networks, Greedy layerwise training, Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, **[5 Hours]**

Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs **[5 Hours]**

Part-B

Convolutional Neural Networks: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet **[6 Hours]**

Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines. **[5 Hours]**

Recent trends: Variational Autoencoders, Auto-encoders and unsupervised learning, Stacked auto-encoders and semi-supervised learning, transfer learning, multi-model learning, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning **[6 Hours]**

Textbooks

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

2. Bengio, Yoshua. "Learning deep architectures for AI", Foundations and trends in Machine Learning 2.1 (2009):

Reference Books

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

E-books and online learning material

1. http://deeplearning.net/tutorial/deeplearning.pdf

2. http://neuralnetworksanddeeplearning.com/index.html

3. https://d2l.ai/d2l-en.pdf

Online Courses and Video Lectures

1. "Deep Learning", https://nptel.ac.in/courses/106/106/106106184/ Accessed on July 9, 2021

2. "Deep Learning for Visual Computing",

   https://nptel.ac.in/courses/108/105/108105103/ Accessed on July 9, 2021

Subject Code: LPECS-110

Subject Name: Natural Language Processing Laboratory

Programme: B.Tech. CSE	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 20
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Experience with programming and machine learning

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Apply the knowledge of engineering to understand the computational properties of natural languages and to implement the algorithms for processing linguistic information.
2.	Utilize the models and methods of statistical natural language processing for common NLP tasks such as speech recognition, machine translation, text classification, spell checking etc.
3.	Understand the key concepts of morphology, syntactic analysis for implementing POS tagging algorithms and context free grammar for English language.
4.	Identify and apply natural language processing algorithms to solve real world problems
5.	Understanding semantics and pragmatics of English language for processing.
6.	Implement, and apply state-of-the-art techniques to novel problems involving natural language data.

List of Practicals:

1. Use Naïve Bayes method to classify positive or negative sentiment in tweets.
2. Apply the orthographic e-insertion rule for morphological analysis.
3. Implement the auto-complete algorithm using an N-gram model.
4. Implement a simple auto-correct algorithm using minimum edit distance and dynamic programming.
5. Use the auto-correct algorithm to implement a simple spell checker, using unigram frequency to sort options at similar edit distance.
6. Apply the Viterbi algorithm for Part of Speech tagging.
7. Implement the top down and bottom up parsing algorithms.

8. Implement the CYK Parser using Dynamic programming.
9. Implement the Earley Algorithm using suitable example.
10. Implement named entity recognition in information extraction.

Reference Material
Manuals available in Lab.

Subject Code: LPECS-112

Subject Name: Deep Learning Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Evaluate the performance of neural network using various metrics.
CO2	Implement LSTM-based sentiment analysis on their own datasets to reinforce the learned concepts.
CO3	Implement real-world applications of ResNet and AlexNet.
CO4	Inspect CNN and hybrid CNN for speech data analysis.
CO5	Implement deep neural networks in simulated environment.
CO6	Implement the generator network architecture to generate realistic faces.

List of Practicals

1. Learn to build your first simple neural network and analyse it using some real data.
2. Build recurrent networks and long short-term memory networks and perform sentiment analysis on it.
3. Build a ResNet architecture and use it for some real-world data.
4. Implement AlexNet architecture and use it for image database.
5. Implement a 2-D CNN and use it for speech data corpus.
6. Implement a hybrid network using CNN and LSTM and use it for classification.
7. Use deep neural networks to design agents that can learn to take actions in a simulated environment. Apply reinforcement learning to complex control tasks like video games and robotics.
8. Build a pair of multi-layer neural networks and make them compete against each other in order to generate new, realistic faces.

Reference Material

Manuals available in Lab.

Subject Code: PECS-125

Subject Name: System Programming

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 5	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:**
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Course Status:** Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain system software, operating systems and components of programming system.
CO2	Elaborate language processors and elements of assembly language programming.
CO3	Design of macro processor, linkers and loaders.
CO4	Determine the process of scanning and parsing.
CO5	Discuss the phases of compiler.
CO6	Use interpreters and debuggers.

Detailed Contents:

Part-A

Overview of System Software: System Software, Application Software, Systems Programming, Recent Trends in Software Development, Levels of System Software, Evolution of Operating Systems, Operating System & Kernel, Functions of Operating System, Machine Structure, Evolution of components of a programming system -Assembler, Loader, Macros, Compiler.**[5 Hours]**

Language Processors: Fundamentals of Language Processing & Language Specification, Language Processing Activities, Data Structures for Language Processing - Search Data structures, Allocation Data Structures.**[4 Hours]**

Introduction to Assembly Language Program: Elements of Assembly Language Programming, A Simple Assembly Scheme, Pass Structure of Assemblers, One-Pass and Two-Pass Assemblers with reference to IBM 360 machines.**[6 Hours]**

Macro and Macro Processors: Introduction, Macro Definition and Call, Macro Expansion, Nested Macro calls, Advanced Macro Facilities, Design of a Macro Pre-processor, design of a Macro Assembler, Functions of a Macro Processor. **[5 Hours]**

Part-B

Linkers and Loaders: Linkers - Relocation of Linking Concept, Design of a Linker, Self-Relocating Programs, Linking of Overlay Structured Programs, Dynamic Linking. Loaders - Different Loading Schemes, Sequential and Direct Loaders, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, Linker v/s Loader. **[6 Hours]**

Scanning and Parsing: Programming Language Grammars, Classification of Grammar, Ambiguity in Grammar Specification, Scanning, Parsing, Top Down Parsing, Bottom up Parsing, Language Processor Development Tools - LEX, YACC. **[4 Hours]**

Compilers: Causes of Large Semantic Gap, Compiler and its phases – lexical, syntax and semantic analysis, intermediate code generation, code optimization and code generation. **[7Hours]**

Interpreters and Debuggers: Interpreters - Overview of interpreters, Benefits of Interpretation. Types of Errors, Debugging Debuggers. Procedures, Classification of Debuggers, Dynamic/Interactive **[3 Hours]**

Text Books

1. Donovan J.J., “Systems Programming”, New York, Mc-Graw Hill.
2. D. M. Dhamdhere, “Systems Programming and Operating Systems”, Tata McGraw-Hill.
3. Santanu Chattopadhyay, “System Software”, Prentice-Hall India.

Reference Books

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques, and Tools”, Pearson Education Asia.
2. Kenneth C. Louden,” Compiler Construction”, Cengage Learning.
3. Leland L. Beck, “System Software: An Introduction to Systems Programming”, Pearson Education.
4. Adam Hoover, “System Programming with C and Unix”, Pearson Education

E-Books and online learning material

1. https://www.engineerstudyhub.com/books/systems_programming_by_donovan.pdf
2. https://lecturenotes.in/subject/29/system-programming-sp
3. https://www.tutorialsduniya.com/notes/system-programming-notes/

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106/108/106108052/ Accessed on 28/07/2020
2. https://www.coursera.org/learn/application-systems-programming Accessed on 28/07/2020
3. https://www.virtuq.com/module_details/linux-system-programmingAccessed on 28/07/2020

Subject Code: PECS-126

Subject Name: Java Programming

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P**: 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 03
Internal Marks: 40	**Percentage of Numerical/ Design/ Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE**): 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Object Oriented Programming

On Completion of the course student should be able to:

CO#	Course Outcomes(CO)
CO1	Understanding of Java's core features, its object-oriented principles, and the significance of Java bytecode
CO2	Identify the various aspects of a specific problem and apply the concepts of classes and objects to develop object oriented model.
CO3	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages to formulate a solution for complex analytical problem.
CO4	Design event driven GUI based and web based applications by implementing concepts like event handling and applets
CO5	Examine the errors in the developed system and resolve them by applying the knowledge of exception handling
CO6	Apply multithreading and Synchronization concepts to develop high-performance, responsive software solutions for modern computing environments.

Detailed Contents

Part-A

Introduction: History of Java, Importance of Java to the internet, Java's Magic – The Byte code features of Java, Overview of Java. **[3 Hours]**

Java Basics: Data-types, Variables, Arrays, Operators, Expressions, Control statements, Type conversion, Concepts of classes and objects, Constructors, Methods, Access control, this keyword, Garbage collection, Overloading methods and constructors, Parameter passing, Recursion, Understanding static, Introducing nested and inner classes, Using command line arguments, Introduction to string handling. [**5 Hours]**

Inheritance: Basics of inheritance, Types of inheritance, Member access rules, Using super, Using final

with inheritance, Method overriding, Dynamic method dispatch, Using abstract classes. **[3 Hours]**

Packages and Interfaces: Defining a package, Accessing a package, Understanding CLASSPATH, Importing packages, Differences between classes and interfaces, defining an interface, implementing interface, Variables in interface, Extending interfaces. [**5 Hours]**

Part-B

Exception Handling: Concepts of exception handling, Exception types, Using try, catch, throw, throws and finally, Java's built in exceptions, Creating own exception subclasses. **[3 Hours]**

Multithreading: Java thread life cycle, Creating threads, Using isAlive() and join(), Synchronization, Interthread communication, Suspending, resuming, stopping threads. **[3 Hours]**

Event Handling: Delegation event model, Event classes, Sources of events, Event listeners, Handling mouse and keyboard events, Adapter classes, Inner classes. The AWT class hierarchy, User interface components – Labels, Button, Canvas, Scrollbars, Text components, Check box, Check box groups, Choices. Lists panels – Scrollpane, Dialogs, Menubar, Graphics. Understanding layout managers – Flow Layout, BorderLayout, GridLayout and CardLayout. [**8 Hours]**

Applets: Basics of applets, Differences between applets and applications, Life cycle of an applet, Types of applets, The HTML applet tag, Creating applets, Passing parameters to applets. **[4 Hours]**

Text Books:

1. E Balagurusamy "Programming with Java" 6th Edition, Tata McGraw-Hill.
2. Herbert Schildt , "The Complete Reference Java " , Tata McGraw-Hill.

Reference Books:

1. Joyce Farrell, "Java for Beginners", Cengage Learning.
2. J. Nino and F.A. Hosch, "An Introduction to programming and OO design using Java", John Wiley & Sons.
3. Y. Daniel Liang, "Introduction to Java programming", Pearson education.

E-Books and Online Learning Material

1. Introduction to Programming using Java by David J. Eck

https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

2. Lecture Notes on Java Programming by Surendra Baswana, IIT Kanpur https://www.iitk.ac.in/esc101/08Jul/notes.htmlR\
3. https://www.tutorialspoint.com/java/java_pdf_version.htm Accessed on Dec. 29, 2020

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105191/ Accessed on Dec. 29, 2020
2. https://www.udemy.com/course/java-tutorial/ Accessed on Feb. 17, 2021
3. https://www.coursera.org/learn/object-oriented-java? Accessed on Feb. 17, 2021

Subject Code: PECS-129
Subject Name: Parallel and Distributed Algorithms

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Knowledge of Parallel and Distributed Computing Algorithms.

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Demonstrate parallel algorithms models, development techniques and algorithms.
CO2	Explain the PRAM model, various parallel algorithms and cost of communication.
CO3	Analyze the pipeline performance, stages, hazards and dynamic instruction scheduling.
CO4	Apply techniques and methods for data mapping and scheduling in SIMD parallel algorithms
CO5	Determine the concepts and issues related to distributed systems.
CO6	Evaluate performance, reliability and other issues while designing token based and non token based algorithms in distributed environment.

Detailed Contents:

Part-A

Introduction: The Idea of Parallelism, Parallel Computing, Models of computation, Parallel Algorithms analysis, Parallel Algorithms models, Design Techniques, Matrix Multiplication, Sorting, Parallel Search Algorithm, Graph Algorithms. [**5 Hours**]

PRAM Algorithms: PRAM Model of Parallel Computation, Parallel Reduction, Prefix Sums, List Ranking, Preorder Tree Traversal, Merging Two Sorted Lists, Graph Coloring, Reducing the Number of Processors and Brent's Theorem, Dichotomoy of Parallel Computing Platforms, Cost of Communication. [**6 Hours]**

Pipeline Processing: Introduction, Pipeline Performance, Arithmetic Pipelines, Pipelined Instruction Processing, Pipeline Stage Design, Hazards, Dynamic Instruction Scheduling. **[6 Hours]**

Part-B

Synchronous Parallel Processing: Introduction, Example-SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, Data Mapping and scheduling in array processors. **[6 Hours]**

Distributed Algorithms: Definition, Issues, Goals, Types of distributed systems, Distributed System Models and complexity measures, Distributed Graph algorithms, Safety, liveness, termination, logical time and event ordering, Global state and snapshot algorithms, Mutual exclusion. **[5 Hours]**

Synchronization: Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure, Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala's Algorithm, Maekawa's Algorithm, Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms, Singhal's Heurastic Algorithm, Raymond's Tree based Algorithm, Comparative Performance Analysis. **[8 Hours]**

Text Books

1. Michael J Quinn, "Parallel Computing: Theory and Practice", second edition, McGraw Hill.

2. Joseph Jaja, "An Introduction to Parallel Algorithms", second edition, Addison-Wesley/Pearson.

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", second edition, Addison-Wesley/Pearson.
2. Mukesh Singhal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems", first edition, TMH.

Subject Code: PECS-130

Subject Name: Mobile Application Development

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 Hours
Total Marks: 100	**Course Status:** Elective

Prerequisites: Programming in Java

Additional Material Allowed in ESE: - NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Demonstrate the android features and develop application using Android.
CO2	Utilize rapid prototyping techniques to design and develop sophisticated mobile Interfaces.
CO3	Design and develop mobile application that accommodates user specific requirements and constraints analysis.
CO4	Illustrate android basic principles and common APIs to manage data for mobile application development.
CO5	Apply mobile applications for Android and iOS based operating system that uses basic and advanced phone features.
CO6	Make use of the concept React Native for creating Hybrid Mobile Application.

Detailed Contents

PART-A

Introduction: Introduction to mobile applications, Market and business drivers for mobile applications, Publishing and delivery of mobile applications, Requirements gathering and validation for mobile applications, Different types of Mobile Applications – Native Application Development and Hybrid Mobile Application Development. **[6 Hours]**

Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file. **[6 Hours]**

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions. **[6 Hours]**

PART-B

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation, Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. **[5 Hours]**

Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs. **[3 Hours]**

iOS: Introduction to iOS, XCode and Swift, Architecture of Swift, Conditional Statement & Operators, Loops. **[4 Hours]**

React Native: Introduction to React and React Native, Architecture of React Native, Working with content, Navigation, Statement Management in React Components **[6 Hours]**

Text Books

1. Jeff McWherter, "Professional Mobile Application Development 1st Edition", Wrox
2. John R. Carlson Ph.D., "Cross-Platform Mobile Application Development: A Beginner's Guide Using Solar2D", Independently published
3. S. Sydhani Begum, "Mobile App Development - Android Programs Using Eclipse: Android Programs Using Eclipse Indigo", Notion Press

Reference Books

1. Gookin, "Android For Dummies, 2nd Edition", For Dummies
2. Adam Boduch, "React and React Native: A complete hands-on guide to modern web and mobile development with React.js, 3rd Edition", Packt Publishing

E-Books and Online learning material

1. Android https://books.goalkicker.com/AndroidBook/
2. React Native https://allitbooks.net/programming/82-react-native-action.html

Online Courses and Video Lectures

1. "The Complete React Native + Hooks Course", https://www.udemy.com/share/101Wbw/ Accessed on July 09, 2021
2. "The Complete Android N Developer Course", https://www.udemy.com/share/101Wfk/ Accessed on July 09, 2021
3. "Advanced App Development in Android Specialization"https://www.coursera.org/specializations/advanced-app-android Accessed on July 09, 2021

Subject Code: LPECS-113

Subject Name: Java Programming Laboratory

Programme: B.Tech. CSE	**L:** 0 **T:** 0 **P:** 2
Semester: 6	**Teaching Hours:** 20
Theory/Practical: Practical	**Credits:** 1
Internal Marks:30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites:

On Completion of the laboratory course student should be able to:

CO#	Course Outcomes(CO)
CO1	Apply the knowledge of JAVA language syntax and semantics to write and execute Java programs.
CO2	Develop reusable programs using the concepts of inheritance , polymorphism, interfaces and packages to formulate a solution for complex analytical problem
CO3	Design event driven GUI based java program which mimic the real world scenarios.
CO4	Create interactive and visually appealing web-based applications using Java applets
CO5	Implement exception handling techniques to make the system bug free.
CO6	Develop effective java applications by applying the concepts of multithreading and Synchronization for solving real world problems

List of Practicals:

1. Write a program to create a pattern of stars(triangle)
2. Create a program to display the sum of digits of a given number.
3. Develop a program in java to print the factorial of a given number.
4. Write a program in java to find if a input number is palindrome or not.
5. Define a class '*student'* with its attributes, describe its constructor, overload the constructors and

instantiate its objects. Demonstrate use of '*this*' keyword.

6. Demonstrate the use of inheritance with its types and also use '*super*' keyword
7. Demonstrate initialization of an array of objects using constructors and methods.

8. Demonstrate the concept of method overloading and method overriding.
9. Write a program for the demonstration of extending and implementing interfaces.
10. Create threads by using *Runnable* Interface and extending '*Thread*' class.
11. Demonstrate the use of try ,catch, throw and finally for exception handling
12. Write a program in java to demonstrate JDBC Connectivity
13. Create Applet for configuring '*Applet'* class by passing different parameters
14. Create an application to implement the concept of socket programming in Java
15. Create number counter in an Applet using '*Thread*' and '*Applet*' class
16. Write an Applet that illustrates how to process mouse click, enter, exit, press and release events. The background color changes when the mouse is entered, clicked, pressed, released or exited.
17. Implementation of a scientific calculator using event-driven programming
18. Write a java program that handles all keyboard events and shows the event name at the center of the window when keyboard event is executed.

Resource Material:

Manuals available in Lab.

Subject Code: - LPECS-115
Subject Name: Mobile Application Development Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Programming in Java

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Demonstrate the basic principles of Mobile application development.
CO2	Build a native application using GUI components, Layouts and Mobile application development framework.
CO3	Develop an application using basic graphical primitives and databases.
CO4	Make use of location identification using GPS in an application.
CO5	Construct an application using multi-threading and RSS feed.
CO6	Model new applications to handheld devices.

List of Practicals

1. Create working environment – Installation of Android SDK.
2. Create an application that uses GUI Components, Fonts and Colors.
3. Create an application that uses Layout Managers and Event Listeners.
4. Create a calculator application.
5. Create an application that makes use of database.
6. Create an application that uses GPS location information.
7. Write a code that draws basic graphical primitives on the screen.
8. Create an application that makes use of RSS Feed.
9. Create an application that creates an alert upon receiving a message.
10. Create an application that writes data to the SD card.

Reference Material

Manuals available in Lab.

Subject Code: PECS-103

Subject Name: Agile Software Development

Programme: B.Tech. (CSE)	**L: 3 T: 1 P: 0**
Semester: 7	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE)**: 3 hrs
Total Marks: 100	**Course Status**: Elective

Prerequisites: Knowledge of software engineering fundamentals.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Interpret the concept of agile software engineering and its advantages in software development.
CO2	Analyze the core practices behind several specific agile methodologies
CO3	Determine the role of design principles in agile software design
CO4	Explain design methodologies of agile software development.
CO5	Assess implications of functional testing, unit testing, and continuous integration.
CO6	Apply testing strategies in agile software testing.

Detailed Contents:

PART-A

Introduction: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility. **[7 Hours]**

Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations. **[7 Hours]**

Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation. **[8 Hours]**

PART-B

Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development. **[9 Hours]**

Testing: The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation. **[9 Hours]**

Text Books

1. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, "Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design", First edition, Packt Publisher.

Reference Books

1. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams", International edition, Addison Wesley.
2. Alistair Cockburn, "Agile Software Development: The Cooperative Game", 2nd Edition, Addison-Wesley

E-Books and Online learning material

1. "The Complete Guide to Agile Software Development" https://clearbridgemobile.com/complete-guide-agile-software-development/
2. "Agile Fundamentals Ebook: A Complete Guide for Beginners", https://agileken.com/agile-fundamentals-ebook/

Online Courses and Video lectures

1. "Agile Software Development", https://www.edx.org/course/agile-software-development Accessed on August 27, 2021.
2. "Agile Software Development", https://www.coursera.org/learn/agile-software-development Accessed on August 27, 2021.

Subject Code: PECS-104

Subject Name: Object Oriented Design Using UML

Programme: B.Tech. (CSE)	**L: 3 T: 0 P: 0**
Semester: 7	**Teaching Hours**: 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE**): 3 hrs
Total Marks: 100	**Course Status**: Elective

Prerequisites: Knowledge of software engineering fundamentals.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the fundamentals of OOD, system models and their usage.
CO2	Design UML diagrams and their relationships.
CO3	Define structural modeling and software requirement specification document.
CO4	Determine behavioral modeling and architectural modeling using use cases.
CO5	Discuss object oriented methodologies, System testing and maintenance.
CO6	Use open source UML design tools for real world problems.

Detailed Contents:

Part-A

Introduction: Introduction to Object Oriented Development, Introduction to Object Oriented analysis and design with fundamentals, Various Principles of modeling, Need of Object-Oriented analysis and design**.** **[5 Hours]**

System and Process: Introduction to SDLC, Iterative and evolutionary analysis and design, Agile modeling, Class Modeling, State Modeling and Interaction Modeling. **[4 Hours]**

Various UML Diagrams and Relationships: Use case diagram, Class diagram, Object diagrams, Aggregation, Generalization, Association and multiplicity, Activity diagram, State diagram, Sequence diagram, Collaboration diagram, Component diagram. **[5 Hours]**

Structural Modeling: Classes, Access specification, Advanced classes, Interface types, Introduction to Packages, Introduction to Instances and object, Need of SRS document, creation of Software Requirement Specification Documentation. **[6 Hours]**

Part-B

Behavioral Modeling: Interactions and examples, Introduction to Use cases and Use case diagrams. Conditional messaging & Branching in Interaction diagrams. **[5 Hours]**

Architectural Modeling: Nodes and connections in Component diagrams, Modeling a client/server system, Deployment diagrams components, Reverse Engineering, Difficulties and risks in use-case modeling.**[5 Hours]**

OO Methodologies: OO Methodologies (Structured Analysis, Structured Design (SA/SD), Reverse Engineering, Difficulties and risks in use-case modeling and UI design, System testing and maintenance**. [3 Hours]**

Case Studies: Case studies for Railway reservation, Library management system, Online mobile recharge, Familiarization of open source tools for UML Design such as Plant UML, Argo UML etc. **[3 Hours]**

Text Books

1. Frederick Eddy, James Rumbaugh, Michael Blaha, Willliam Premerlani, William Lorensen, "Object-

2. James Rumbaugh, Michael R. Blaha, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education.
3. Timothy C. Lethbridge, Robert Laganiere, "Object Oriented Software Engineering, Practical Software Development using UML and Java", 2nd Edition, Tata McGraw-Hill
4. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML 2 Toolkit", 3rd Edition, WILEY-Dreamtech India Pvt. Ltd.

Reference Books

1. Meilir Page-Jones, "Fundamentals of Object Oriented Design in UML", 2nd Edition, Pearson Education.
2. Pascal Roques, "Modeling Software Systems Using UML2", 3rd Edition, WILEY-Dreamtech India Pvt. Ltd.
3. Atul Kahate, "Object Oriented Analysis & Design", 2nd Edition, The McGraw-Hill Companies.
4. Mark Priestley, "Practical Object-Oriented Design with UML", 2nd Edition, TATA McGrawHill.

E-Books and online learning material

1. HandBook: https://www.cs.drexel.edu/~spiros/teaching/CS575/slides/uml.pdf
2. HandBook: http://www.cs.kent.edu/~jmaletic/cs63901/lectures/UML.pdf

Online Courses and Video lectures

1."Object Oriented Analysis and Design", https://nptel.ac.in/courses/106/105/106105153/ Accessed on August 20, 2021.
2."Object Oriented System Development using UML, Java and Patterns", https://nptel.ac.in/courses/106/105/106105224/# Accessed on August 20, 2021.

Subject Code: LPECS- 102

Subject Name: Object Oriented Design Using UML Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 P**:** 2
Semester: 7	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):**2 hrs
Total Marks: 50	**Course Status:** Elective

Prerequisites: Knowledge of software engineering fundamentals.

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Identify various models to plan correct software.
CO2	Illustrate suitable project organization structure by using suitable tool.
CO3	Apply the usage of various class modeling.
CO4	Outline the phases of software projects and practice the state modeling.
CO5	Extend the interacting modeling techniques for project.
CO6	Apply knowledge to create various diagrams.

List of Practicals

1. Study of OpenProj or similar software related to measure the UML.
2. Usage of OpenProj or similar software to draft the diagrams for object oriented analysis and design.
3. Getting familiar with the importance of UML compilers and its benefits.
4. Design and draft the Class Modeling for Railway reservation etc.
5. Design and draft the State Modeling for Library management system etc.
6. Design and draft the Interaction Modeling for Online mobile recharge etc.
7. Getting familiar and hands on practice with tools like Plant UML, Argo UML etc

Reference Material

Manuals available in Lab.

Subject Code: PECS-109

Subject Name: Software Defined Networks

Programme: B.Tech. (CSE)	**L:** 3 **T:** 1 **P:** 0
Semester: 7	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Data Communication and Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the concepts of software defined networks and compare it with traditional networks.
CO2	Analyse the functions and components of the SDN architecture.
CO3	Describe Network Functions Virtualization components and their roles in SDN.
CO4	Evaluate the pros and cons of applying SDN controllers in data centers.
CO5	Explain Open Flow Specifications of SDN using separation of data, control plane and application plane.
CO6	Make use of different technologies available in SDN data centre as per need.

Detailed Contents:

Part-A

Introduction: Historical Background of Software Defined Networking (SDN), The SDN Approach: Requirements, Characteristics of Software-Defined Networking, The Modern Data Center, Traditional Switch Architecture: Data Control and Management Planes, Centralized and Distributed Control and Data Planes. **[6 Hours]**

Software Defined Networking (SDN): The need of SDN, Fundamental Characteristics of SDN, SDN Operation, SDN Devices: Flow Tables, SDN software switches, hardware SDN devices, SDN Applications. **[6 Hours]**

Network Functions Virtualization: Background and motivation for NFV- Virtual Machines- NFV Concepts: Simple example of use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements-NFV Reference Architecture. **[5 Hours]**

SDN Controllers: SDN Controllers: Core modules, Its Interfaces, implementations, Alternative SDN Methods: SDN via APIs, SDN via Hypervisor Based Overlays. **[4 Hours]**

Part- B

The Open Flow Specification: Overview: Open Flow Switch, Open Flow Controller, Open Flow Protocol, the controller-switch Secure channel, Open Flow basics: Ports and Port Queues, Flow Table, Packet Matching, Actions and Packet Forwarding, Messaging Between Controller and Switch and its examples, Open Flow Limitations. **[6 Hours]**

SDN Data and Control plane: SDN data plane: Data plane Functions, Data plane protocols, SDN Control Plane: SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- OpenDaylight-REST- Cooperation and Coordination Among Controllers. SDN Application Plane: SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN **[7 Hours]**

SDN in the Data Center: Data Center Definition, Data center demands, Tunneling Technologies for Data center, Path technologies in the data center, Ethernet Fabrics in the data Center, SDN use Cases in Data Center: Overcoming Current Network Limitations, Adding, Moving, and Changing Resources, Failure Recovery, Traffic Engineering and Path Efficiency. **[6 Hours]**

Text Books

1. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach",

2. Thomas D.Nadeau and Ken Gray, "SDN-Software Defined Networks", Illustrated Edition, O'Reilly Publishers.

3. William Stallings, "Foundations of Modern Networking", Pearson.

Reference Books

1. Jim Doherty, "SDN and NFV Simplified", 1st Edition, Addison Wesley.

2. Siamak Azodoimolky, "Software Defined Networking with OpenFlow", Packet Publishing Limited.

3. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", 1st Edition, CRC Press.

E-Books and online learning material

1. Feamster, Nick, Jennifer Rexford, and Ellen Zegura, "The road to SDN: an intellectual history of programmable networks", ACM SIGCOMM Computer Communication Review 44.2 (2014): 87-98.

2. Kreutz, Diego, et al, "Software-defined networking: A comprehensive survey", Proceedings of the IEEE 103.1 (2015): 14-76

3. Nunes, Bruno AA, et al., "A survey of software-defined networking: Past, present, and future of programmable networks", Communications Surveys & Tutorials, IEEE 16.3 (2014): 1617-1634.

Online Courses and Video Lectures

1. "Software Defined Networking", https://www.coursera.org/learn/sdn
Accessed on September 10, 2021.

2. "Software Defined Networking - I (Basics)", https://www.youtube.com/watch?v=CaukSKg_sI0
Accessed on September 10, 2021.

3."Software Defined Networking - II (Open Flow)", https://www.youtube.com/watch?v=l3E-C1j-SJg Accessed on September 10, 2021.

Subject Code: PECS-110

Subject Name: Wireless Sensor Networks

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 7	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Computer Networks

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Outline the basics of wireless sensor networks and its emerging technologies.
CO2	Apply the design principles of WSN architectures and operating systems for simulating environment situations.
CO3	Identify the issues pertaining to sensor networks and the challenges involved in managing sensor networks.
CO4	Recognize appropriate infrastructure, topology, joint routing and information aggregation for wireless sensor networks.
CO5	Analyse the sensor network platform and tools for programming.
CO6	Design suitable routing algorithms based on the network and user requirement.

Detailed Contents:

Part-A

Introduction to wireless communication: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels: Path loss, fading, interference, Doppler effect, Transmission rate constraints. Modulation Techniques, Multiple Access Techniques, wireless LANs, PANs, WANs, and MANs. **[6 Hours]**

Wireless Sensor Networks: History of Wireless Sensor Networks, Introduction to Wireless sensor networks, Key definitions, Unique constraints and challenges, Differentiate between traditional networks and wireless sensor networks, advantages of ad-hoc/sensor network, Design issues and challenges in wireless sensor networks **[6 Hours]**

Basic Wireless Sensor Technology: Introduction, Sensor Node Technology, Architecture of a wireless sensor Network, Node architecture, Protocol stack, Communication in wireless sensor network: flooding, gossiping. data dissemination and Data Aggregation **[6 Hours]**

Part- B

MAC Protocols in WSN: Overview, design issues in MAC protocols, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, classification of MAC protocols, Contention-Free MAC Protocols, Contention-Based MAC Protocols with Reservation, Contention-Based MAC

Protocols with Scheduling Mechanisms and Hybrid MAC Protocols **[7 Hours]**

Routing Protocols: Overview, Routing metrics, Issues in designing a routing protocol, Flooding and Gossiping classification of routing protocols, Data-Centric Routing, Proactive Routing/ table-driven, On-Demand Routing, Hierarchical Routing, Location-Based Routing and QoS-Based Routing Protocols. **[7 Hours]**

Applications and Future Trends: Applications and case studies on Structural Health Monitoring, Habitat Monitoring, Health Monitoring, Traffic Control, Precision Agriculture, Tracking Chemical Plumes. Future Research Directions: Security and privacy in sensor networks, Embedded Systems Networks of High-Data-Rate Sensors Light weight Signal Processing **[4 Hours]**

Text Books

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks", 2nd Edition, Pearson Education.
2. Feng Zhao and LeonidesvGuibas, "Wireless sensor networks ", 1st Edition, Elsevier publication.

Reference Books

1. Jochen Schiller, "Mobile Communications", 2nd Edition, Pearson Education.
2. William Stallings, "Wireless Communications and Networks ", 2nd Edition, Pearson Education.

E-Books and online learning material

1. Wireless Sensor Networks by Kazem Sohraby, Daniel Minoli and TaiebZnati
http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02

2. An Introduction to Wireless Sensor Networks by Carlo Fischione
https://www.kth.se/social/files/5431a388f276540a05ad2514/ An_Introduction_WSNS_V1.8.pdf

Online Courses and Video Lectures

1. "Ad-hoc and Sensor Networks", https://nptel.ac.in/courses/106105160/
Accessed on July 24, 2021.
2. "Wireless Ad Hoc and Sensor Networks", https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs09/ Accessed on July 24, 2021

Subject Code: LPECS-105

Subject Name: Wireless Sensor Networks laboratory

Programme: B.Tech. (CSE**)**	**L:** 0 **T:** 0 **P:** 2
Semester: 7	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam(ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Computer Networks

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Design wireless network environment for any application using latest wireless protocols and standards.
CO2	Implement different type of applications with latest network topologies.
CO3	Examine the network security issues in Mobile and ad hoc networks.
CO4	Apply the knowledge to identify the suitable routing algorithm based on the network and user requirement.
CO5	Simulate and experiment with sensor network software and hardware.
CO6	Be familiar with WSN standards.

List of Practicals

1. Study of Wireless sensor network simulation tools and its comparison with merits and demerits.
2. Installation and configuration of any simulation tool MATLAB/NS2/ OPNET++ /etc.
3. Implementation of basic network topology using any simulation Tool and analysis.
4. Implementation of cluster and hierarchical topologies using any simulation Tool.
5. Implementation of LEACH protocol using any simulation Tool.
6. Implementation of DSR routing protocol using any simulation Tool.
7. Implementation of AODV routing protocol using any simulation Tool.
8. Study other wireless sensor network simulators (Mannasim,Contiki)
9. Analyze the performance comparison of implemented protocols (any two).

Reference Material

Manuals available in Lab.

Subject Code: PECS-115

Subject Name: Data Warehousing and Data Mining

Programme: B.Tech. (CSE)	L: 3 T: 1 P: 0
Semester: 7	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Fundamentals of database systems

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:
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CO#	Course Outcomes(CO)
CO1	Elaborate the basics of data warehousing and data mining.
CO2	Describe building blocks of data warehouse and design data marts
CO3	Apply OLAP operations to multi dimensional data.
CO4	Identify appropriate data mining classification algorithms to solve real world problems
CO5	Examine clustering algorithms and find patterns by applying association rule mining.
CO6	Use data mining tools for applications and case studies of data warehouse, web mining and data mining.

Detailed Contents:

Part-A

Introduction to Data Warehousing and Data Mining: Historical developments in data warehousing, Defining data warehousing, Data warehouse architecture, Benefits of data warehousing, Data Granularity, The Information Flow Mechanism, Metadata, Two Classes of Data, The Lifecycle of Data, Data Flow from Warehouse to Operational Systems, Data Warehouse v/s Data Mining, Data Mining Applications, Data Mining Process, Data Mining Techniques, Predictive modelling, Database segmentation, Link analysis, Deviation detection, Difference between Data Mining and Machine Learning. **[6 Hours]**

The Building Blocks of a Data Warehouse: Data Warehouse: The Need for an Operational Data Store (ODS), Operational Data Store, Data Marts: Comparative Study of Data Warehouse with OLTP and ODS, Data Warehouse Schema, Introduction to Data Warehouse Schema: Dimension, Measure, Fact Table, Multi-dimensional view of data, Star Schema, Snowflake Schema, Fact Constellation Schema (Galaxy Schema) , Comparison among Star, Snowflake and Fact Constellation Schema. **[8 Hours]**

Online Analytical Processing: Introduction to Online Analytical Processing, Defining OLAP, OLAP applications, Features of OLAP, OLAP Benefits, Strengths of OLAP, Comparison between OLTP and

OLAP, Differences between OLAP and data mining.**[5 Hours]**

Part-B

Data Mining Techniques: Introduction to Data Preprocessing, Data Preprocessing Methods, Introduction to Classification, Types of Classification, Input and Output Attributes, Working of Classification, Guidelines for Size and Quality of the Training Dataset, Decision Tree Classifier, Naïve Bayes Method. [**6 Hours]**

Cluster Analysis and Association Mining: Cluster Analysis, Applications of Cluster Analysis , Desired Features of Clustering , Distance Metrics: Euclidean distance, Manhattan distance, Chebyshev distance, Major Clustering Methods/Algorithms, Partitioning Clustering, Hierarchical Clustering Algorithms (HCA), Introduction to Association Rule Mining, Defining Association Rule Mining, Representations of Items for Association Mining, The Metrics to Evaluate the Strength of Association Rules, The Apriori Algorithm. **[7 Hours]**

Data mining tools, Applications and Case Studies: Introduction to WEKA, Application of Data Warehousing (Data Visualization) and Data Mining (Web Mining: Web Content Mining, Web Structure Mining, Web Usage mining)

Study 1: OLAP for the Fast Food Industry

Study 2: Intrusion Detection using kNN classification **[8 Hours]**

Text Books

1. Parteek Bhatia, Data Mining and Data Warehousing: Principles and Practical Techniques, 1st edition, Cambridge University Press.

2.Reema Thareja, “Data Warehousing”, Edition, Oxford University Press.

3. Jiawei Han and Micheline Kamber, “Data Mining Concepts & Techniques”, 3rd edition, Elsevier Pub.

4. Paulraj Ponniah, “Data Warehousing Fundamentals”, 2nd Edition, John Wiley & Sons, Inc.

Reference Books

1. Margret H. Dunham “Data Mining: Introductory and Advanced topics”, 4th Edition, Pearson Education

2. Vikram Pudi, P. Radha Krishana “Data Mining”, 2009 Edition, Oxford University press.

E-Books and online learning material:

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts & Techniques”, Elsevier Pub.
2. “Learn Data Warehousing in 1 Day: Complete ETL guide for beginners” by Krishna Rungta

Online Courses and Video Lectures:

1. “Data Warehousing Tutorial for Beginners”,

https://freevideolectures.com/course/3609/data-warehousing Accessed on August 6, 2021.

2. “Data Warehouse Examples”,

https://www.coursera.org/lecture/dwdesign/data-warehouse-examples-video-lecture-hU1gW

Accessed on August 6, 2021.

Subject Code: PECS-117

Subject Name: Cloud Computing

Programme: B.Tech (CSE)	**L:**3 **T:**0 **P:**0
Semester: 7	**Teaching Hours:** 36
Theory / Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Prerequisites: Fundamentals of database systems

Additional Material Allowed in ESE: NIL

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Discuss cloud computing fundamentals, computing paradigms and NIST model of cloud computing.
CO2	Make use of core technologies of cloud computing in building cloud platforms.
CO3	Classify cloud service models and their applications in business and industry perspectives.
CO4	Explain cloud deployment models and their implementation.
CO5	Assess issues and challenges in cloud security.
CO6	Compare and contrast open cloud platforms with commercial cloud platforms.

Detailed Contents:

Part-A

Cloud Computing Fundamentals: Evolution of cloud computing, Overview of computing paradigms: Distributed computing, Parallel computing, Cluster computing, Grid computing, Utility computing, Edge Computing, Fog Computing, and Cloud computing. The NIST model of cloud computing, Benefits and challenges of cloud computing, Big Data, Internet of things (IoT). Introduction to Mobile cloud computing. **[8 Hours]**

Cloud Concepts and Technologies: Virtualization: Definition, Characteristics and benefits of virtualization, Virtualization and cloud computing, Types of virtualization, and Load balancing, Classic datacenter, Virtualized datacenter. Hypervisors, Types of hypervisors, Multitenancy, Scalability and elasticity, Service level agreement (SLA). **[8 Hours]**

Part-B

Cloud Architecture and Services: Cloud computing reference model architecture, Common Cloud Management Platform (CCMP), Cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). Cloud-based services and applications: Cloud computing for healthcare, Energy systems, Transportation systems, Manufacturing industry, Government, and Education. Cloud deployment models: Public, Private, Community, and Hybrid

cloud. **[8 Hours]**

Security in Clouds: Cloud security issues and challenges, Cloud security reference model, Encryption techniques: Symmetric key encryption and Asymmetric key encryption. Identity and key management, Digital signature, Secure Socket Layer (SSL). **[6 Hours]**

Cloud Computing Platforms: Study and comparison of various open source and commercial cloud platforms. **[6 Hours]**

Text Books

1. Raj Kumar Buyya, James Broberg, Andrezei Goscinski, "Cloud Computing: Principles and Paradigms", 1st Edition, John Wiley and Sons Inc.
2. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley India Pvt. Ltd.
3. John Rittinghouse, James F.Ransome, "Cloud Computing: Implementation, Management, and Security", International Edition, CRC Press Taylor and Francis Group.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper," Cloud Computing for Dummies", International Edition, John Wiley and Sons Inc.

Reference Books

1 R.L. Krutz and R.D. Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India.
2 Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing Concepts, Technology, & Architecture" 1st Edition, Prentice Hall
3 Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 1st Edition, Tata McGrawHill.
4 Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, "Mastering Cloud Computing", Tata McGrawHill.

E –Books and online learning Material

1. Introduction to Cloud Computing by Dan C. Marinec, https://www.cs.ucf.edu/~dcm/Tutorials/RCIS-Tutorial.pdf
2. Security Guidance for Critical Areas of Focus in Cloud Computing by Cloud Security Alliance, https://cloudsecurityalliance.org/artifacts/security-guidance-v4/

Online Courses and Video Lectures

1 https://youtu.be/NzZXz3fJf6o "Cloud Computing", Accessed on September 11, 2021.

2 "Cloud Computing Architecture", https://youtu.be/fZ3D6HQrWzs Accessed on September 11, 2021.

3 "Cloud Computing Architecture-Deployment Models", https://youtu.be/4xrYN2Ecmas Accessed on September 11, 2021.

Subject Code: LPECS-108

Subject Name: Cloud Computing Laboratory

Programme: B.Tech (CSE)	**L:**0 **T:**0 **P:**2
Semester: 7	**Teaching Hours:** 24
Theory / Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Fundamentals of database systems

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Make use of CloudSim Toolkit to simulate different scenarios of Cloud Computing Paradigm.
CO2	Simulate the role of Network Topology on Data centre using CloudSim.
CO3	Apply Cloud Analyst tool to visualize Data Centres and User Bases.
CO4	Implement broker policy and load balancing techniques using simulation tool.
CO5	Examine architecture constructs of different Cloud platforms.
CO6	Assess the services offered by Cloud Platforms.

List of Practicals

I. Use CloudSim Toolkit and do the following:

1. To create a datacenter with one host and run one cloudlet on it.
2. To create two datacenters with one host each and two cloudlets on them.
3. To create two datacenters with one host each and run cloudlets of two users on them.
4. To create a datacenter with one host and a network topology and run one cloudlet on it.
5. To create two datacenters with one host each and run cloudlets of two users with network topology on them.

II. Use CloudAnalyst Simulation tool and do the following:

1. Set up a simulation with one datacenter and one userbase.
2. Set up a simulation with multiple datacenters and multiple userbases in various regions of the world.
3. Use closest data center service broker policy and throttled load balancing algorithm to set up a simulation.
4. Configure the simulation tool to analyse the performance of social networking App.

III. Examine the architecture and services offered by any one of the following cloud platforms.

1. Amazon Cloud platform
2. Google Cloud Platform

3. Microsoft Azure Cloud platform.

Reference Material

Manuals available in Lab.

Subject Code: - PECS-121

Subject Name: Computer Vision

Programme: B.Tech.	**L:** 3 **T:** 1 **P:** 0
Semester: 7	**Teaching Hours:** 40
Theory/Practical: Theory	**Credits:** 4
Internal Marks:40	**Percentage of Numerical Content:** 20%
External Marks:60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Course Status:** Elective

Prerequisites: Digital Image Processing

Additional Material Allowed in ESE:- NIL

On completion of the course the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain basic terminologies and models for digital image formation.
CO2	Apply edge detection, blobs detection and corner detection techniques to represent visual features.
CO3	Make use of feature descriptors and matching techniques to identify objects.
CO4	Analyse the characteristics by segmenting the image into different regions.
CO5	Determine objects by identifying regularities in pattern analysis.
CO6	Design a computer vision system for a real-world problem.

Detailed Contents:

Part-A

Digital Image Formation and Low-Level Processing: Introduction to Computer Vision, Image Formation: Photometric Image Formation, Reflectance Capture and Representation, Image Sensing Pipelining, Sampling and Aliasing, Image Compression; Image Processing: Operations, Linear Filtering, Correlation, Convolution,

Image in Frequency Domain, Image Sampling. **[9 Hours]**

Visual Features and Representations: Edge Detection, Image Gradients, Canny Edge Detection, More Recent Methods in Edge Detection, Blobs Detection, Corner Detection, Harris Corner Detector; Scale Space and Scale Selection; SIFT, SURF; HoG, LBP, etc. **[9 Hours]**

Part-B

Feature Detection and Matching: Human Visual System, Feature Matching. Hough transform; From points Matching. **[8 Hours]**

Segmentation and Pattern Analysis: Region Splitting and Merging, Edge Based approaches to segmentation, Graph-Cut,K-Means and mixtures of Gaussians, Mean-Shift, MRFs, Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-

supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA [**8 Hours]**

Applications of Computer Vision: Motion Estimation and Object Tracking, Gesture Recognition, Face and Facial Expression Recognition, Image Fusion. **[6 Hours]**

Text Books

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 1st Edition, Springer.
2. Gonzaleze and Woods, "Digital Image Processing", 4th Edition, Pearson.
3. Richard Hartley, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press.

Reference Books:

1. KeinosukeFukunaga, "Introduction to Statistical Pattern Recognition", Academic Press Professional, Inc. San Diego, CA, USA.
2. Anil K. Jain, "Fundamental of Digital Image Processing", Prentice-Hall of India Pvt. Ltd

E-Books and online learning material

1. Computer Vision – Algorithms and Applications http://szeliski.org/Book/
2. Computer Vision Metrics https://link.springer.com/book/10.1007%2F978-1-4302-5930-5

Online Courses and Video Lectures

1. "Computer Vision", https://nptel.ac.in/courses/106/105/106105216/

Accessed on September 15, 2021

2. "Computer Vision", https://swayam.gov.in/nd1_noc19_cs58/preview

Accessed on September 15, 2021

Subject Code: PECS-122
Subject Name: Soft Computing

Programme: B.Tech.	**L**: 3 **T**: 0 **P**: 0
Semester: 7	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits**: 3
Internal marks: 40	**Percentage of numerical/design/programming problems**: 20%
External marks: 60	**Duration of end semester exam (ESE):** 3 hrs
Total marks: 100	**Course status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Illustrate soft computing techniques and their role in problem solving.
CO2	Apply different ANN training models to solve classification problems.
CO3	Make use of fuzzy set theory to interpret fuzzy inference systems.
CO4	Explain the concept of genetic algorithms to develop various genetic applications.
CO5	Select appropriate nature inspired algorithm to solve optimization problems.
CO6	Identify and select a suitable soft computing technology to solve real-world problem.

Detailed Contents:

Part-A

Introduction: Introduction to soft computing, Definition and importance, Evolution of soft computing, Difference between Hard and Soft computing, Requirement of Soft computing, Usefulness and applications. **[6 Hours]**

Neural Networks: Introduction to Neural Networks, Model of an artificial neuron, Comparison of artificial neural network and Biological neural network, Activation Functions, Recurrent Neural Networks, Neural network models– Perceptron, Adaline and medaline networks, Single layer, Back propagation, Multi-layer networks. **[11 Hours]**

Part- B

Fuzzy Logic: Crisp and fuzzy sets, Fuzzy sets – Membership functions, Basic operations, Properties and fuzzy relations, Predicate logic, Fuzzy Decision Making, Fuzzy rule based system, Fuzzy inference system, Applications of fuzzy logic. **[7 Hours]**

Genetic Algorithms: Working principle– Crossover, Mutation, Encoding, Fitness function and Reproduction, Classification of genetic algorithm, Multi-objective genetic algorithm, Application of GA in search and optimization. **[7 Hours]**

Nature Inspired Algorithms: Cukcoo Search Algorithm, Fire Fly Algorithm, Fruit Fly Algorithm, Bat Algorithm, Particle Swarm Optimization, Bee Colony Optimization, Ant Colony Optimization.

[5 Hours]

Text Books

1. V. Kecman, 'Learning and Soft Computing", MIT Press.
2. S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy logic and Genetic Algorithms", Eastern Economy Edition, Prentice Hall of India.
3. D.E. Goldberg, "Genetic Algorithms in Search and Optimization, and Machine Learning", 13th Edition, Addison-Wesley.
4. Ross T.J., "Fuzzy Logic with Engineering Applications", 4th Edition, McGraw Hill.

Reference Books

1. S. N. Sivanandam and S. N.Deepa, "Principles of soft computing", 1st Edition, Wiley India.
2. Simon Haykin, "Neural Network- A Comprehensive Foundation", 2nd Edition, Prentice Hall International, Inc.
3. Bart Kosko, "Neural Network and Fuzzy Systems", 4th Edition, Prentice Hall, Inc

E-Books and online learning material:

1. https://www.youtube.com/watch?v=Z_8MpZeMdD4
2. https://bookboon.com/en/introduction-to-soft-computing-ebook
3. https://www.academia.edu/32241003/TB04_soft_computing_ebook

Online Courses and Video Lectures:

1. "Introduction to Soft Computing", https://nptel.ac.in/courses/106/105/106105173/ Accessed on September 17, 2021.
2. "Introduction to Soft Computing", https://onlinecourses.nptel.ac.in/noc20_cs17/preview Accessed on September 17, 2021.
4. "Neural Networks and Applications", https://nptel.ac.in/courses/117/105/117105084/ Accessed on September 17, 2021.

Subject Code: LPECS-111

Subject Name: Soft Computing Laboratory

Programme: B.Tech. (CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 7	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Construct an inference system by making use of Fuzzy set theory.
CO2	Develop an application using concepts of genetic algorithm.
CO3	Implement neural network concepts using perceptron, hebb's rule, delta rule etc.
CO4	Analyse back propagation algorithms by changing weights.
CO5	Create a neural network to solve real world classification problems.
CO6	Develop projects using soft computing tools and techniques while working in multidisciplinary teams.

List of Practicals

1. Study and Analysis of Fuzzy vs Crisp Logic.
2. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
3. Study and Analysis of Genetic Algorithm Life Cycle.
4. Write a Program for Implementing TSP using GA.
5. Write a Program of Perceptron Training Algorithm.
6. Write a Program to Implement Hebb’s Rule.
7. Write a Program to Implement Delta Rule.
8. Write a Program for Back Propagation Algorithm.
9. Write a Program For Error Back Propagation Algorithm (EBPA) Learning.
10. Study and Analysis of Counter Propagation Network (CPN).

Project: Students are required to develop a solution for practically complex real life problems; like for a production system or a medical diagnosis expert system or just creating a simple ADALINE network with appropriate no. of input and output nodes and further train it using delta/Hebb learning rule until

no change in weights is required and calculating its final weights, and implementation of neural/fuzzy network.

Reference Material

Manuals available in Lab.

SubjectCode:PECS-132

Subject Name: Design and Analysis of Advanced Algorithms

Programme: B.Tech.(CSE)	**L: 3 T: 1 P: 0**
Semester:7	**Teaching Hours**: 40
Theory/Practical: Theory	**Credits:**4
Internal Marks:40	**Percentage of Numerical/Design/Programming Problems:**40%
External Marks:60	**Duration of End Semester Exam(ESE)**:3hrs
Total Marks:100	**Course Status**: Elective

Prerequisites: Design and Analysis of Algorithms fundamentals

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Explain the principles of dynamic programming for solving optimization problems efficiently.
CO2	Apply Greedy algorithms design techniques for problem solving.
CO3	Analyze the complexity of advanced algorithms using Amortized techniques.
CO4	Apply randomized algorithms in problem solving with probabilistic and approximation guarantees.
CO5	Implement network flow algorithms in engineering problems to reduce complexity.
CO6	Elaborate multithreaded algorithmic principles in the modeling of computer based systems.

Detailed Contents:

PART-A

Dynamic Programming: Introduction, Elements of dynamic programming: Optimal substructure, Overlapping subproblems, reconstructing an optimal solution, Memoization, Rod cutting: Recursive top-down implementation, using dynamic programming for optimal rod cutting. Subproblem graphs. Matrix-chain multiplication, Longest common subsequence, Optimal binary search trees. **[8Hours]**

Greedy Algorithms: Introduction, Elements of the greedy strategy, An activity-selection problem: The optimal substructure of the activity-selection problem, A recursive greedy algorithm, An iterative greedy algorithm. Greedy versus dynamic programming, Matroids and greedy methods, A task-scheduling problem as a matroid. [**6Hours]**

Amortized Analysis: Introduction, Aggregate analysis, The accounting method, The potential method, Dynamic tables: Table expansion, Table expansion and contraction. **[5 Hours]**

PART-B

Probabilistic Analysis and Randomized Algorithms : The hiring problem, Indicator random variables, randomized algorithms, Probabilistic analysis and further uses of indicator random variables. **[7 Hours]**

Flow networks: Introduction to flow networks, The Ford-Fulkerson method, Maximumbipartite matching, Push-relabel algorithms, The relabel-to-front algorithm.

[7Hours]

Multithreaded Algorithms: Introduction, Dynamic multithreaded programming, The basics of dynamic multithreading: A model for multithreaded execution, Multithreaded matrix multiplication, Multithreaded merge sort.

[7Hours]

Text Books

1. Ellis Horowitz, SartajSahni and S. Rajasekharan, "Fundamentals of Computer Algorithms, Universities Press.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms, 4th Edition", PHI.

Reference Books

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 4 th Edition, Pearson, 2004.
2. Michael T Goodrich, Roberto Tamassia, Algorithm Design and Applications, John Wiley,2002.
3. Michael T Goodrich, Roberto Tamassia, Algorithm Design,Data Structures and Algorithms in C++,Second Edition John Wiley & Sons, Inc., 2011.
4. Ellis Horowitz, Dinesh Mehta,SartajSahni,Fundamentals of Data Structures in C++, University Press.

E-Books and Online learning material

1. Ellis Horowitz, Sartaj Sahni and S. Rajasekharan, "Fundamentals of Computer Algorithms, 2nd Edition", Universities Press.
2. https://jainakshay781.files.wordpress.com/2017/12/horowitz-and-sahani-fundamentals-of-computer-algorithms-2nd-edition.pdf
3. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms, 3rd Edition", PHI.

4. https://dl.ebooksworld.ir/books/Introduction.to.Algorithms.4th.Leiserson.Stein.Rivest.Cormen.MIT.Press.9780262046305.EBooksWorld.ir.pdf

Online Courses and Video lectures

1. https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/resources/lecture-5-amortization-amortized-analysis/
2. https://www.youtube.com/watch?v=PvWIT-LjcPs
3. https://www.youtube.com/watch?v=J0wzih3_5Wo
4. https://www.youtube.com/watch?v=3LG-My_MoWc
5. https://www.youtube.com/watch?v=6JxvKfSV9Ns

Subject Code: PECS-128
Subject Name: Web Technologies

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 7	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems: 50%**
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hrs
Total Marks: 100	**Course Status:** Elective

Prerequisite: Knowledge of basic programming skills.

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Provide an insight on the basics of internet technology.
CO2	Design web applications using HTML and CSS.
CO3	Build dynamic web pages using javascript for real world problems.
CO4	Design responsive web applications using Twitter Bootstrap, AngularJS and NodeJS.
CO5	Create dynamic and server-side web applications, using PHP and MYSQL.
CO6	Optimize websites for better search engine rankings and organic traffic growth

Detailed Contents:

Part-A

Introduction: History and evolution of Internet protocols, Internet addressing, Internet Service Provider (ISP), Introduction to WWW, DNS, URLS, HTTP, HTTPS, SSL, Web browsers, Cookies, Web servers, Proxy servers, Web applications. **[6 hours]**

HTML: Introduction to HTML and DHTML, History of HTML, Structure of HTML Document: Text Basics, Structure of HTML Document: Images, Multimedia, Links, Audio, Video, Table and Forms, Document Layout, HTML vs. DHTML, Meta tags, and Website structure. Overview and features of HTML5. **[7 hours]**

Style Sheets: Need for CSS, Introduction to CSS, Basic syntax and structure, Types of CSS – Inline, Internal and External CSS style sheets. CSS Properties - Background images, Colors and properties, Text Formatting, Margin, Padding, Positioning, CSS3- Animation, Page structure, Responsive Design, Framework - Twitter Bootstrap **[5 hours]**

Part-B

JavaScript: Introduction, JavaScript's history and versions, Basic syntax, Variables, Data types,

Statements, Operators, Functions, Arrays, Objects, Dialog boxes, JavaScript DOM, JavaScript Validations, Overview of AngularJS and NodeJS. **[6 Hours]**

PHP and MySQL: Introduction and basic syntax -of PHP, Data types, Variables, Decision and looping with examples, String, Functions, Array, Form processing, Cookies and Sessions Management, E-mail, PHP-MySQL: Connection to server, Creating database, Selecting a database, Listing database, Listing table names, Creating a table, inserting data, altering tables, queries, Deleting database, Deleting data and tables, and Overview of Model View Controller platform **[8 Hours]**

Search Engine Optimization: Deploying a website on server, Search engine optimization and its different types, Web application testing and security, Web APIs **[4 Hours]**

Text Books

1. DT Editorial Services, "Web Technologies, Black Book, 2018", 1st Edition, Dreamtech Press.
2. Rajkamal, "Internet and Web Technology", 1st Edition, Tata McGraw Hill.
3. Ray Rischpater, "JavaScript JSON Cookbook", 1st Edition, Packt Publishing,
4. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, "Mastering Html, Css & Javascript", 1st Edition BPB Publications,

Reference Books

1. Ivan Bayross, "Web Enabled Commercial Application Development using HTML, DHTML JavaScript, Perl, CGI", 4th Edition, BPB Publications.
2. Peter Moulding, "PHP Black Book", 1st Edition , Coriolis,

E-Books and Online learning material

1. Twitter Bootstrap https://www.syncfusion.com/succinctly-free-ebooks/twitterbootstrap4-succinctly/the-grids-the-grids-the-beautiful-grids
2. PHP Programming https://en.wikibooks.org/wiki/PHP_Programming
3. HTML and CSS https://wtf.tw/ref/duckett.pdf
4. Search Engine Optimization https://static.googleusercontent.com/media/www.google.com/sk//webmasters/docs/search-engine-optimization-starter-guide.pdf

Online Courses and Video Lectures

1. "Web Design for Beginners", https://www.udemy.com/share/1013yI/ Accessed on August 30, 2021
2. "Building web applications in PHP", https://www.coursera.org/learn/web-applications-php Accessed on August 30, 2021

Subject Code: - LPECS-114

Subject Name: Web Technologies Laboratory

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 7th	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 30	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 20	**Duration of End Semester Exam (ESE):** 2 hrs
Total Marks: 50	**Elective Status:** Elective

Prerequisites: Knowledge of basic programming skills

On completion of the course, the student will have the ability to:

CO#	COURSE OUTCOMES (CO)
CO1	Create well-structured, accessible, and responsive web content using HTML, which is foundational to web development and design.
CO2	Create Scripts to manipulate the Document Object Model (DOM), enabling them to create dynamic and interactive web pages and enhance user experiences on websites
CO3	Design responsive and visually appealing web applications using Twitter Bootstrap, create dynamic and interactive front-end interfaces with AngularJS, and build server-side applications and APIs with Node.js, providing them with a comprehensive understanding of modern web development technologies and frameworks
CO4	Build dynamic and interactive web applications, including form processing, user authentication, and session management using PHP
CO5	Create interactive websites that store, retrieve, and manipulate data from relational databases
CO6	Integrate PHP, MySQL, and JavaScript to develop complete full-stack web applications, bridging the gap between front-end and back-end development.

List of Practicals

1. Check and List down Government guidelines for creating a website.

2. Configuration and administration Apache Web Server.

3. Develop an HTML page to demonstrate the use of basic HTML tags, Link to different HTML page and also link within a page, insertion of images and creation of tables.

4. Develop a registration form by using various form elements like input box, text area, radio buttons, check boxes etc.

5. Design an HTML page by using the concept of internal, inline, external style sheets.

6. Create an HTML file to implement the styles related to text, fonts, links using cascading style sheets.

7. Create an HTML file to implement the concept of document object model using JavaScript

8. Create an HTML page including JavaScript that takes a given set of integer numbers and shows them after sorting in descending order.

9. Write an HTML page including any required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show "out of range" and if it is not a number, it should show "not a number" message in the result box.

10. Create a PHP file to print any text using variable.

11. Demonstrate the use of Loops and arrays in PHP

12. Create a PHP file using GET and POST methods.

13. A simple calculator web application that takes two numbers and an operator (+, -, /, * and %) from an HTML page and returns the result page with the operation performed on the operands.

14. Implement login page contains the user name and the password of the user to authenticate with Session using PHP and MySQL, also implement this with the help of PHP-Ajax.

15. A web application for implementation:

    a. The user is first served a login page which takes user's name and password. After submitting the details the server checks these values against the data from a database and takes the following decisions.

    b. If name and password matches, serves a welcome page with user's full name.

    c. If name matches and password doesn't match, then serves "password mismatch" page

    d. If name is not found in the database, serves a registration page, where user's full name is asked and on submitting the full name, it stores, the login name, password and full name in the database (hint: use session for storing the submitted login name and password)

16. Minor project using different technologies studied.

Reference Material

Manuals available in Lab.

Subject Code: OECS-101

Subject Name: Software Project Management

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 30%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hr
Total Marks: 100	**Elective Status:** Open Elective

Prerequisites:
Additional Material Allowed in ESE: NIL
On completion of the course, the student will have the ability to:

CO#	Course Outcomes(CO)
CO1	Apply project management activities involved in software projects.
CO2	Estimate project cost, plan project and evaluate software project.
CO3	Analyse risks during project scheduling activities.
CO4	Design key strategies to monitor, control and quality assurance of software projects.
CO5	Develop effective organisational, leadership and change skills for managing projects, teams and stakeholders.
CO6	Utilize software project management tools to model real-world problems.

Detailed Contents:

Part-A

Introduction to Project Management: The characteristics of software projects, Objectives of project management: time, cost and quality, Basics of Project Management, Stakeholders, Stages of Project, The Feasibility Study, Cost-benefit Analysis, Planning, Project Execution, Project and Product Life Cycles, Project Management Knowledge areas, Project Management Tools &Techniques, Project success factors, role of project manager **[5 Hours]**

Project Evaluation and Planning: Activities in Software project management, Project evaluation – Cost benefit analysis, Cash flow forecasting, Cost benefit evaluation techniques, Risk evaluation. Project planning – Stepwise project planning, Software processes and process models. Project costing, COCOMO II, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb. **[6 Hours]**

Project Scheduling and Risk Management: Project sequencing and scheduling activities, Scheduling resources, Critical path analysis, Network planning, Risk management – Nature and types of risks, Risk planning and control, Risk assessment, Hazard identification, Hazard analysis, PERT and Monte Carlo simulation techniques. **[6 Hours]**

Part-B

Monitoring and Control: Collecting data, Review techniques, Project termination review, Visualizing progress, Cost monitoring, Earned value analysis, Change control, Software Configuration Management (SCM), Managing contracts and acceptance. **[7 Hours]**

People Management: Introduction, Understanding behaviour, Organizational behaviour, Recruitment process, Motivation, The Oldman – Hackman Job Characteristics model, Stress, Health and safety. Working in teams, Decision making, Leadership, Organization and team structures. **[6 Hours]**

Software Quality Management: ISO Standards, Process capability models, Testing and software reliability, Quality plans, Test automation, Overview of project management tools. **[6 Hours]**

Text Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Royce, "Software Project Management", Pearson Education.
3. Robert K. Wysocki, "Effective Software Project Management", Wiley.

Reference Books

1. Ian Sommerville, "Software Engineering", Pearson Education.
2. R.S. Pressman, "Software Engineering: A Practitioner's Approach", Tata McGraw Hill.
3. Kassem, "Software Engineering", Cengage Learning

1. Dwayne Phillips, "The Software Project Manager's Handbook: Principles That Work at Work", Wiley-IEEE Press, URL: https://ieeexplore.ieee.org/servlet/opac?bknumber=5989544

2. Mark Christensen; Richard H. Thayer, "The Project Manager's Guide to Software Engineering's Best Practices, Wiley-IEEE Press", URL: https://ieeexplore.ieee.org/servlet/opac?bknumber=5989224

3. Walker Royce, "Software Project Management: A Unified Framework", Addison-Wesley Professional", URL: https://dl.acm.org/doi/book/10.5555/1942096

Online Courses and Video Lectures

1. https://www.coursera.org/specializations/product-management
2. https://www.edx.org/learn/project-management

Subject Code: OECS-102

Subject Name: Object Oriented Programming using Java

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 40%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Course Status:** Open Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Apply object oriented programming techniques to propose solution pertaining to real world problem.
2.	Identify and analyze the various aspects of a specific problem and apply the concepts of classes and objects to develop object oriented model.
3.	Utilize the concept of inheritance and interfaces to formulate a solution for complex analytical problem.
4.	Demonstrate an understanding of multithreaded programming.
5.	Design console based, GUI based and web based applications by implementing various concepts like applets.
6.	Examine the errors in the developed system and resolve them by applying the knowledge of exception handling.

Detailed Contents:

Part-A

Introduction to Object Oriented Programming: Difference between procedural and object oriented programming, Object oriented programming concepts – Class, Object, Data abstraction, Encapsulation, Data hiding, Inheritance and polymorphism. **[4 Hours]**

Basics of Java: Importance of Java to Internet, Bytecode, Java Virtual Machine, Difference between Java and C++, Data types, Declaration of variable, Scope and lifetime of variable, Operators – Arithmetic, Bit-wise, Relational, Boolean. Operator precedence, one dimensional and multidimensional arrays, Type conversion and casting, Control statements. **[6 Hours]**

Classes, Methods and Objects: Introduction to classes, Declaring objects, Methods, Constructors, this keyword, Overloading constructors, Garbage collection, Passing parameters to methods, Recursion, Nested and inner classes, Exploring string class. **[7 Hours]**

Part-B

Inheritance and Packages: Types of inheritance, Access modifiers – Private, Public, Protected; Overriding, Super and this keyword, Final variable, Final classes and methods, Static variable, Static method, Abstract methods and classes, Packages and interfaces, importing packages, implementing interfaces, some uses of interfaces, overloading. **[7 Hours]**

Exception Handling: Exception handling mechanism, Exception types, Uncaught exceptions, try and catch, throw and throws, finally, Built in exceptions, Creating own exception subclasses. [**4 Hours**]

Multithreading: Multithreaded programming, Thread priorities, Synchronization, Inter-thread communication, Thread class methods, Runnable interface, Suspending, Resuming and Stopping threads. [**4 Hours**]

Applets: What are Applets, The Applet Class, The Applet and HTML, Life Cycle of an Applet, The Graphics Class, Painting the Applet, User Interfaces for Applet, Adding Components to user interface, AWT (Abstract Windowing Toolkit) controls. **[4 Hours]**

Text Books:

1. Balagurusamy, "Programming in JAVA", BPB Publications.
2. T. Budd, "An Introduction to OOP", Pearson Education.
3. Patrick Naughton, Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Edition

Reference Books:

1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
3. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
4. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
5. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH. 6 Java Programming, D. S. Malik, Cengage Learning.

E-Books and online learning material:

1. E. Balagurusamy, "Object Oriented Programming with JAVA", Tata McGraw Hill. "https://wdn2.ipublishcentral.com//tata_mcgraw_hill/viewinsidehtml/501275211640634"
2. Simon Kendal, "Object Oriented Programming with JAVA", Simon Kendal & Ventus publishing ApS.
3. By Stephen Wong , Dung Nguyen, "Principles of Object Oriented Programming", "http://www.opentextbooks.org.hk/system/files/export/8/8163/pdf/Principles_of_ObjectOriented_Programming_8163_r.pdf"
4. R. Morelli and R. Walde, "Java, Object-Oriented Problem Solving, Third Edition", "http://www.cs.trincoll.edu/~ram/jjj/jjj-os-20170625.pdf"

Online Courses and video lectures:

1. Programming in Java, Prof. Debasis Samanta, IIT Kharagpur, Link: https://nptel.ac.in/courses/106/105/106105191/

2. Programming in C++, Prof. Partha Pratim Das, IIT Kharagpur, Link: https://nptel.ac.in/courses/106/105/106105151/

3. Java, Spoken Tutorial, IIT Bombay Link: https://spoken-tutorial.org/tutorial-search/?search_foss=Java&search_language=English

Subject Code: OECS-103

Subject Name: Cyber Laws and Ethics

Programme: B.Tech. (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1.	Apply the knowledge of cyber security systems to solve the complex problems of cyber crime.
2.	Make use of Intellectual Property Rights and commit to professional ethics and responsibilities and norms of the engineering practice.
3.	Recognize the need for patents and to engage in life-long learning in the broadest context of cyber security.
4.	Identify Professional and ethical issues and responsibilities.
5.	Examine the legal and policy developments in various countries for cyber space and synthesis of the information to provide valid conclusions.
6.	Analyze national and international cyber issues reaching substantiated conclusions using first principles of cyber security.

Detailed Contents:

Part-A

Cyber World and Security: Introduction to Cyberspace and Cyber law, Different components of cyber laws, Cyber law and Netizens, Attacks and Malware – The Zero-Day Attack and Mutation in delivery, Crimeware Toolkits and Trojans, Sophisticated Malware. Defensive measures for Cybersecurity – The Firewall, The Intrusion Detection System (IDS) and The Intrusion Prevention System (IPS), Virtual Private Networks (VPN), integrated defence for an enterprise network. **[6 Hours]**

Intellectual Property Rights: IPR regime in the digital society, International treaties and conventions, Business software patents, Domain name disputes and resolution, Intellectual property issues in cyberspace – Domain names and related issues, Copyright in the digital media. **[6 Hours]**

Ethics and Patents: Objectives, Rights, Assignments, Defences in case of infringement, Copyright – Objectives, Rights, Transfer of copyright. Work of employment infringement, Defences for infringement. Trademarks – Objectives, Rights, Protection of Goodwill, Infringement, Passing off and Patents in the cyber world. **[6 Hours]**

Part-B

Professional and Ethical Issues and Responsibility: Relationships with Professional Societies, codes of professional conduct, Engineering as Social Experimentation, Engineers as responsible experimenters, Ethics and history of ethics, whistle-blowing, workplace issues (harassment, discrimination), identify theft, ethical hacking. **[7 Hours]**

IT ACT 2000: Aim and objectives, Overview of the Act, Information Technology Act-2000-1 Information Technology Act-2000-2, Information Technology Act-2000-3, Information Technology Act-2000-4, Information Technology Act-2000-5, Information Technology Act2000-6, IT Act 2020 Amendments, Jurisdiction, Role of certifying authority, Regulators under IT Act, Cyber crimes – offences and contraventions and Grey areas of IT Act. **[8 Hours]**

Case Study: Case studies of infringement of cyber laws and IPR in Government sector, Corporate sector, Financial sector. **[3 Hours**

Text Books:

1. Nandan Kamath, "Guide to information technology act, rules and regulations", Universal Law Pub.
2. Chwan-Hwa (John) Wu, J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press.
3. Vikas Vashishth, "Bharat's law & practice of intellectual property in India", Bharat Law House.

Reference Books:

1. William Rudolph Cornish, David Llewellyn, Tanya Aplin, "Intellectual property: patents, copyrights, trademarks and allied rights" Thomson Reuters, Sweet and Maxwell.
2. Deepti Chopra, Kieth Merrill, "Cyber cops, cyber criminals and the Internet", I.K. International.
3. Robert McGinn, "The Ethically Responsible Engineer: Concepts and Cases for Students and Professionals" John Wiley and Sons.

E-Books and online learning material:

1. Zeinab KarakeShalhoub, "Cyber law and cyber security in developing and emerging economies", Edward Elgar, USA. https://www.pdfdrive.com/download.pdf?id=185019171&h=f9b11e92d249b458f29a3e25bd0da620&u=cache&ext=pdf.

Online Courses and Video Lectures:

1. https://www.youtube.com/watch?v=xeDZalBaLkQ.
2. https://www.youtube.com/watch?v=yNRIfo3q4Zo.
3. https://www.youtube.com/watch?v=74XncBZEnN4.
4. https://www.youtube.com/watch?v=s-SFB-EW_4A.
5. https://www.youtube.com/watch?v=1vQhSm5_UqY.

Subject Code: OECS-104

Subject Name: Data Structures

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 6	**Teaching Hours:** 37
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 50%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
Total Marks: 100	**Elective Status:** Open Elective

Prerequisites: Knowledge of Programming for Problem Solving and OOPS

Additional Material Allowed in ESE: [Scientific Calculator]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes
1	Apply knowledge of statistics and programming skills to solve complex engineering problems related to data structures.
2	Make use of Research based knowledge to identify the appropriate data structure and provide better solution to reduce space and time complexity.
3	Identify, Formulate and analyse data structure to develop skills and understand their applications to perform operations on it.
4	Design appropriate algorithm for autonomous realization of sub-programs to model complex engineering activities.
5	Demonstrate various methods of organizing large amounts of data and recognize systematic way to retrieve data and solve problems.
6	Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.

Detailed Contents:

Part-A

Basic concepts: Concept of data type, Linear and non-linear data structures, Data structures versus data types, Operations on data structures, Algorithm complexity and Asymptotic notations. **[2 Hours]**

Arrays: Linear and multi-dimensional arrays and their representation, Operations on arrays, Sparse matrices and their storage. **[2 Hours**]

Stacks: Sequential representation of stacks, Operations on stacks, Application of stacks – parenthesis checker, Conversion from infix to postfix, Evaluation of postfix expressions, implementing recursive functions. **[5 Hours]**

Queues: Sequential representation of queue, Types of queue- Linear Queue, Circular Queue, Deque, Priority Queue, Operations on each types of Queues, Applications of Queues. **[4 Hours]**

Linked List: Definition and representation of Linked list, Types of Linked list- Linear linked list, Doubly linked list, Circular linked list and Header linked list and their operations, Application of linked lists, Garbage collection and compaction, Linked representation of Stack and Queues. **[6 Hours]**

Part-B

Trees: Basic terminology, Sequential and linked representations of trees, Different types of Trees- Binary Tree, Binary search tree. Operations on each of the trees. Application of Binary Trees. **[5 Hours]**

Graphs: Basic terminology, Representation of graphs – Adjacency matrix, Adjacency list. Operations on graph, Traversal of a graph – Breadth first search, Depth first search. Shortest path algorithms – Dijkstra's and Floyd. Minimum spanning tree – Prim and Kruskal. Applications of graphs. **[4 Hours]**

Heaps: Representing a heap in memory, Operations on heaps. **[2 Hours]**

Hashing and Hash Tables: Introduction to hash table, Hash functions. **[2 Hours]**

Searching and Sorting: Linear and binary search techniques, Sorting methods – Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Shell sort and radix sort. Complexities of searching and sorting algorithms. **[5 Hours]**

Text Books

1. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw Hill.
2. Sartaj Sahni, "Data Structures, Algorithms and Applications in C++", Tata McGraw Hill.

Reference Books

1. Michael T. Goodrich, Roberto Tamassia, & David Mount, "Data Structures and Algorithms in C++", Wiley India.
2. Kruse, "Data Structures & Program Design", Prentice Hall of India.
3. Y. Langsa, M.J. Augenstein, A.M. Tanenbaum, "Data structures using C and C++", Prentice Hall ofIndia.
4. Vishal Goyal, Lali Goyal, Pawan Kumar, "Simplified Approach to Data Structures", ShroffPublications and Distributors

E-Books and online learning material

1. Data Structures and Algorithms: by Granville Barnett, and Luca Del Tongo. https://apps2.mdp.ac.id/perpustakaan/ebook/Karya%20Umum/Dsa.pdf

2. Data Structures and Algorithms in JAVA :by Michael T. Goodrich and Roberto Tamassiahttp://enos.itcollege.ee/~jpoial/algorithms/GT/Data%20Structures%20and%20Algorithms%20in%20Java%20Fourth%20Edition.pdf

Online Courses and Video Lectures

1. https://nptel.ac.in/courses/106102064/
2. https://nptel.ac.in/courses/106106133/
3. https://nptel.ac.in/courses/106106145/

Subject Code: OECS-106

Subject Name: Business Information Systems

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 7	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hrs
Total Marks: 100	**Elective Status:** Open Elective

Additional Material Allowed in ESE: Not Any

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Align information systems and services with business strategy and formulate plans for the retrieval and analysis of supporting data.
2.	Apply networking concepts and technologies to support business needs.
3.	Formulate plans and architectures to adapt the Data Resource management approach, storage, and retrieval of data.
4.	Analyze Integration of business and technology skills in a sector context**.**
5.	Use different business development methodologies and design a business strategy.
6.	Identify the various threats and security issues in Business Information systems.

Detailed Contents:

Part-A

Introduction to Business Information System: Introduction to Information System, Impact of IS in Business, Transformation from Old to Digital Economy, Acquiring Information system, Components of IS, Resources that support BIS, Types of BIS, E-business system. [**6 hours]**

Business Development of Data Systems- Overview of Hardware and Software, Networks, Network Components, Telecommunication and Internet, Scenario in India, Networking Technologies- Wi-Fi, WiMax, NextGen mobile networks, Data Capture and Computer Input / Output devices. [**5 hours]**

Data Resource Management: Differentiating Data and Information, Traditional Processing Systems, Functionalities of Database approach and its advantages and disadvantages, Components of database environment, Concepts of Data Warehousing, Data Mining and Tools, OLAP, Data Visualization, Data Centers, Fabric Data Centers, Server Farms, Big data overview, V's of big data,

Drivers of big data, Big data ecosystem and a New Approach to Analytics. **[7 hours]**

Part-B

Enterprise and Functional Business Systems: Classification of IS – TPS, MIS, DSS, AI, Expert Systems**,** NLP, Inventory Management (INMANS) System, Account Payable System (ACPAYS), Payroll System (PAYSY). **[5 hours]**

Developing & Implementing Business Systems- Feasibility studies, Risk Management, SDLC, Phases, Implementation of Business Systems, Management of IS – Organizing data & information processing, roles & responsibilities of IS professionals. **[5 hours]**

Information System Security and Control: Threat of Project Failure, Threat of Accidents and Malfunctions, Threat of Computer Crime, Protecting Information System against Security Breaches, Factors that Increase the Risks, Methods for Minimizing Risks. **[8 hours]**

Text Books:

1. Paul Bocij, Andrew Greasley, Simon Hickie, "Business Information Systems: Technology, Development & Management".
2. PalgeBaltzan, "Business Driven Information System", McGraw Hill Publication.

References:

1. R. Kelly Rainer, Brad Prince, Watson, "Management Information System", Wiley Publication.
2. Nandan Kamath, "Guide to information technology act, rules and regulations", Universal Law Pub.

E-books and online learning material:

1. Business Information System by Elizabeth Hardcastle
http://www.promeng.eu/downloads/training-materials/ebooks/business-information-systems.pdf
Accessed on 02/08/2021.

2. Information Systems for Business and Beyond by JOSEPH MORTATI, SHOUHONG WANG, AND JAMES SMITH https://opentextbook.site/exports/ISBB-2019.pdf
Accessed on 02/08/2021

Online Courses and Video Lectures:

https://www.coursera.org/specializations/information-systems. Accessed on 02/08/2021.

https://nptel.ac.in/courses/110/105/110105083/ Accessed on 02/08/2021

Subject Code: OECS-107

Subject Name: Artificial Intelligence

Programme: B.Tech. (CSE**)**	**L:** 3 **T:** 0 **P:** 0
Semester: 7	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** Nil
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hrs
Total Marks: 100	**Elective Status:** Open Elective

Additional Material Allowed in ESE: Not Any

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1.	Understand the concept of Artificial Intelligence, Agents, their types and structure.
2.	Apply and analyze search strategies to solve the informed and uninformed problems.
3.	Design and evaluate intelligent expert models for perception and prediction from an intelligent environment.
4.	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
5.	Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models within constraints of application area.
6.	Examine the issues involved in knowledge bases, reasoning systems and planning

Detailed Contents:

Part-A

Introduction: Intelligence, Foundations of artificial intelligence (AI). History of AI, Agents and their architecture, Communication among agents. Problem Formulation and solution, Problem types, States and operators, State space. Uninformed Search Strategies: DFS, BFS, DFID, Bi-directional. Informed Search Strategies– Best first search, A* algorithm, Heuristic functions. Game playing – Perfect decision game, Imperfect decision game, Evaluation function, Minimax algorithm, Alpha-beta pruning. [9 hours]

Logical Reasoning: Inference, Propositional logic, Predicate logic (first order logic), Resolution, Logical reasoning, Forward chaining, Backward chaining; Knowledge representation techniques: semantic networks, Frames. **[9 hours]**

Part-B

Uncertainty: Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making– Utility theory, Utility functions, Decision theoretic expert systems. **[7 hours]**

Inductive learning: Decision trees, Rule based learning, Current-best-hypothesis search, Least commitment search, Neural networks, Reinforcement learning, Genetic algorithms. **[7 hours]**

Applications: Areas of AI, Case study of existing expert systems. **[4 hours]**

Text Books:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education Press.
2. Kevin Knight, Elaine Rich, B. Nair, "Artificial Intelligence" McGraw Hill.

Reference Books:

1. George F. Luger, "Artificial Intelligence", Pearson Education.
2. Nils J. Nils on,"Artificial Intelligence: A New Synthesis", Morgan Kaufmann Publishers, Inc.

E-Books and online learning material

1. HandBook of Artificial Intelligence Edited by Avron Barr and Edward A. Feigenbaum, Computer Science Department, Stanford University. https://stacks.stanford.edu/file/druid:qn160ck3308/qn160ck3308.pdf

Online Courses and Video Lectures

1. https://www.coursera.org/courses?query=artificial%20intelligence Accessed on May 20,2020.
2. https://nptel.ac.in/courses/106/105/106105077/ Accessed on May20,2020.

Subject Code : OECS-114

Subject Name: Cloud Computing-II

Programme: B.Tech (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 7th	**Teaching Hours:** 36
Theory / Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE) :** 3 hrs
Total Marks: 100	**Elective Status :** Open Elective

Additional Material Allowed in ESE: [NIL]

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Apply shared security model on Amazon Web Services (AWS) cloud implementation.
2	Apply automatic scaling in AWS cloud environments.
3	Host a static or dynamic website and use Lambda service on AWS cloud.
4	Use Artificial intelligence and Machine learning services on AWS cloud.
5	Make use of Internet of Things and Big Data products on AWS cloud.
6	Implement Blockchain technology using AWS cloud.

Detailed Contents:

Part-A

Amazon Web Services (AWS) Shared Security Model: Introduction to AWS security model for cloud services, Identity and access management (IAM), Principle of least privilege (PoLP), Denial of service (DoS), Distributed denial of service (DDoS), Watering hole attack, Multi-factor authentication (MFA), Amazon inspector, AWS trusted advisor, Amazon simple storage service (Amazon S3), Amazon elastic block store (Amazon EBS), Amazon relational database service (Amazon RDS)

[06]

Cloud Services, Instance States and Auto Scaling in Cloud Environments: Cloud service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a

Service (SaaS). Amazon elastic compute cloud (Amazon EC2), EC2 instance states, AWS instance lifecycle, Instance store volumes, Amazon machine image (AMI), IPv4 address and IPv6 address, Elastic IP address, Automatic scaling in cloud environments, Auto scaling groups, Fleet, Launch template, Scale-out and Scale-in. **[7 hours]**

Dynamic Web Servers, Lambda and CloudFormation: Static website, Dynamic website, Amazon CloudFront, Content delivery network (CDN), Edge location, Origin, Distribution, Time to live (TTL), AWS Lambda, CloudFormation template, Infrastructure as code (IaC)

[**5 hours]**

Part-B

Artificial Intelligence (AI) and Machine Learning (ML): Introduction to AI and ML, AWS DeepLens, AI services from AWS platform: Amazon Comprehend, Amazon Forecast, Amazon Lex, Amazon Personalize, Amazon Polly, Amazon Rekognition, Amazon Textract, Amazon Translate, Amazon Transcribe. Impact of AI, Deep learning, Reinforcement learning, Supervised learning, Unsupervised learning, Forecasting, Neural network, AWS machine learning applications. **[8 hours]**

Internet of Things (IoT) and Big Data: Introduction to IoT and Big data, AWS IoT services, Apache Hadoop, Big data processing cycle, Data analytics, AWS Big data applications and services. **[6 hours]**

Blockchain and Cryptocurrency: Introduction to blockchain technology, Cryptocurrency, Cryptocurrency mining, Decentralized database, Hash, Immutable transactions, Smart contract, AWS blockchain products. **[4 hours]**

Text Books:

1. Raj Kumar Buyya, James Broberg, Andrezei Goscinski, “Cloud Computing: Principles and Paradigms”, First edition, John Wiley & Sons Inc.
2. Barrie Sosinsky, “Cloud Computing Bible”, First edition, Wiley India Pvt. Ltd.

Reference Books:

1. John Rittinghouse, James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, International edition, CRC Press Taylor and Francis Group.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper,” Cloud Computing for Dummies”, International edition, John Wiley & Sons Inc.

Books and online learning Material:

1 Best Practices for Security, Identity, & Compliance: https://aws.amazon.com/architecture/security-identity-compliance/ Accessed on July 21st, 2022.
2 Share an Amazon EBS Snapshot: https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-modifying-snapshot-permissions.html Accessed on July 21st, 2022.
3 Sharing a DB Snapshot: https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/USER_ShareSnapshot.html Accessed on July 21st, 2022.
4 Bucket Policies and User Policies: https://docs.aws.amazon.com/AmazonS3/latest/userguide/using-iam-policies.html Accessed on July 21st, 2022.
5 AWS Trusted Advisor for Everyone: https://aws.amazon.com/blogs/aws/trusted-advisor-console-basic/ Accessed on July 21st, 2022.
6 Understand the Instance Store and EBS: https://aws.amazon.com/premiumsupport/knowledge-center/instance-store-vs-ebs/ Accessed on July 21st, 2022.
7 Learn About Elastic IP Addresses: https://aws.amazon.com/premiumsupport/knowledge-center/intro-elastic-ip-addresses/ Accessed on July 21st, 2022.
8 https://aws.amazon.com/ec2/autoscaling/ Accessed on July 21st, 2022.
9 AWS Lambda FAQs https://aws.amazon.com/lambda/faqs/ Accessed on July 21st, 2022.
10 Explore AWS AI services https://aws.amazon.com/machine-learning/ai-services/ Accessed on July 21st, 2022.
11 AI with AWS Machine Learning https://aws.amazon.com/ai/Accessed on July 21st, 2022.
12 https://aws.amazon.com/iot/ Accessed on July 21st, 2022.
13 https://aws.amazon.com/blogs/big-data/ Accessed on July 21st, 2022.
14 Blockchain on AWS https://aws.amazon.com/blockchain/ Accessed on July 21st, 2022.

Online Courses and Video Lectures

1 https://youtu.be/bSRTAMPqS3E Accessed on July 21st, 2022.
2 https://www.youtube.com/watch?v=PideBMIcwBQ Accessed on July 21st, 2022.
3 AWS Quick Start - Hosting a Static Website on AWS (Demo) video https://www.youtube.com/watch?v=BpFKnPae1oY Accessed on July 21st, 2022.
4 Getting Started with AWS - Build a Simple Static Website video https://www.youtube.com/watch?v=jHH-rN3y3Qc Accessed on July 21st, 2022.
5 Big Data on Amazon Web Services https://www.youtube.com/watch?v=3fkGCM0feC0&feature=youtu.be Accessed on July 21st, 2022.
6 Introduction to Blockchain on AWS" https://www.youtube.com/watch?v=oMzyZ49pykU accessed on July 21st, 2022.
7 What is Blockchain on AWS?" https://www.youtube.com/watch?v=9xbtq362Scs Accessed on July 21st, 2022.

Subject Code: - OECS-112
Subject Name: Web Technologies

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 70%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Course Status:** Open Elective

Additional Material Allowed in ESE: [NIL]

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Apply the knowledge of web technology stack to deploy various web services.
CO2	Analyze and evaluate web technology components for formulating web related problems.
CO3	Design and develop client server internet application that accommodates user specific requirements and constraints analysis.
CO4	Select latest web technologies and tools by conducting experiments with an understanding of the limitations.
CO5	Apply advance concepts of web APIs to build web projects in multidisciplinary environments.
CO6	Implement the concept for creating content based dynamic websites.

Detailed Contents:

PART-A

Introduction: History and evolution of Internet protocols, Internet addressing, Internet Service Provider (ISP), Introduction to WWW, DNS, URLS, HTTP, HTTPS, SSL, Web browsers, Cookies, Web servers, Proxy servers, Web applications. [6 Hours]

HTML: Introduction to HTML and DHTML, History of HTML, Structure of HTML Document: Text Basics, Structure of HTML Document: Images, Multimedia, Links, Audio,

Video, Table and Forms, Document Layout, HTML vs. DHTML, Meta tags, and Website structure. Overview and features of HTML5. [8 Hours]

Style Sheets: Need for CSS, Introduction to CSS, Basic syntax and structure, Types of CSS – Inline, Internal and External CSS style sheets. CSS Properties - Background images, Colors and properties, Text Formatting, Margin, Padding, Positioning etc. [6 Hours]

PART - B

JavaScript: Introduction, JavaScript's history and versions, Basic syntax, Variables, Data types, Statements, Operators, Functions, Arrays, Objects, JavaScript DOM. [6 Hours]

PHP: Introduction and basic syntax -of PHP, Data types, Variables, Decision and looping with examples, String, Functions, Array, Form processing, Cookies and Sessions Management, E-mail. [8 Hours]

SEO and CMS: Deploying a website on server, Search engine optimization and its different types, Web application testing and security, Web APIs, CMS – WordPress. [6 Hours]

Text Books

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education
2. Rajkamal, "Internet and Web Technology", Tata McGraw Hill
3. Ray Rischpater, "JavaScript JSON Cookbook", Packt Publishing.

Reference Books

1. Ivan Bayross, "Web Enabled Commercial Application Development using HTML, DHTML JavaScript, Perl, CGI", BPB Publications.
2. Peter Moulding, "PHP Black Book", Coriolis.

E-Books and Online learning material

1. Twitter Bootstrap
   https://www.syncfusion.com/succinctly-free-ebooks/twitterbootstrap4-succinctly/the-grids-the-grids-the-beautiful-grids Accessed on 09-July-2021
2. PHP Programming
   https://en.wikibooks.org/wiki/PHP_Programming Accessed on 09-July-2021
3. HTML and CSS
   https://wtf.tw/ref/duckett.pdf Accessed on 09-July-2021
4. Search Engine Optimization
   https://static.googleusercontent.com/media/www.google.com/sk//webmasters/docs/search-engine-optimization-starter-guide.pdf Accessed on 09-July-2021

Online Courses and Video Lectures

1. https://www.udemy.com/share/1013yI/ Accessed on 09-July-2021
2. https://www.coursera.org/learn/web-applications-php Accessed on 09-July-2021
3. https://www.coursera.org/learn/single-page-web-apps-with-angularjs Accessed on 09-July-2021
4. https://www.udemy.com/share/1013wC/ Accessed on 09-July-2021

Subject Code: OECS-110

Subject Name: Real Time Systems

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 8	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** NIL
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Open Elective

Prerequisites: NIL

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	To Provide the knowledge on the implementation aspects of real time concepts
2	Analyse real time systems with regard to keeping time and resource restrictions.
3	To learn various approaches to real-time scheduling
4	Understand the working of real-time operating systems and real-time database.
5	To learn the selection process of processor and memory for the embedded systems.
6	To work on design and development of protocols related to real-time communication.

Detailed Contents:

Part-A

Introduction to Real-Time Systems: Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs, Issues in Real Time Computing, Structure of a Real Time System. **[4 Hours]**

Model of real time systems: Jobs and processors, Release times, Deadlines, and timing constraints, Hard and soft timing constraints, Hard real-time systems, Soft real-time systems, Processor and

resources, Temporal parameters of real-time workload, Periodic task model.**[6 Hours]**

Task Assignment and Scheduling: Introduction, Classical Uniprocessor scheduling algorithms: Rate Monotonic, EDF algorithm, Task assignment, Fault tolerant Scheduling **[5 Hours]**

Part-B

Operating Systems: Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion**.** **[7 hours]**

Real Time Databases: Basic definitions, Real time Vs General Purpose databases, Main Memory databases, concurrency control issues, databases for hard real time systems **[7 Hours]**

Real Time Communication: Introduction, Architectural Issues, Protocols: Contention based protocols, Token based protocols, Deadlines based protocols, Stop and Go Multihop protocol, The polled bus protocol, Hierarchical round robin protocol. **[7 Hours]**

Text Books

1. "Real Time Systems", Liu Pearson Education
2. "Real? Time Systems", C. M. Krishna and Kang G. Shin

Reference Books

1. "Real Time Systems: Theory and Practice", R Mall
2. "Real Time Systems", C M Krishna and K G Shin
3. "Real-Time Systems Scheduling", Maryline Chetto
4. "Real-Time And Distributed Real-Time Systems", Gupta

E-Books and online learning material

1. The Concise Handbook of Real-Time Systems TimeSys Corporation Version 1.3

https://course.ece.cmu.edu/~ece749/docs/RTSHandbook.pdf Accessed on 02/08/2021

2. A practical introduction to real-time systems for undergraduate engineering by Douglas Wilhelm Version 0.2018.07.31
https://ece.uwaterloo.ca/~dwharder/icsrts/Lecture_materials/A_practical_introduction_to_real-time_systems_for_undergraduate_engineering.pdf Accessed on 02/08/2021

Online Courses and Video Lectures

https://www.youtube.com/watch?v=vo7LN-zMI2s Accessed on 02/08/2021

Subject Code: OECS-105

Subject Name: Simulation and Modeling

Programme: B.Tech.(CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 7/8	**Teaching Hours:** 36 Hours
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam(ESE):** 3hours
Total Marks: 100	**Elective Status:** Open Elective

Additional Material Allowed in ESE: Nil

On completion of the course the student will have the ability to:

CO #	Course Outcomes
1.	Discuss the fundamental elements of discrete-event simulation including statistical models, random processes, random variates, and inputs to simulation
2.	Analyze a real world problem and apply modelling methodologies to develop a discrete-event simulation model
3.	Generate random numbers and random variates using different techniques
4.	Analysis of Simulation models using input analyzer and output analyzer
5.	Explain Verification and Validation of simulation model
6.	Compare and evaluate alternative system designs using sampling and regression

Detailed Contents:

PART-A

Introduction: Introduction to simulation and modeling, Application areas, System and system environment, Components of a system, Discrete and continuous systems, Basic model forms and its types, Discrete-event simulation, Steps in a simulation study, Simulation examples. **[6 hours]**

General Principles: Concepts in discrete event simulation, Handling Stepped and Event-based Time in Simulations, Event scheduling/time advance algorithms, World views, List processing using dynamic allocation and linked list. **[4 hours]**

Statistical and Queuing Models in Simulation: Terms and concepts, Statistical models, Discrete and continuous distributions, Poisson distributions, Empirical distributions, Little's equation. Characteristics of queuing systems, Queuing notation, Long- Run measures of performance of queuing systems, Steady state behavior of infinite and finite calling population models, Use of network of queues. **[9 hours]**

PART-B

Random Number Generation: Pseudo random numbers, Techniques for generation of pseudo random numbers, Tests for random numbers, Random variate generation, Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and lognormal distributions. **[6 hours]**

Input Modeling and Output Analysis of a Single Model: Data collection, Identifying the distribution of data - histograms and quantile plots, Parameter estimation, Goodness of fit tests applied to simulation inputs, Verification and validation of simulation models, Output analysis and measures of performance and estimation. **[6 hours]**

Comparison and Evaluation of Alternative System Designs: Comparison of two system designs, Sampling with equal and unequal variances, Common random numbers, Comparison of several system designs, Linear regression, Random number assignment for regression. **[5 hours]**

Text Books:

1. Jerry Banks, John S. Carson II, Barry L.Nelson and David M.Nicol, "Discrete- event system and simulation", Prentice Hall of India.
2. Averill M.Law, "Simulation modeling and analysis (SIE)", Tata McGraw Hill India.

Reference Books:

1. David Cloud, Larry Rainey, "Applied Modeling and Simulation", Tata McGraw Hill.
2. Gabriel A. Wainer, "Discrete-event modeling and simulation: a practitioner's approach", CRC Press.
3. Bernard P. Zeiger, Herbert Praehofer, Tag Gon Kim, "Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems", Academic Press.
4. Walter J. Karplus, George A. Bekey, Boris YakobKogan, "Modeling and simulation: theory and practice", Springer.

E-Books and online learning material

1. https://ptolemy.berkeley.edu/books/Systems/PtolemyII_DigitalV1_02.pdf
2. https://www.tutorialspoint.com/modelling_and_simulation/modelling_and_simulation_tutorial.pdf

Online Courses and Video Lectures

1. https://www.coursera.org/lecture/modeling-simulation-natural-processes/modeling-and-simulation-F7vas Accessed on August 2, 2021
2. https://onlinecourses.nptel.ac.in/noc20_me37/preview# Accessed on August 2, 2021

Subject Code: OECS-108
Subject Name: Soft Computing

Program: B.Tech.	**L**: 3 **T**: 0 **P**: 0
Semester: 7/8	**Teaching Hours: 36**
Theory/Practical: Theory	**Credits**: 3
Internal marks: 40	**Percentage of numerical/design/programming problems**: 20%
External marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Course status:** Open Elective

Prerequisites: Knowledge of problem solving using different algorithms and basic programming.
Additional Material Allowed in ESE: [NIL]
On completion of the course, the student will have the ability to:

CO#	Course Outcome
CO1	Analyze the behavioral aspects of various soft computing techniques.
CO2	Implement the concept of genetic algorithms to develop various genetic applications.
CO3	Describe the operational benefits of neural network architectures and Fuzzy logic.
CO4	Identify and Apply a suitable Soft Computing technology to solve the problem.
CO5	Construct optimized solution for various Fuzzy Systems.
CO6	Demonstrate and Apply various optimization techniques to solve a real world problem.

Section – A

Introduction: Introduction to soft computing, Definition and importance, Evolution of soft computing, Difference between Hard and Soft computing, Requirement of Soft computing, Usefulness and applications. **[6 hours]**

Neural Networks: Introduction to Neural Networks, Model of an artificial neuron, Comparison of artificial neural network and Biological neural network, Activation Functions, Recurrent Neural Networks, Neural network models– Perceptron, Adaline and medaline networks, Single layer, Back propagation, Multi-layer networks. **[11 hours]**

Section- B

Fuzzy Logic: Crisp and fuzzy sets, Fuzzy sets – Membership functions, Basic operations, Properties and fuzzy relations, Predicate logic, Fuzzy Decision Making, Fuzzy rule based system, Fuzzy inference system, Applications of fuzzy logic. **[7 hours]**

Genetic Algorithms: Working principle– Crossover, Mutation, Encoding, Fitness function and Reproduction, Classification of genetic algorithm, Multi-objective genetic algorithm, Application of GA in search and optimization. **[7 hours]**

Optimization Techniques: Optimization of Forest Planning Problems, Particle Swarm Optimization, Bee Colony Optimization, Ant Colony Optimization, Tabu Search. **[5 hours]**

Text Books:

1. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India, 1st Edition.
2. S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy logic and Genetic Algorithms", Prentice Hall of India, Eastern Economy Edition.
3. D.E. Goldberg, "Genetic Algorithms in Search and Optimization, and Machine Learning", Addison-Wesley, 13th Edition.
4. Ross T.J., Fuzzy Logic with Engineering Applications- McGraw Hill, 4th Edition.

Reference Books:

1. N. K. Sinha and M. M. Gupta, Soft Computing & Intelligent Systems: Theory &Applications-Academic Press /Elsevier 2009, 1st Edition.
2. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc, 2nd Edition.
3. Bart Kosko, Neural Network and Fuzzy Systems- Prentice Hall, Inc., Englewood Cliffs, 4th Edition.

E-Books and online learning material:

1. https://www.youtube.com/watch?v=Z_8MpZeMdD4
2. https://bookboon.com/en/introduction-to-soft-computing-ebook
3. https://www.academia.edu/32241003/TB04_soft_computing_ebook

Online Courses and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105173/ Accessed on September 17th, 2021.
2. https://onlinecourses.nptel.ac.in/noc20_cs17/preview Accessed on September 17uı, 2021.
3. https://nptel.ac.in/courses/106/105/106105077/ Accessed on September 17uı, 2021.
4. https://nptel.ac.in/courses/117/105/117105084/ Accessed on September 17uı, 2021.

Subject Code: OECS-111

Subject Name: Multimedia Systems

Programme: B.Tech.	**L:** 3 **T:** 0 **P:** 0
Semester: 7	**Teaching Hours:** 36
Theory/Practical: Theory	**Credits:** 3
Internal Marks: 40	**Percentage of Numerical/Design/Programming Problems:** 20%
External Marks: 60	**Duration of End Semester Exam (ESE):** 3 hrs
Total Marks: 100	**Elective Status:** Open Elective

Prerequisites: NIL

Additional Material Allowed in ESE: NIL

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.
2	Gain proficiency in identified technical skills; understand the process of creating, analyzing, and evaluating graphic design solutions.
3	Analyze the protocols, standards and representation techniques used for storage and transmission of multimedia system.
4	Understand the fundamentals and underlying theories of Multimedia to design and develop film-making, visual effects for the creative media.
5	Use and apply tools for image processing, video, sound and animations.
6	Understand multimedia components using various tools and techniques.

Detailed Contents:

Part-A

Introduction: Multimedia and its types, Architecture and components, Introduction to Hypermedia, Hyper Text, Multimedia Systems and their Characteristics, Challenges, Desirable Features, Components and Applications, Trends in Multimedia. **[4 Hours]**

Multimedia Technology: Multimedia Systems Technology, Multimedia Hardware devices, Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG, Multimedia Software for different media. **[4 Hours]**

Storage Media: Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards, Multimedia Servers. **[4 Hours]**

Audio: Basics of Digital Audio, Application of Digital Audio, Digitization of Sound, Sample Rates and Bit Size, Nyquist's Sampling Theorem Typical Audio Formats Delivering Audio over a Network , Introduction to MIDI (Musical Instrument Digital Interface), Components of a MIDI System Hardware Aspects of MIDI, MIDI Messages. Audio Compression, Simple Audio Compression Methods, Psychoacoustics, MPEG Audio Compression. **[7 Hours]**

Part-B

Basics of Compression: Classifying Compression Algorithms, Lossless Compression Algorithms, Entropy Encoding, Run-length Encoding, Pattern Substitution, Basics of Information theory, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, and Source Coding Techniques: Transform Coding, Frequency Domain Methods, and Differential Encoding. **[6 Hours]**

Image Graphics and Video Compression: Color in Images, Types of Color Models, Graphic/Image File Formats: BMP, PNG, PDF, Graphic/Image Data, and JPEG Compression, Basics of Video , Video Signals, Analog Video, Digital Video, TV Standards H.261 Compression, Intra Frame Coding, Inter-frame (P-frame) Coding, MPEG Video, The MPEG Video Bit stream , Decoding MPEG Video in Software. **[6 Hours]**

Multimedia Communication: Building Communication network, Application Subsystem, Transport Subsystem, QOS, Resource Management, Distributed Multimedia Systems, multimedia over LAN and WAN. **[5 Hours]**

Text Books

1. Ralf Steinmetz amd Klara Nahrstedt,“ Multimedia Computing Communications and Applications” Pearson Educations.

Reference Books

1. Parag Havaldar, Gerard Medioni,"Multimedia Systems Design", PHI
2. K. Sayood, Introduction to Data Compression, Morgan-Kaufmann
3. A.Puri and T.Chen, Multimedia Systems, Standards and Networks, Marcel Dekker.
4. Iain E.G. Richardson, H.264 and MPEG-4 Video Compression, John Wiley.
5. Borivoje Furht, handbook of Multimedia Computing, CRC Press

E-Books and online learning material

1. https://nptel.ac.in/courses/117/105/117105083/

Online Courses and Video Lectures

1. https://www.youtube.com/watch?v=fAJzLuce_ms

Subject Code: PRCS-107
Subject Name: Software Management Tools

Programme: B.Tech.(CSE)	**L:** 0 **T:** 0 **P:** 2
Semester: 8	**Teaching Hours:** 24 Hours
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:**100%
External Marks: 0	**Duration of End Semester Exam (ESE): NA**
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Knowledge of basic programming skills

On completion of the course, the student will have the ability to:

CO#	**COURSE OUTCOMES (CO)**
CO1	Apply knowledge for the management of various software.
CO2	Recognize the benefits of software planning and configuration management tools.
CO3	Explore various software management tools for throughout evaluation of the software projects.
CO4	Analyze various software management tools along with their components for project planning and designing purpose.
CO5	Implement various CICD tools and techniques for effective application of relevant standards for project management.
CO6	Identify the benefits of various tools for software debugging, UML Diagrams and various project charts.

Detailed Contents:

To provide the hands-on experience in managing various software projects. In this lab, students are required to work on various open-source software management tools like Github, OpenProj, Bugzilla, Jenkins, Harvest, WinRunner and tools of CICD (DEV or UAT) etc. for planning, managing, analyzing, designing, testing and implementing various software projects based on the platform used from the developer as well as client point of view. Languages they have learned so far. Therefore, based on the software requirement, project management reports should be prepared under the guidance of faculty coordinator.

Subject Code : OECS-113
Subject Name: Cloud Computing-I

Programme: B.Tech (CSE)	**L:** 3 **T:** 0 **P:** 0
Semester: 6th	**Teaching Hours:** 36
Theory / Practical: Theory	**Credits:** 3
Inte rnal Marks: 40	**Percentage of Nume rical/Design/Programming Proble ms:** 10%
External Marks: 60	**Duration of End Semester Exam (ESE) :** 3 hrs
Total Marks: 100	**Elective Status :** Open Elective

Additional Material Allowed in ESE: [NIL]

On Completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
1	Use Amazon Web Services (AWS) console for different cloud services and understand the structure of AWS cloud.
2	Apply Amazon Elastic Compute Cloud (Amazon EC2), Amazon Simple Storage Service (S3), and Amazon CloudFront service on AWS cloud
3	Implement cloud security and monitor the working of AWS cloud.
4	Use database and load balancing service on AWS cloud.
5	Make use of Elastic Beanstalk and AWS simple monthly calculator.
6	Use Machine learning, Artificial intelligence, and Blockchain technology services on AWS cloud

Detailed Contents:

Part-A

Introduction to Amazon Web Services (AWS) Cloud: Global infrastructure of AWS cloud, Cloud Services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), Cloud storage. Structure of Cloud: Availability Zone, Edge Location, Origin, Latency, Region. Introduction to AWS Console. [06]

Virtual Servers, Content Delivery and Virtual Storage: Virtual Servers: Amazon Elastic Compute Cloud (Amazon EC2), Domain Name, Domain Name System (DNS), Amazon S imple Storage Service (S3) bucket, Amazon Route 53, Javascript Object Notation (JSON), Dynamic website, Static website. Content Delivery: Amazon CloudFront, AWS Direct Connect, Caching, Content Delivery Network (CDN), Distribution. Virtual Storage: Amazon Simple Storage Service (Amazon S3), Amazon Elastic Block Store (Amazon EBS), Hard Disk Drive (HDD), Solid State Drive (SDD), Input / Output Operations Per second (IOPS) [08]

Cloud Security and Monitoring the Cloud: Cloud Security: AWS Identity and Access Management (IAM), Role, User, Security group, Policy, Amazon Inspector, Root User, Credential, Multi-Factor Authentication (MFA), AWS shield, AWS Web Application Firewall (WAF), Distributed Denial of Service (DDoS), AWS Artifact. Monitoring the Cloud: Amazon CloudWatch, AWS CloudTrail, AWS Config, Amazon Simple Notification Service (Amazon SNS) [06]

Part-B

Databases and Load Balancing: Databases: Relational database, Amazon Relational Database Service (Amazon RDS), Amazon DynamoDB, Nonrelational database, Amazon Redshift, Online Transaction Processing (OLTP), Online Analytic Processing (OLAP), Amazon Aurora, MySQL. Load balancing: Load balancer, Amazon ElastiCache, Data caching, Elastic Load Balancing, Random Access Memory (RAM) [06]

Elastic Beanstalk, CloudFormation, Billing and Support: AWS Elastic Beanstalk, AWS CloudFormation, Stack. Billing and Support: AWS simple monthly calculator, AWS support plan, Consolidated billing, Technical Account Manager (TAM) [05]

Emerging Technologies in Cloud and Cloud Optimization: Machine Learning (ML), Artificial Intelligence (AI), Amazon SageMaker, Deep Learning, AWS DeepRacer, AWS DeepLens, Neural network, Blockchain technology. Cloud optimization using AWS Cloud Development Kit (CDK). [05]

Text Books:

1. Raj Kumar Buyya, James Broberg, Andrezei Goscinski, "Cloud Computing: Principles and Paradigms", First edition, John Wiley & Sons Inc.
2. Barrie Sosinsky, "Cloud Computing Bible", First edition, Wiley India Pvt. Ltd.

Reference Books:

1. John Rittinghouse, James F.Ransome, "Cloud Computing: Implementation, Management, and Security", International edition, CRC Press Taylor and Francis Group.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper," Cloud Computing for Dummies", International edition, John Wiley & Sons Inc.

E –Books and online learning Material:

1 Types of Cloud Computing: https://aws.amazon.com/types-of-cloud-computing/ accessed on July 21st , 2022.
2 Amazon EC2: https://aws.amazon.com/ec2/ accessed on July 21st , 2022.
3 Amazon S3: https://aws.amazon.com/s3/ accessed on July 21st , 2022.
4 Tutorial: Configuring a Static Website on Amazon S3: https://docs.aws.amazon.com/AmazonS3/latest/dev/HostingWebsiteOnS3Setup.html accessed on July 21st , 2022.
5 Amazon EBS volume types: https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-volume-types.html accessed on July 21st , 2022.
6 AWS Cloud Security overview: https://aws.amazon.com/security/ accessed on July 21st , 2022.
7 Amazon Inspector: https://aws.amazon.com/inspector/faqs/ accessed on July 21st , 2022.
8 AWS Shield: https://aws.amazon.com/shield/faqs/ accessed on July 21st , 2022.
9 AWS WAF: https://aws.amazon.com/waf/faqs/ accessed on July 21st , 2022.
10 AWS Artifact: https://aws.amazon.com/artifact/faq/ accessed on July 21st , 2022.

11 AWS Config: https://aws.amazon.com/config/ accessed on July 21st , 2022.
12 AWS CloudTrail: https://aws.amazon.com/cloudtrail/ accessed on July 21st , 2022.
13 Amazon CloudWatch : https://aws.amazon.com/cloudwatch/ accessed on July 21st , 2022.
14 Amazon Simple Notification Service: https://aws.amazon.com/sns/ accessed on July 21st , 2022.
15 Amazon Relational Database Service: https://aws.amazon.com/rds/ accessed on July 21st , 2022.
16 Amazon Redshift : https://aws.amazon.com/redshift/ accessed on July 21st , 2022.
17 Amazon Aurora : https://aws.amazon.com/rds/aurora/ accessed on July 21st , 2022.
18 Elastic Load Balancing : https://aws.amazon.com/elasticloadbalancing/ accessed on July 21st , 2022.
19 Caching Overview : https://aws.amazon.com/caching/ accessed on July 21st , 2022.
20 Amazon ElastiCache : https://aws.amazon.com/elasticache/ accessed on July 21st , 2022.
21 AWS CloudFormation : https://aws.amazon.com/cloudformation/ accessed on July 21st , 2022.
22 AWS Elastic Beanstalk: https://aws.amazon.com/elasticbeanstalk/ accessed on July 21st , 2022.
23 Compare AWS Support Plans: https://aws.amazon.com/premiumsupport/plans/ accessed on July 21st , 2022.
24 AWS DeepRacer: https://aws.amazon.com/deepracer/ accessed on July 21st , 2022.
25 SageMaker: https://aws.amazon.com/sagemaker/ accessed on July 21st , 2022.
26 AWS DeepLens: https://aws.amazon.com/deeplens/ accessed on July 21st , 2022.
27 Blockchain on AWS: https://aws.amazon.com/blockchain/ accessed on July 21st , 2022.
28 Getting started with the AWS CDK: https://docs.aws.amazon.com/cdk/latest/guide/getting_started.html accessed on July 21st , 2022.

Online Courses and Video Lectures

1 Amazon EC2 https://www.youtube.com/watch?v=TsRBftzZsQo accessed on July 21st , 2022.
2 Amazon S3: https://www.youtube.com/watch?v=_I14_sXHO8U accessed on July 21st , 2022.
3 Amazon EBS: https://www.youtube.com/watch?v=77qLAl- lRpo accessed on July 21st , 2022.
4 Amazon RDS: https://www.youtube.com/watch?v=eMzCI7S1P9M accessed on July 21st , 2022.
5 DynamoDB: https://www.youtube.com/watch?v=sI- zciHAh-4 accessed on July 21st , 2022.
6 Amazon Redshift: https://www.youtube.com/watch?v=lWwFJV_9PoE accessed on July 21st , 2022.
7 CloudWatch: https://www.youtube.com/watch?v=a4dhoTQCyRA accessed on July 21st , 2022.
8 CloudTrail: https://www.youtube.com/watch?v=mXQSnbc9jMs accessed on July 21st , 2022.
9 Set up of an Amazon CloudFront Distribution: https://www.youtube.com/watch?v=KIltfPRpTi4 accessed on July 21st , 2022.

AWS Cloud Development Kit: https://www.youtube.com/watch?v=bz4jTx4v-l8 accessed on July 21st , 2022.

Subject Code: PRCS-106

Subject Name: Technical Aptitude

Programme: B.Tech. (CSE**)**	**L:** 0 **T:** 0 **P:** 2
Semester: 7th	**Teaching Hours:** 24
Theory/Practical: Practical	**Credits:** 1
Internal Marks: 50	**Percentage of Numerical/Design/Programming Problems:** 100%
External Marks: 0	**Duration of End Semester Exam (ESE): NA**
Total Marks: 50	**Elective Status:** Compulsory

Prerequisites: Knowledge of core subjects

On completion of the course, the student will have the ability to:

CO#	Course Outcomes (CO)
CO1	Apply technical expertise in design, coding and testing principles in software systems development projects.
CO2	Identify and use technical and analytical thinking to model the research based problems and solve them.
CO3	Understand the use of technical aptitude in all the aspects of career and prepare for them accordingly.
CO4	Solve different types of questions based on Core areas of Computer Science and Engineering.
CO5	Speak fluently and confidently to demonstrate various techniques during presentations.
CO6	Demonstrate corporate readiness in terms of attitude, communication, team work and emotional balance

Detailed Contents:

The course aims to make students industry ready with technical expertise and to conduct research-based projects. The course is offered in the final year as a refresher course and during the period they shall be prepared for various competitive exams. The students shall be prepared in various core areas of Computer Science and Engineering such as Data Structures, Digital Logic, Higher Level Programming constructs, Compilers and Algorithms; Operating Systems; Computer Networks; Databases; Data Analytics; Graphics Processor Unit; Computer and data security; Program Verification.