Model Curriculum for Three/Four Year Degree Course

(With Multiple Entry/Exit Option)

Based on NEP-2020

B.Sc. ITM

Odisha State Higher Education Council, Bhubaneswar

Government of Odisha

Semester	Subjects
I	Core I - Data structure Using C
	Core II- Operating Systems
II	Core III- Principle of Management
	Core IV – Java Programming
III	Core V- Digital Logic
	Core VI- Computer Networks
	Core VII- Business Accounting
IV	Core VIII- Database Systems
	Core IX- Organizational Behaviour
	Core X- Foundation of Data Science and Data Analytics
V	Core XI- Web Technology
	Core XII- Software Engineering
	Core XIII- Digital Marketing
VI	Core XIV- Theory of Computation
	Core XV- PythonProgramming
VII	Core XVI- AdvancedComputerArchitecture
	Core XVII- ComputerGraphics
	Core XVIII- Project Management
	Core XIX- Machine Learning
VIII	Core XX- DataMining& DataWarehousing
	Core XXI- Designand AnalysisofAlgorithm
	Core XXII- CryptographyandNetworkSecurity
	Core XXIII- ProjectWork

Program Outcome:

The Department of Information Technology Management (ITM) is dedicated to promote learning the various subjects and technologies in the field of information technology and management. This program inspires the students who want to shape their career in IT professional world. As the IT industry is the fastest growing industry in India and in the world, this program generates ample opportunities for employment. The program prepares the students for a range of computer applications, techniques of computer networking, software engineering, Web Development, Data Analytics, SQL, Python and Java etc. which helps them to enter into the software industry. Apart from these, the program focuses on principle of management and organization behaviour through which the students gain the knowledge of management which help them to effectively understand and handle managerial requirements in the industry. This program incorporates human values and morality by responsibly accepting the roles to work for the sustainable development of self and society. It also focuses on acquiring the ability to survive in the environment of rapid technological changes through dynamic learning. Students will develop leadership and communication skills, goal setting, time management techniques and to collaborate more effectively in teams in their workplaces.

Semester-I
Core I   Data structure Using C

Course Objectives:

ThecourseisdesignedtoprovidecompleteknowledgeofClanguage and its use in data structure.Students will be able to develop logics which will help them to write programs C. Also, by learning the basic programmingconstructs they can easily switch overto any otherprogramminglanguagesin future. It strengthens the ability of the students toidentify and apply the suitable datastructure for the given real- w o r l d problems.Itenablesthemtogainknowledgeinpracticalapplicationsofdatastructures.

Course Outcome:
Oncompletionofthiscourse,thestudentswillbeableto
- Learn various elements of C language including data types, Operators, expressions, decision making implementation in programs.
- Write complex programs using arrays, structure, pointer & functions.
- Know the concept of stack, queue, linked list to represent data in various ways to solve real time applications.
- Search and sort the data using various searching and sorting methods.

Unit-I:

Introduction:IntroductiontoProgrammingLanguage, C h a r a c t e r s e t s , Keywords & Identifiers, Constants, Variables, Input and Output statements (Formatted and Unformatted), Data types and modifiers, Types of Operators, Precedenceandassociativityofoperators.
Controlstatements (SimpleIFStatement, IF…ELSE, Nested IF…ELSE, IF...ELSE...IF Ladder), SwitchStatement. Looping: Do…WHILE, WHILE and FOR Loop. Array Concept (1D and 2D Array).
Outcome: Students will able to understand the basics of C language to write programs and to store the data using array.

Unit-II:

Pointers and its types, Pointer arithmetic, ArrayofPointers, Pointertopointer. Storage classes. Functions: Types, Function Calls, Recursion, String, Structure, Self-Referential Structure, Array of Structures, Union.
Outcome: Students will be able to understand the use of Pointers in data structures, can learn the reusability of codes through functions, can be able to write complex programs in C.

Unit-III:

Dynamic Memory allocation (calloc, malloc, realloc&, free). **Stack:** Definition, Representation, Stack operations, Applications (Infix–Prefix–PostfixConversion&Evaluation). **Queues:** Definition, Representation, queueoperations & Applications. **Linked Lists:** Definition, Types (Single and Doubly Linked List), representation, and Linked listinsertion and deletion operations.

Outcome: Students will be aware of data arrangements and accessing those data for various real-time applications.

Unit-IV:

Trees: Tree Terminologies, Binary Tree, Representation, Binary search Tree, Traversing BST, Operations on BST, Heap Tree (max-Heap & Min-Heap). Sorting: Bubble Sort, Insertion Sort, Selection Sort, Quick Sort. Searching: Linear Search, Binary Search.

Outcome: Students will be able to search and sort the data and will come to know about the arrangements of data in a hierarchical manner.

TextBooks:

- ✓ *E. Balagurusamy, "Programming in ANSIC",4/e, (TMH)*
- ✓ *ClassicDataStructure, P. Samanta, PHI,2/ed*

Reference Books:
- ✓ *B. Kernighan &Dennis Ritchie, "The C Programming Language",2/ePHI*
- ✓ *Paul Deitel, Harvey Deitel, "C: How to Program",8/prentice Hall.*
- ✓ *P.C. Sethi,P.K. Behera,"Programming using C",KalyaniPublisher,Ludhiana*
- ✓ *Ellis Horowitz, SartajSahni, "Fundamentals of Data Structures", GalgotiaPublications,2000.*
- ✓ *Sastry C.V.,Nayak , R,Ch. Rajaramesh, Data Structure & Algorithms,I.K. InternationalPublishingHousePvt .Ltd,NewDelhi.*

Practical

Tutorial C&DataStructureLab WriteC'

- BasicprogramsinClanguage.
- Programsusingconditionalstatements(if.else,elseifladder,nestedif,switchcase)
- Programsusingvariousloops
- Programsusing1D, 2D andmultidimensionalarray.
- Programbasedonpointers.
- Programsusingfunctions,recursionandstrings.
- Programsbasedonstructureandunion.
- Programsoncommandlinearguments.
- Tosearchanelementandprintthetotaltimeofoccurrenceinthearray.
- Todeletealloccurrenceofanelementinanarray.
- ArrayimplementationofStack.
- ArrayimplementationofLinearQueue.
- To implement linear linked list and perform different operations such asnodeinsertanddelete,searchofanitem,reversethelist.
- To implement double linked list and perform different operations such asnodeinsertand delete.
- LinkedlistimplementationofStack.
- LinkedlistimplementationofQueue.
- ToimplementaBinarySearchTree.
- Toperformbinarysearchoperation.
- Bubblesort, Insertionsort, Selectionsort, Quicksort.

Core-II   **Operating Systems**

Course Objectives:

This course has two components: a theory component to teach you the concepts andprinciplesthatunderliemodern operating systems,andapracticecomponenttorelatetheoreticalprinciples with operating system implementation. In the theory component, you will learn aboutprocesses and processor management, concurrency and synchronization, memory managementschemes,filesystemandsecondarystoragemanagement,securityandprotection, etc.

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

- UnderstandthedifferentservicesprovidedbyOperatingSystematdifferentlevel.
- LearnreallifeapplicationsofOperatingSystemineveryfield.
- Understandtheuseofdifferentprocessschedulingalgorithmandsynchronization techniques to avoid deadlock.
- Learndifferentmemorymanagementtechniqueslikepaging,segmentationanddemand paging etc.

Unit-I:

Introduction to Operating System, System Structures: Operating system services, system calls,systemprograms,Operatingsystemdesignandimplementation,Operatingsystemstructure.
Outcome: Students will be able to know the basic components and services of operating system.

Unit-II:

ProcessManagement:ProcessConcept,Operationsonprocesses,Processschedulingandalgorithms, Inter-process Communication, Concepts on Thread and Process, Deadlocks: Deadlockdetection, deadlockpreventionanddeadlockavoidancefundamentals.
Outcome: Students will be able to discuss various scheduling algorithms and know the concept of deadlock.

Unit-III:
MemoryManagementStrategies:Swapping,ContiguousMemoryAllocation,Paging,Segmentation,VirtualMemoryManagement:Concepts,implementation(DemandPaging),PageReplacement,Thrashing.
Outcome: Students will be able to comprehend how an operating system virtualizes CPU and memory.

Unit-IV:

Storage Management: File System concept, Access Methods, File System Mounting, File Sharing and File Protection, Implementing File Systems, Kernel I/O Systems.
Outcome: Students will be able to understand the functionality of file systems.

Text Books:
- ✓ *Operating System Concepts, Abraham Silberschatz, Peter B. Galvin, and Greg Gagne, Eighth Edition, WileyStudentEdition2009.*

ReferenceBooks:
- ✓ *ModernOperatingSystem,Tanenbaum,Pearson,4/Ed.2014.*
- ✓ *RichardFAshley,LinuxwithOperatingSystemConcepts,ChapmanandHall/CRC Published,August 26, 2014.*
- ✓ *RichardBlum,LinuxCommandLineandShellScriptingBible,O'Reilly.*

Core II- Operating Systems Lab

- Writeaprogram(using*fork( )*and/or*exec( )*commands)whereparentandchildexecute:same program,samecode.sameprogram,differentcode. Beforeterminating,theparentwaits forthechildtofinishitstask.
- Writeaprogramtoreportbehavior ofLinuxkernelincludingkernelversion,CPUtypeandmodel.(CPUinformation)
- WriteaprogramtoreportbehaviorofLinuxkernelincludinginformationonconfiguredmemory, amountoffreeandusedmemory. (memoryinformation)
- Writeaprogramtoprintfiledetailsincludingowneraccesspermissions,fileaccesstime,wherefilenameisgivenasargument.
- Writeaprogramto copyfilesusingsystemcalls.
- WriteaprogramusingCtoimplementFCFSschedulingalgorithm.
- WriteaprogramusingCtoimplementRoundRobinschedulingalgorithm.
- WriteaprogramusingCtoimplementSJFschedulingalgorithm.
- WriteaprogramusingC   toimplementnon-preemptivepriority-basedschedulingalgorithm.
- WriteaprogramusingCtoimplementpreemptivepriority-basedschedulingalgorithm.
- WriteaprogramusingCtoimplementSRTFschedulingalgorithm.
- WriteaprogramusingCtoimplementfirst-fit,best-fitandworst-fitallocation strategies.

Semester-II

Core III   **Principle of Management**

Course Objectives:

The objective of this course is to help the students to get aware towards varied management principles and practices. This course covers the explanations about the fundamentals of management disciplines in organizational context. It details the different functions of management such as planning, organizing, staffing, directing and controlling.

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

- UnderstandtheconceptsrelatedtoBusiness.
- Demonstratetheroles,skillsandfunctionsofmanagement.
- Focusonthetheoriesofmanagement.
- Demonstrateaclearunderstandingoftheconcepts,tools&techniquesuse dbyexecutives in developing and executing strategies and will appreciate its integrative andinterdisciplinarynature.

Unit-I:
- **Nature of Management:** Meaning, Definition, importance & Functions, Nature ofManagementasArt,Science&Profession,levelsofmanagement, managerialtasksandskills.
- **DifferentSchoolsofThoughts:**ClassicalSchool- contributionsofTaylorandHenriFayolNeo-classical School-Human Relations approach and Behavioural Science Approach;ModernSchool;SystemapproachandContingencyapproach.
- **Outcome:** The students will be able to understand the basic concepts, principles, approaches and practices of management. It inculcates the ability to apply multifunctional approach to organizational objective.

Unit-II:
- **Planning-**Meaning-Need&Importance,types, –advantages&limitations,**Forecasting**-Need & Techniques, **Decision making** - Types - Process of rational decision making &techniquesofdecision making,
- **Organizing-** Concept, importance, principles, different organization models-line and staff;Functional;Departmentation-need,basis,principles,**DelegationofAuthority**-Elements,stepsbarriers; Centralization and Decentralization of Authority; Span of Management; conceptanddeterminingfactors.
- **Outcome:** The students will be able to have a conceptual knowledge about the planning and decision making and also able to apply the concept of organizing for the effective functioning of management.

Unit-III:

- **Staffing -** Meaning & Importance. **Directing**: concepts, importance of directing, Leadership:Concept,importance,types,leadershiptraits,Tannenbaum&Schmidt'sM odelandBlake&Mouton'sModel.
- **Outcome:** The students will be able to evaluate leadership style to anticipate the consequences of each leadership style, diagnose qualities of efficient leadership, and able to demonstrate elements of directing and its applications.

Unit-IV:

- **Motivation:** Concept, importance, importance of need theory, and contributions ofMcGregor, Maslow, Herzberg. Coordination: concepts, importance, principles andimplementationtechniques.Control:concepts,importance, processandtoolsofcontrol.
- **Outcome:** The students will be able to demonstrate clear understanding of the concepts, tools and models of Motivation, coordination and controlling.

Text Books:

- ✓ *HaroldKoontzandIteinzWeibrich,EssentialofManagement,McGrawHills International.*
- ✓ *K.Aswathapa,EssentialofBusinessAdministration,HimalayaPublishingHouse.*

Reference Books:

- ✓ *L.M.PrasadPrinciples&practiceofmanagement-SultanChand&Sons–NewDelhi.*
- ✓ *Tripathi,Reddy,PrinciplesofManagement,TataMcGrawHill.*

Core III- Project Work

Guidelines for the Project:

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developability to apply multidisciplinary concepts, tools and techniques to solve organizational problems.Theproject maybefromanyoneofyourareasrelatedtotheconcernedsubject.

Projectreport: TheProjectReportmusthavethefollowing.
- CoverPage–musthavethenameandrollno.ofthestudentandthename& designationoftheguidealongwiththetitleoftheProject.
- Acknowledgement,declaration,Certificateoforiginalitysignedbytheguidewithdate
- Detailedtables&figuresofcontentswithpagenos.
- AllpagesoftheProjectReportmustbenumberedasreflectedinIndexofChapters.

Index of Chapters:

- Chapter-I:Introduction&Reviewofliteratures
- Chapter-II: ResearchMethodology
- Chapter-III:Conceptual& TheoreticalDescriptions
- Chapter-IV:DataAnalysis&Interpretations
- Chapter-V:Conclusion,Findings,suggestions&Scopeforfurtherresearch.
- References,Annexure,etc.

Core IV   **Java Programming**

Course Objectives:
- Tounderstandthebasicconceptsandfundamentalsofplatformindependentobject-

orientedlanguage.
- Todemonstrateskillsinwritingprogramsusingexceptionhandlingtechniquesandmulti threading.
- Tounderstandstreamsandefficientuserinterfacedesigntechniques.
- UsethesyntaxandsemanticsofjavaprogramminglanguageandbasicconceptsofOOP.

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

- Developreusableprograms usingtheconcepts of inheritance,polymorphism, interfacesandpackages.
- ApplytheconceptsofMultithreadingandExceptionhandlingtodevelopefficient anderrorfreecodes.
- DesigneventdrivenGUIandwebrelatedapplicationswhichmimictherealwordscenari os

Unit-I:

Introduction to Java: Java History, Architecture and Features, Understanding the semantic andsyntax differences between C++ and Java, Compiling and Executing a Java Program, Variables,Constants, Keywords (super, this, final, abstract, static, extends, implements, interface) , DataTypes,Wrapper class,Operators(Arithmetic,LogicalandBitwise)andExpressions,Comments,Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) andNesting,JavaMethods(Defining,Scope,PassingandReturningArguments,TypeConversi on and Type and Checking, Built-in Java Class Methods). Input through keyboard using CommandlineArgument,theScannerclass,BufferedReaderclass.
Outcome: Students will be able to identify java language components and how they work together in applications.

Unit-II:

Object-Oriented Programming Overview: Principles of Object-Oriented Programming, Defining& Using Classes, Class Variables & Methods, Objects, Object reference, Objects as parameters,in all classes, Garbage Collection. Constructor-types of constructor, this keyword, super keyword.MethodoverloadingandConstructoroverloading.Aggregationvs Inheritance,Inheritance:extends vs implements, types of Inheritance, Interface, Up-Casting, Down-Casting, Auto-Boxing,Enumerations,Polymorphism,MethodOverridingandrestrictions.Package:Pre-definedpackagesandCustompackages.
Outcome: Students will be able to solve real world problem using OOP techniques.

Unit-III:

Arrays: Creating & Using Arrays (1D, 2D, 3D and Jagged Array), Array of Object, ReferencingArrays Dynamically. Strings and I/O: Java Strings: The Java String class, Creating & Using StringObjects, Manipulating Strings, String Immutability & Equality, and Passing Strings to & fromMethods, String Buffer Classes and String Builder Classes.
IO package: Understanding StreamsFileclassand itsmethods,Creating,Reading,Writingusing

Classes: Byte and Character streams, File Output Stream, File Input Stream, File Writer, FileReader,InputStreamReader,PrintStream,PrintWriter.CompressingandUncompressing File.

Outcome: Students will be able to solve the various problems in array and string, working with file.

Unit-IV:
ExceptionHandling,Threading,NetworkingandDatabaseConnectivity:Exceptiontypes,unc aught exceptions, throw, built-in exceptions, creating your own exceptions; Multi-threading:TheThreadclassandRunableinterface,creatingsingleandmultiplethreads,Threadp rioritization, synchronizationandcommunication, suspending/resumingthreads.Usingjava.netpackage,OverviewofTCP/IPandDatagramprog ramming.Accessingandmanipulatingdatabasesusing JDBC.

Outcome: Students will be able to develop multithreaded applications with synchronization, working with how to handle exception.

Text Books:

✓ *E.Balagurusamy,"ProgrammingwithJava",TMH,4/Ed.*

Reference Books:

✓ *HerbertSchildt,"TheCompleteReferencetoJava",TMH,10/Ed.*

Core IV- Java Programming Lab

Write the following programs using Java

• Tofindthesumofanynumberofintegersenteredascommandlinearguments.

- Tofindthefactorialofa givennumber.
- Toconvertadecimaltobinarynumber.
- Tocheckifanumberisprimeornot,bytakingthenumber asinputfromthekeyboard.
- To find the sum of any number of integers interactively, i.e., entering every number fromthekeyboard,whereasthetotalnumberofintegersisgivenasacommandlineargument.
- Write a program that show working of different functions of String and String BufferclasseslikesetCharAt(),setLength(),append(),insert(),concat()andequals().
- Writea programto createa–"distance"classwith methodswheredistanceiscomputedin terms of feet and inches, how to create objects of a class and to see the use of thispointer.
- Modify the– "distance" class by creating constructor for assigning values (feet andinches) to the distance object. Create another object and assign second object as referencevariable to anotherobject reference variable. Further create a third object which is a cloneofthefirstobject.
- Write a program to show that during function overloading, if no matching argument isfound,thenJavawillapplyautomatictypeconversions (fromlowertohigher datatype).
- Write a program to show the difference between public and private access specifiers.The program should also show that primitive data types are passed by value and objectsarepassedbyreferenceandtolearn useoffinalkeyword.
- Write a program to show the use of static functions and to pass variable length argumentsinafunction.
- Write a program to create a multilevel package and also creates a reusable class togenerate Fibonacci series, where the function to generate Fibonacci series is given in adifferentfilebelongingto thesamepackage.
- Write a program – "Divide by Zero" that takes two numbers aand b as input,computes a/b,andinvokesArithmeticExceptiontogenerate amessagewhen thedenominatoriszero.
- Writeaprogramto showtheuseofnestedtrystatementsthatemphasizesthe sequenceofcheckingforcatchhandlerstatements.
- Writea programtocreateyourownexceptiontypestohandlesituation specifictoyourapplication (Hint: Define a sub class of Exception which itself is a sub class of Throwable).
- Writeaprogramtodemonstrateprioritiesamongmultiplethreads.
- Write a program to demonstrate different mouse handling event like mouseClicked (),mouseEntered (),mouseExited (),mousePressed (),mouseReleased ()& mouseDragged ().
- Writeaprogramtodemonstratedifferentkeyboardhandlingevents.
- Writeaprogramtodemonstratetheconceptofboxingandunboxing.
- Create a multi-file program where in one file a string message is taken as in put from theuserandthe functiontodisplaythemessageonthe screenisgiveninanotherfile(makeuseofScannerpackagein thisprogram).
- Write a program that creates illustrates different levels of protection in classes/sub

classesbelongingtosamepackageordifferentpackages

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Semester-III
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Core V   **Digital Logic**

Course Objectives:

Introduce theconcept of digital and binarysystems. Be able to design and analyzecombinational logic circuits. Be able to design and analyze sequential logic circuits.   Understandthebasicsoftwaretoolsfor

thedesignandimplementationofdigitalcircuitsandsystems.

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

- Convertdifferenttypeofcodesandnumbersystemswhichareusedindigitalcommunicationandcomputersystems.
- Compare different types of logic families which are the basic unit of different types of logic gates in the domainofeconomy,performanceand efficiency.
- Analyze different types of digital electronic circuit using various mapping and logicaltools and know the techniques to prepare the most simplified circuit using variousmappingand mathematicalmethods.
- Design different types of digital electronic circuits forparticularoperation.

Unit-I:

Character Codes, Decimal System, Binary System, Decimal to Binary Conversion, HexadecimalNotation, Boolean Algebra, Basic Logic Functions: Electronic Logic Gates, Synthesis of LogicFunctions, Minimization of Logic Expressions, Minimization using Karnaugh Maps, SynthesiswithNANDand NORGates,Tri-StateBuffers.
Outcome: Students will be able to understand the various types of number systems and their conversions and simplify Boolean expression and apply the Boolean theorems through logical gates.

Unit-II:

Arithmetic: Addition and Subtraction of Signed Numbers, Addition/ Subtraction Logic Unit,DesignofFastAdders:Carry-
LookaheadAddition,MultiplicationofPositiveNumbers,Signed-Operand Multiplication: Booth Algorithm, Fast Multiplication: Bit-Pair Recoding Multipliers,Carry-Save Addition of Summands, Integer Division, Floating-Point Numbers and Operations:IEEE Standard for Floating-point Numbers, Arithmetic Operations on Floating-Point Numbers,GuardBitsandTruncation,ImplementingFloating-PointOperations.
Outcome: Students will be able to design and implement variety of logical devices using combinational circuits concept.

Unit-III:

Flip-Flops, Gated Latches, Master-Slave Flip-Flops, Edge-Triggering, TFlip-Flops, JK FlipFlops. Registers and Shift Registers, Counters, Decoders, Multiplexers, Programmable LogicDevices(PLDs),ProgrammableArrayLogic(PAL),ComplexProgrammableLogic Devices (CPLDs),Field-ProgrammableGateArray (FPGA), SequentialCircuits,UP/DOWNCounters.
Outcome: Students will be able to analyze sequential circuits like registers and counters

using flip-flops.

Unit-IV:

Memory System: Semiconductor RAM Memories, Internal Organization of Memory Chips, StaticMemories,AsynchronousDRAMS,SynchronousDRAMS,StructureofLargeMemorie s,Memory System Considerations, RAMBUS Memory. Read-Only Memories: ROM, PROM,EPROM, EEPROM, Flash Memory, Speed, Size, and Cost of Memory. Secondary Storage:MagneticHardDisks,OpticalDisks,MagneticTapeSystems.
Outcome: Students will be able to demonstrate and compare the construction of programmable logic devices and different types of ROM and RAM.

Text Books:
✓ *Carl Hamacher,Z. Vranesic,S. Zaky:ComputerOrganization,5/e(TMH).*

Refence Books:
✓ *M.Morris Mano:DigitalLogicandComputerDesign,Pearson.*
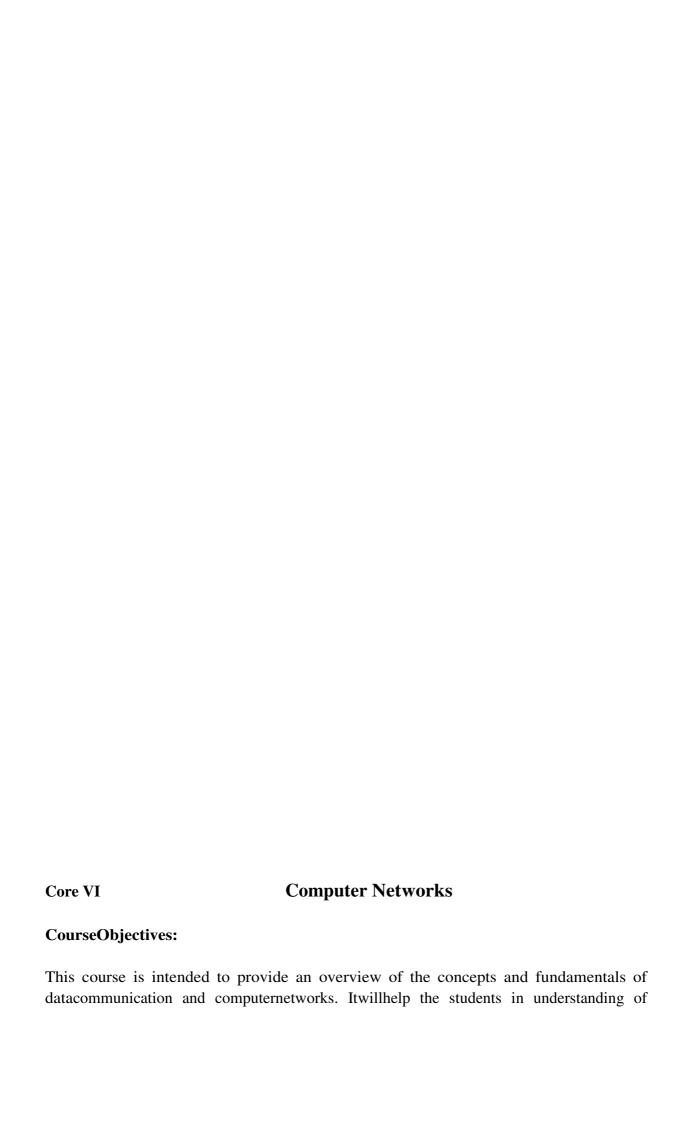
Core V- Practical/Tutorial: Digital Logic Lab

Introduction to Xilinx S/W (VHDL). Write the codes for the following using VHDL.

- Realizingalllogicgates.
- CombinationCircuit.
- ADDER.
- SUBTRACTOR.
- MUX.
- DE-MUX.
- Encoder.
- Decoder.
- PAL.
- PLA.

Also write the codes using VHDL for the following Sequential Logic Circuits:

- FlipFlops.
- ShiftRegisters.
- Counters.
- MemoryElements.

Core VI   **Computer Networks**

CourseObjectives:

This course is intended to provide an overview of the concepts and fundamentals of datacommunication and computernetworks. Itwillhelp the students in understanding of

various typesofcomputernetworks,differentcomponentsofcomputernetworks,variousprotocols,e-mailandcommunicationprotocols,networknamingandaddressing,moderntechnologiesused innetworkingand theirapplications.

Course Outcome: On completion of this course, the students will be able to

- Understandnetworkcommunicationusingthelayeredconcept,OpenSystemInterconnect(OSI)andtheInternetModel.
- Understandvarioustypesoftransmissionmedia,networkdevices.
- Understandtheconceptofflowcontrol,errorcontrolandLANprotocols.
- Explainthedesignofandalgorithmsusedinthephysical,datalinklayers.
- UnderstandtheworkingprinciplesofLANandtheconceptsbehindphysicalandlogicaladdressing,subnettingandsuper netting.
- AnalyzethecontentsinagivenDataLinklayerpacket,basedonthelayerconcept.
- Determinethevariousmodulationanderrordetectionandcorrectiontechniquesandtheirapplicationin communicationsystems.

Unit-I:

Introduction to Data Communications and Network Models: Protocols and Standards, Layers inOSI Models, Analog and Digital Signals, Transmission Modes, Transmission Impairment, DataRate Limits, Performance, Digital Transmission, Network Devices & Drivers: Router, Modem,Repeater,Hub,Switch,Bridge (fundamentalconceptsonly).
Outcome: Students will have the basic knowledge about computer network, causes of network errors, layers in networking and network devices & drivers.

Unit-II:

SignalConversion:Digital-to-DigitalConversion,Analog-to-DigitalConversion,Digital-to-analog Conversion, Analog-to-analog Conversion. Transmission Media: Guided Media, UnguidedMedia, Switching Techniques: Packet Switching, Circuit Switching, Datagram Networks, Virtual-CircuitNetworks,and StructureofaSwitch.
Outcome: Students will have the knowledge about how data transmission takes place through signals and use of switching techniques.

Unit-III:

Error Detection and Correction: Checksum, CRC, Data Link Control: Framing, Flow and ErrorControl, Noiseless Channels, Noisy channels, (Stop and Wait ARQ, Sliding Window Protocol,Go Back N, Selective Repeat) HDLC, Point-to-Point Protocol. Access Control: TDM, CSMA/CD,andChannelization (FDMA,TDMA,andCDMA).
Outcome: Students will come to know about identifying and correcting errors occurred

during data transmission.

Unit-IV:

NetworkLayer:LogicalAddressing,IPv4Addresses,IPv6Addresses,Virtual-CircuitNetworks:Frame Relay and ATM, Transport Layer: Process-Process Delivery: UDP, TCP. Applicationlayers: DNS, SMTP, POP, FTP, HTTP, Basics of WiFi (Fundamental   concepts   only), NetworkSecurity:Authentication,BasicsofPublicKeyandPrivateKey,DigitalSignaturesand Certificates(Fundamentalconceptsonly).

Outcome: Students will able to understand various protocols used in network to transmit different types of data.

TextBooks:
  ✓ *DataCommunicationsandNetworking,FourthEditionbyBehrouza A. Forouzan,T*

ReferenceBooks:
  ✓ *ComputerNetworks,A.S.Tanenbaum, 4thedition,PearsonEducation.*

Core VI- Computer Network Lab using C/C++/any Simulator

- SimulateEvenParitygeneratorandchecker.
- Simulatetwo-dimensionalParitygeneratorandchecker.
- Simulatechecksumgeneratorandchecker.
- SimulateHammingcodemethod.
- SimulateCyclicRedundancyCheck(CRC)errordetectionalgorithmfornoisychannel.
- Simulateandimplementstopandwaitprotocolfornoisychannel.
- Simulateandimplementgobackslidingwindowprotocol.
- Simulateandimplementselectiverepeatslidingwindowprotocol.
- Simulateandimplementdistancevectorroutingalgorithm.

CoreVII   Business Accounting

Course Objectives:

The objective of this course is to introduce problems of financial accounting such asmeasuring   andreportingissues   relatedtoassets   and   liabilities andpreparingthefinancialstatements. Students are expected to gain the ability of using

accounting information as a tool inapplying solutions for managerial problems, evaluating the financial performance, and interpretingthefinancialstructure.

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

- Enablethestudentslearnbasicaccountingprinciples,concepts,principlesandconventions.
- PracticeFinancialandManagementaccountingapplications.
- Constructthefinancialstatementsofcompany.
- AbletounderstandtheprovisionsofCompaniesAct,1956.
- Exposureonthedifferentaccountingsoftwarepackages.

Unit-I:

Introduction: Financial Accounting-definition and Scope, objectives of Financial Accounting,Accounting v/s Book Keeping terms used in accounting, users of accounting information andlimitationsofFinancialAccounting.Conceptual Framework: Accounting Concepts,Principles and Conventions, Accounting Standards concept, objectives, benefits, briefer view ofAccounting Standards in India, Accounting Policies, Accounting as a measurement discipline,valuationPrinciples,accountingestimates.
Outcome: The students will be able to learn basic accounting principles, concepts, principles and conventions which used in business transactions and its applications.

Unit-II:

Recording of transactions: Voucher system; Accounting Process, Journals, Subsidiary Books,Ledger, Cash Book, BankReconciliation Statement, Trial Balance.Depreciation:Meaning,
need&importanceofdepreciation,methodsofchargingdepreciation.
Outcome: The students will be able to prepare trial balance, bank reconciliation statement, identify and rectify the errors in bank reconciliation statement and also understand methods of charging Depreciation.

Unit-III:

Preparation of final accounts: Preparation of Trading and Profit & Loss Account and BalanceSheetofsoleproprietary business.
Outcome: The students will be able to prepare financial statements in accordance with generally accepted accounting principles, employ critical thinking skills to analyze financial data as well as the effects of differing financial accounting methods on the financial statements.

Unit-IV:

IntroductiontoCompanyFinalAccounts:ImportantprovisionsofCompaniesAct,1956inrespect of preparation of final accounts, Understanding of final accounts of a company. anoverviewofcomputerizedaccountingsystem–Salient featuresandsignificance

Outcome: The students will be able to understand the provisions of companies act 1956, significance and application of computerized accounting system.

Text Books:
- ✓ *AnilChowdhry,"FundamentalsofAccounting&FinancialAnalysis",PearsonEducation.*
- ✓ *Agarwal,R.Srinivasan,"AccountingMadeEasy",TMH*

Reference Books:

- ✓ *AmrishGupta,"Financial AccountingforManagement",PearsonEducation*
- ✓ *S.N.Maheshwari, "FinancialAccountingforManagement:VikasPublishingHouse*

Core VII- Business Accounting

- IntroductiontoTally,FeaturesandVersionsofTally.
- ComponentsofTallyScreen,Creation,Alteration&DeletionofCompany.
- PrimaryGroup&Subgroup,Creation.
- Alteration&DisplayofLedgerAccounting.
- RecordingofTransactionsthroughvouchers.
- DisplayofFinancialreportsF11andF12configuration.
- IntroductiontoInventorysystem:AdvantagesofmaintaininginventorysysteminTallystock groupStockcategory,stockitemunitsofmeasure,creationofinventorysystem.

Semester-IV
Core VIII   **Database Systems**

Course Objectives:

Toexplainbasicdatabaseconcepts,applications,datamodels,schemasandinstances.Todemonstrate the use of constraints and relational algebra operations. Describe the basics of SQLand construct queries using SQL. To emphasize the importance of normalization in databases. Tofacilitate students in Database design. To familiarize issues of concurrency

control and transactionmanagement.

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

- ApplythebasicconceptsofDatabaseSystemsandApplications.
- Usethebasics ofSQLandconstructqueries usingSQL indatabasecreationandinteraction.
- Designacommercialrelationaldatabasesystem(Oracle,MySQL)bywritingSQLusingthes ystem.
- AnalyzeandSelectstorageandrecoverytechniquesofdatabasesystem

Unit-I:

Introduction to Database and Database Users, Database System Concepts and Architecture: dataModels, schema, and instances, Conceptual Modeling and Database Design: Entity Relationship(ER)Model:EntityTypes,EntitySets,Attributes,Keys, RelationshipTypes,RelationshipSets, Roles and Structural Constraints, Weak Entity Types, ER Naming Conventions. Enhanced Entity-Relationship(EER)Model.
Outcome: Students will understand the database, its types, uses and applications. They will able to understand various data models.

Unit-II:

DatabaseDesignTheoryandNormalization:FunctionalDependencies, JoinDependencies,Normal Forms based on Primary Keys, Second and third Normal Forms, Boyce-Codd NormalForm,MultivaluedDependencyandFourthNormalForm.
Outcome: Students will understand details of database design and will be able to design the real time data using various normal forms.

Unit-III:

Relational data Model and SQL: Relational Model Concepts, Basic SQLs, SQL Data Definitionand Data types, Constraints in SQL, Retrieval Queries in SQL, INSERT, DELETE, UPDATEStatements in SQL, Relational Algebra and Relational Calculus: Unary Relational Operations:SELECT andPROJECT,BinaryRelation:JOINandDIVISION.
Outcome: Students will able to access and manipulate the data using SQL.

Unit-IV:

IntroductiontoTransactionProcessingConceptsandTheory:IntroductiontoTransactionProce ssing, Properties of Transactions, Recoverability, Serializability, Concurrency Control:lockingtechniquesandTime-Stamp Ordering.

Outcome: Students will learn about transaction processing in real world, how to handle data when more than one user accessing the same database using various methods.

Text Books:

- ✓ *FundamentalsofDatabaseSystems,6thedition,RamezElmasri,Shamkant   B. Navathe,PearsonEducation.*

ReferenceBooks:

- ✓ AnIntroductiontoDatabaseSystem,DateC.J.-PearsonEducation,NewDelhi-2005.

Database Systems
Createandusethefollowingdatabaseschemastoanswerthegivenqueries.

EMPLOYEESchema			
Field	**Type**	**NULLKEY**	**DEFAULT**
Eno	Char (3)	NO	PRI
Ename	Varchar(50)	NO	
Job_type	Varchar (50)	NO	
Manager	Char (3)	Yes	FK
Hire_date	Date	NO	
Dno	Integer	YES	FK
Commission	Decimal (10,2)	YES	
Salary	Decimal (7,2)	NO	
DEPARTMENTSchema			
Field	**Type**	**NULLKEY**	
Dno	Integer	No	PRI
Dname	Varchar (50)	Yes	

Location	Varchar (50)	Yes	

QueryList:

- Query to display EmployeeName, Job, HireDate, EmployeeNumber; for each employee with the EmployeeNumber appearing first.
- Query to display unique Jobs from the Employee Table.
- Query to display the EmployeeName concatenated by a Job separated by a comma.
- Query to display all the data from the Employee Table. Separate each Column by a comma and name the said columns as THE_OUTPUT.
- Query to display the EmployeeName and Salary of all the employees earning more than
- $2850.
- Query to display EmployeeName and DepartmentNumber for the EmployeeNo=7900.
- Query to display EmployeeName and Salary for all employees whose salary is not in the range of $1500 and $2850.
- Query to display EmployeeName and DepartmentNo. of all the employees in Dept10 and Dept30 in the alphabetical order by name.
- Query to display Name and HireDate of every Employee who was hired in 1981.
- Query to display Name and Job of all employees who don't have a current Manager.
- Query to display the Name, Salary and Commission for all the employees who earn commission.
- Sort the data in descending order of Salary and Commission.
- Query to display Name of all the employees where the third letter of their name is 'A'.
- Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No=30 or their Mangers EmployeeNo=7788.
- Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
- Query to display the CurrentDate.
- Query to display Name, HireDate and SalaryReviewDate which is the 1st Monday after six months of employment.
- Query to display Name and calculate the number of months between today and the date each employee was hired.
- Query to display the following for each employee <E-Name> earns <Salary> monthly but wants <3*CurrentSalary>. Label the Columns as DreamSalary.
- Query to display Name with the 1st letter capitalized and all other letter lowercase and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
- Query to display Name, HireDate and Day of the week on which the employee started.
- Query to display Name, DepartmentName and DepartmentNo for all the employees.
- Query to display Unique Listing of all Jobs that are in Department #30.
- Query to display Name, DepartmentName of all employees who have an 'A' in their name.

- Query to display Name, Job, Department No. and Department Name for all the employees working at the Dallas location.
- Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees Name who do not have a Manager.
- Query to display Name, Department No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
- Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies $100.
- Query to display the Highest, Lowest, Sum and Average Salaries of all the employees.
- Query to display the number of employees performing the same Job type functions.
- Query to display the no. of managers without listing their names.
- Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
- Query to display Name and HireDate for all employees in the same dept. as Blake.
- Query to display the Employee No. And Name for all employees who earn more than the average salary.
- Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
- Query to display the names and salaries of all employees who report to King.
- Query to display the department no, name and job for all employees in the Sales department.

Core IX   Organizational Behaviour

Course Objectives:

The objective of this course is to learn the modern trends, theories and changes in organizational behaviour. This course covers the explanations about the human behavior in the organizational context. It details the impact of individual, group and organizational factors on human behavior. The course also focuses on understanding the behavior of the employees working in the organization. It highlights the significance of Challenges and Opportunities of OB, perception, attribution, learning, organizational change, organizational culture, motivation, leadership and conflict management.

Course Outcome: On completion of this course, the students will be able to:

- Understand the behaviour of people in the organization.
- Analyze the complexities associated with management of individual behaviour in the organization.

- Understandthemotivation(why)behindbehaviourofpeopleintheorganization.
- Covertheexplanationsabouthumanbehaviorintheorganizationalcontext.
- Impactofindividual,groupandorganizationalfactorsonhumanbehavior.
- Understand the concept of personality, learning and attitude.

Unit-I:

Organizational Behaviour- Meaning, Definition and importance, Foundations of OB,OBModels,andChallengestoOB.
Outcome: The students will be able to understand the conceptual framework of the discipline of OB, OB Models and its practical applications in the organizational set up.

Unit-II:

IndividualBehaviour: Perception: Definition &Concept; Personality: Concept, Determinants and Personality Types(Type A and Type B, Big Five Model,MBTI Model); Learning: Concept and Theories (ClassicalandOperantConditioning);Attitude:Components&Formation.
Outcome: The students will be able tointerpret key concepts and theories of perception, learning with regard to individual differences and apply these appropriately to specific situations.

Unit-III:

GroupBehaviour:
GroupDynamics:Meaning,FormationandTypesofGroups(Formal&InformalGroups),Stagesof Group Development, Individual vs. Group decision making. Group vs Team. Typesof Team.**Group Communication:** CommunicationTypes,CommunicationProcess,Barrierstocommunication;EffectiveComm unicationMethods.
Outcome: The students will be able to interpret the key concepts and theories with regard to group behaviour and apply these appropriately to specific situations.

Unit-IV:

Motivation-Meaning, Nature &Importance. Motivational Theories (Maslow's Need HierarchyTheory, Herzberg's two factor Theory, McClelland's Need Theory, Vroom's Expectancy Theory,Equity Theory); Motivational Challenges. **Leadership -** Leadership: Nature and Importance;LeadershipStyles;LeadershipTheories(TraitTheory,BehaviourTheory,Contin gencyTheory).
Outcome: The students will be able to understand how the organizational behavior can integrate in understanding the motivation behind behavior of people in the organization. Students also able to identify and develop effective motivational and leadership skills.

Text Books:

- ✓ *OrganizationalBehaviour:L.M.Prasad*
- ✓ *OrganizationalBehaviour:Rao&Narayana*
- ✓ *OrganizationalBehaviour:GuptaandJoshi (KP)*

Reference Books:

- ✓ *OrganizationalBehaviour:KAswathappa(HPH)*
- ✓ *OrganizationalBehaviour:StephenRobbins(PHI)*

Core IX- Project Work
Organizational Behavior

GuidelinesforProject

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developability to apply multidisciplinary concepts,tools and techniques to solve organisationalproblems.Theproject maybefromanyoneofyourareasrelatedtotheconcernedsubject.

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Index of Chapters:

- Chapter- I:Introduction&Reviewofliterature s
- Chapter-II: ResearchMethodology
- Chapter-III:Conceptual& TheoreticalDescriptions
- Chapter- IV:DataAnalysis&Interpretatio

ns
- Chapter-V:Conclusion,Findings,suggestions&Scopeforfurtherresearch.
- Chapter-VI: References, Annexures etc.

Core X   Foundation of Data Science and Data Analytics

Course Objectives:

This course is intended to understand data management like data collection, processing, analysis, interpretation and visualization by applying quantitative modelling and data analysis techniques for real world business problems. The course also provides the knowledge of statistical data analysis techniques utilized in business decision making.

Course Outcome: On completion of this course the students will be able to

- Explain various software tools for data storage, analysis and
- Visualize the data.
- Choose EDA, inference and regression techniques.
- Apply R programming for analyzing statistical data for business decisionmaking.
- Analyze different clustering methods for big data sets.

Unit-I:
Definition of Big Data, Big data characteristics & considerations, Data Repositories – analyst perspective, Business drivers for analytics, Typical analytical architecture, Business Intelligence Vs Data Science, Drivers of Big Data analytics, Role of data scientist in Big data ecosystem, Application of Big data analytics.
Outcome: The students will have to get Fundamentals of Big Data, Use software tools for data storage, analysis and visualization in big-data analytics.

Unit-II:
Need of Data analytic lifecycle, Key roles for successful analytic project, various phases of Data analytic lifecycle: Discovery, Data Preparation, Model Planning, Model Building, Communicating Results, Operationalization.
Outcome: The students can utilize EDA, inference and regression techniques.

Unit-III:
Introduction to R: GUI of R, Getting data into & out of R, Data types in R, Basic operations, Descriptive Statistics.
Outcome: The students can apply R programming for analyzing statistical data for business decision making.

Unit-IV:
Overview of Clustering, K- means, Association Rules, Apriori Algorithm, Linear Regression, Logistic Regression.
Outcome: The students can understand different clustering methods for big data sets.

Text Book:

- ✓ *David Dietrich, Barry Hiller, "Data Science & Big Data Analytics", EMC education services, Wiley publications,2012*

Reference Book:

- ✓ *Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.*

Core XI   **Web Technology**

Courseobjectives:

On completion of this course, a student will be familiar with client server architecture andable to develop a web application using web technologies. Students will gain the skills and project-based experience needed for entry into web application and development careers.Students areabletodevelopadynamicwebpagebytheuseofjavascript.

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

- Analyzeawebpageandidentifyitselementsandattributes.
- CreatewebpagesusingHTMLandCascadingStyleSheets.

- Builddynamicwebpagesusing JavaScript(Client - s i d e programming).
- WorkwithPHPapplication(Server-sideProgramming)foranydatabaseoperation.

Unit-I:

Web Essentials: Clients, Servers and Communication: The Internet –Basic Internet protocols–TheWWW,HTTPrequestmessage–responsemessage,webclient'swebservers–casestudy.Introduction to HTML: HTML, HTMLdomains,basicstructureof an HTML document–creatingan HTML document, mark up tags, heading, paragraphs, line breaks, HTML   tags.   Elements ofHTML,workingwithtext,lists,tablesandframes,workingwithhyperlink,imagesandmultim edia,formsand controls.
Outcome: Students will be able to explain client and server-side communication and able to design web applications

Unit-II:

Introduction to cascading style sheets: Concepts of CSS, creating style sheet, CSS properties, CSSstyling(background,textformat,controllingfonts),workingwiththeblockelementsandobjects . Working who lists and tables, CSS ID and class. Box model (introduction, border properties,padding properties, margin properties), CSS colour, groping, Dimensions, display, positioning,floating,align,pseudoclass,Navigationbar,imagesprites
Outcome: Students will be able to design web pages using CSS and BOX model

Unit-III:

Java scripts: Client-side scripting, what is java script, simple java script, variables, functions,conditions, loops and repetitions. Java scripts and objects, java script own objects, the DOM andweb browser environment, forms and validations. DHTML: Combining HTML, CSS, java scripts,eventsand buttons,controlling yourbrowser.
Outcome: Students will be able to integrate java script in a web page and check for validation (Client-side programming)

Unit-IV:

PHP: Starting to script on server side, PHP basics, variables, data types, operators, expressions,constants, decisions and loop making decisions. Strings – creating, accessing strings, searching,replacing and formatting strings. Arrays: Creation, accessing array, multidimensional arrays, PHPwithDatabase.
Outcome: Students will be able to explain server-side scripting and their applicability

TextBook:

- ✓ *WebTechnologies–BlackBook–DreamTechPress*
- ✓ *MattDoyle,BeginningPHP5.3(wrox-Willeypublishing)*
- ✓ *JohnDuckett,BeginningHTML,XHTML,CSSandJavascript.*

ReferenceBook:

- ✓ *HTML,XHTMLandCSSBible,5ed, Willey India-Steven M. Schafer.*

Core XI- Project Work

WebTechnologyLab

- Acquaintancewithelements,tagsandbasicstructureofHTMLfiles.
- Practicingbasicandadvancedtextforformatting.
- Practiceuseofimage,videoandsoundinHTMLdocuments.
- Designingofwebpages-Documentlayout,list,tables.
- PracticingHyperlinkofwebpages,workingwithframes.
- Workingwithformsandcontrols.
- Acquaintancewithcreatingstylesheet,CSSpropertiesandstyling.
- Workingwithbackground,text,font,listproperties.
- Working withHTMLelementsboxpropertiesinCSS.
- Developsimplecalculatorforaddition,subtraction,multiplicationanddivisionoperatio nusing javascript.
- Create HTML page with java script which takes integer number as a input and tellswhetherthenumberisodd oreven.
- Create HTML page that contains form with fields name, Email, mobile number, gender,favorite colour andbutton;now write a javascript code to validate each entry.Also
  writeacodetocombineanddisplaytheinformationintextboxwhenbuttonisclicked.
- Write a PHP program to check if number is prime or not.
- Write a PHP program toprintfirsttenFibonaccinumbers.
- CreateaMySQLdatabaseandconnectwithPHP.
- WritePHP scriptforstoringandretrievinguserinformationfromMySQLtable.
- WriteaHTMLpagewhichtakesName,Address,Emailand Mobilenumberfromuser(registerPHP).
- StorethisdatainMySQLdatabase.
- NextpagedisplaysalluserinHTMLtableusingPHP(display.PHP).
- UsingHTML,CSS,Javascript,PHP,MySQL,designanauthenticationmoduleofawebpage .

Core XII   **Software Engineering**

Course Objectives:

Basic knowledge and understanding of the analysis and design of complex systems. Toapply software engineering principles and techniques. Ability to develop, maintain and evaluatelarge-scale software systems. Toprovide the ideaof decomposing the givenproblem intoAnalysis,Design,Implementation,TestingandMaintenancephases.Toprovideanideaofusing various process models in the software industry according to given circumstances. To gain theknowledge of how Analysis, Design, Implementation, Testing and Maintenance processes areconducted in asoftware project.To perform independentresearch and analysis.Ability to work asaneffectivememberorleaderofsoftwareengineeringteams.

Course Outcome: On completion of this course, the students will be able to

- Understand of software process models such as waterfall and evolutionarymodelisrequired.
- Understand the problem statement and able to describe the Requirementanalysis,creatingadatamodel,usecases,computingfunctionpoint,effort,architecturaldesignandpath testingofasoftwareproject.
- Learn about SoftwarerequirementsandSRSdocuments.
- Understand project management's responsibilities, which includes planning,scheduling,riskmanagement,andso on.
- Explain thedifferencesbetweendatamodels,objectmodels,contextmodels, andbehavioralmodels.
- Familiarwithimplementationdifficultieslikemodularityandcodingstandards.
- Gain knowledgeofverificationandvalidationmethods,suchasstaticanalysisandreviews.
- Know about different softwaretestingmethodologiessuchasunitandintegratedtesting etc.
- Describehowto measuresoftwareandhowtoavoidsoftwarerisks.

Unit-I:

Introduction: Evolution of Software to an Engineering Discipline, software development projects,Software Lifecycle Models: Waterfall Model and its Extensions, Rapid Application Development(RAD),AgileDevelopmentModels,SpiralModel.
Outcome: Students will be able to understand fundamental principles of Software engineering discipline & get an idea of various life cycle models used in software development.

Unit-II:

Software Project Management: Software Project Management Complexities, Responsibilities of
aSoftwareProjectManager,ProjectPlanning,MetricsforProjectSizeEstimation,ProjectEstimationTechniques,EmpiricalEstimationTechniques,COCOMO,Halstead'sSoftwareScience, Staffing Level Estimation, Scheduling, Organization and Team Structures, Staffing, RiskManagement,SoftwareConfigurationManagement.
Outcome: Students will get a brief idea of various project management activities & will understand various cost estimation techniques, organization team structure and management of staff & risk handling.

Unit-III:

RequirementAnalysisandSpecification:RequirementsGatheringandAnalysis,SoftwareReq uirement Specifications, Formal System Specification Axiomatic Specification, AlgebraicSpecification,ExecutableSpecificationand4GL.SoftwareDesign:DesignProcess, CharacterizeaGoodSoftwareDesign,CohesionandCoupling,LayeredArrangementsofModu les,ApproachestoSoftwareDesign(FunctionOriented&Object-Oriented).

Outcome: Students will get knowledge of various requirement analysis techniques and design process during software development work.

Unit-IV:

Coding and Testing: Coding: Code Review, Software Documentation, Testing, Unit Testing,Black Box and White Box Testing, Debugging, Program Analysis Tools, Integration Testing,SystemTesting,SoftwareMaintenance.

Outcome: The students will understand of coding and testing process & will able to learn maintenance in software development projects.

TextBook:

- ✓ *FundamentalofSoftwareEngineering,RajibMall,FifthEdition,PHIPublication,India.*

ReferenceBooks:

- ✓ *SoftwareEngineering–IanSommerville,10/Ed, Pearson.*
- ✓ *SoftwareEngineeringConceptsandPractice– UgrasenSuman,CengageLearningIndiaPvt,Ltd.*

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Core XII- Project Work

Software Engineering

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GuidelinesforProject

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developabilitytoapplymultidisciplinaryconcepts,toolsandtechniquestoimplementsoftwaree ngineering.Theprojectmaybefromanyoneofyourareasrelatedtotheconcernedsubject.

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SampleProjects:

- *CriminalRecordManagement:Implementacriminalrecordmanagementsystemforjailers ,policeofficersandCBIofficers.*
- *Route Information:Online informationaboutthebus routes andtheirfrequency and fares*
- *CarPooling:Tomaintainaweb- basedintranetapplicationthatenablesthecorporateemployeeswithinanorganizationt oavailthefacilityofcarpoolingeffectively.*
- *PatientAppointmentandPrescriptionManagementSystem*
- *OrganizedRetailShoppingManagementSoftware*
- *OnlineHotelReservationServiceSystem*
- *ExaminationandResultcomputationsystem*
- *AutomaticInternalAssessmentSystem*
- *ParkingAllocationSystem*
- *WholesaleManagementSystem*

Core XIII   **Digital Marketing**

CourseObjective:

The key aim of this course is to understand the concepts of marketing management, to learnabout the marketing process for different types of products and services, to understand   the toolsusedbymarketingmanagersindecisionsituationsandtounderstandthemarketingenvironmen t.

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

- Demonstratestrongconceptualknowledgeinthefunctionalareaofmarketingmanageme nt.
- Demonstrateeffectiveunderstandingofrelevantfunctionalareasofmarketingmanagem entanditsapplication.
- Demonstrateanalyticalskillsinidentificationandresolutionofproblemspertainingtoma rketing management.

- Understand the 'Marketing mix' elements and the strategies and principles underlying the modern marketing practices.
- Explore for themselves the role of a marketing manager and the boundaries of marketing

Unit-I:

Marketing: Objectives of Marketing, Marketing vs Selling, Marketing Environment, Consumer Behaviour, Consumer Buying Process, Factors influencing consumer decision making,

Product: Product concept, Product classification, New Product Development, Product life cycle, Product mix.

Outcome: The students will be able to identify core concepts of marketing and the role of marketing in business and society. able to analyse the impact of different environmental factors, factors affecting consumer buying behavior, and different strategies related to product and its application.

Unit-II:

Price: Objective of pricing, Factors Influencing Product Pricing, Pricing policies. Distribution: Channel of Distribution-Meaning and Importance, Types of Distribution Channel.

Promotion: Meaning, Importance of Promotion, Types of Promotion, Factors affecting promotion mix decisions.

Outcome: The students will be able to develop marketing strategies based on price, place and promotion objectives. Develop analytical skills in identification and resolution of problems pertaining to price, place and promotion mix.

Unit-III:

Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape. Fundamentals of Social Media Marketing & its significance, Facebook Marketing-Different types of Ad formats, LinkedIn Marketing- LinkedIn Strategy, Twitter Marketing- Twitter usage, Twitter Ads, Twitter ad campaigns.

Outcome: The students will be able to use the digital platform in the optimal way to formulate possible solutions to marketing problems faced by several firms and also able to Identify and utilize various tools through social media.

Unit-IV:

Digital Advertising, Different Digital Advertisement, Performance of Digital Advertising: - Process & players, Display Advertising Media, Digital metrics. **YouTube Advertising:** - YouTube Channels, YouTube Ads, Type of Videos, Buying Models, Targeting & optimization, Designing & monitoring Video Campaigns, Display campaigns

Outcome: The students will be able to explain the key digital marketing activities needed for competitive success and also Leverage digital strategies to gain competitive advantage for business and career. Able to initiate marketing strategies through the use of Social Media Platform like Face book, Twitter, YouTube & LinkedIn etc.

TextBooks:
- ✓ *MarketingManagementinIndianContext,Sontakki,KP*
- ✓ *MarketingManagement,Karunakaran,*
- ✓ *DigitalMarketing–KamatandKamat-Himalaya*
- ✓ *DigitalMarketing,S.Gupta,McGraw-Hill*

ReferenceBooks:
- ✓ *MarketingManagement,Kotler,Keler,Koshi,Jha,Pearson*

Core XIII- Project Work

DigitalManagement

Guidelinesfor the Project:

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developability to apply multidisciplinary concepts, tools and techniques to solve organizational problems.Theproject maybefromanyoneofyourareasrelatedtotheconcernedsubject.

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- Chapter-
  V:Conclusion,Findings,suggestions&Scopeforfurtherresearch
  .
- Chapter-VI: References, Annexures, etc.

Semester VI
Core XIV   **Theory of Computation**

CourseObjectives:

ThiscoursefocusesonthebasictheoryofComputerScienceandformalmethodsofcomputationl
ikeautomatatheory,variousmachines,grammarsandTuringMachines.Toexplorethetheoretic
al foundations of computer science from the perspective of formal languages and
classifymachinesbytheirpowertorecognizelanguages.

CourseOutcomes: On completion of this course, the students will be able to
- Understandthebasicpropertiesofformallanguagesandgrammars.
- Differentiate among regular,context-freeand recursivelyenumerablelanguages.
- Makegrammars toproducestrings from aspecific language.
- Minimizethefiniteautomata.
- Acquireconceptsrelatingtothetheoryofcomputationandcomputationalmodelsincl
  uding decidabilityandintractability.
- DesignanddealwithTuringmachines.

- Getthebasicfoundationofcompilerdesign.

Unit-I:

Alphabet,Languages,Grammars,FiniteAutomata(DFA,NFA),Regularoperations,RegularLanguages/Grammars, RegularExpressions,FiniteAutomatonWithἐ-Moves,EquivalenceofNFAandDFA.

Outcome: The students will be able to understand the basic properties of formal languages and grammars, DFA & NFA.

Unit-II:

Minimization of Finite Automata, Closure Properties of Regular operations, Pumping Lemma ofRegularLanguages,ContextFreeGrammars,ContextFreeLanguages,DerivationTress,Ambiguity,PropertiesofContext FreeLanguages,LeftandRightLinearGrammars.

Outcome: The students can minimize the finite automata, understand Pumping lemma and Right linear and Left Linear grammar.

Unit-III:

Chomsky Normal Form (Elimination of Useless Symbols, Unit Productions, Null Productions),Pushdown Automata, Deterministic Pushdown Automata, Equivalence of Pushdown AutomataandContextFreeLanguages.

Outcome: The students can be able to Design Push down automata, convert a grammar to CNF'

Unit-IV:

Turing Machines, Turing Computability, Type 0 Languages, Techniques for Turing MachineConstruction, MultiheadAndMultitape Turing Machines, Church Turing thesis, Recursive andRecursivelyEnumerableSet, ChomskyHierarchyofLanguages.

Outcome: The students will be able to Design and deal with Turing machines. Get the basic foundation of compiler design, Differentiate regular, context-free and recursively enumerable languages.

Text Books:
- ✓ *IntroductiontothetheoryofComputation,MichaelSipser,CengageLearning.*
- ✓ *IntroductiontoAutomataTheory,LanguagesandComputation,J.E.Hopcrpftand J.D. Ullman,PearsonEducation,3rdEdition.*

Reference Books:
- ✓ *JFLAP-AnInteractiveFormalLanguagesandAutomataPackageRodger,Finley,ISBN:0*

Core XIV- Practical/Tutorial:TheoryofComputationLab
Use Java Formal Language and Automata Language (FLAP) software Package (can be downloadedfrom<u>www.jflap.org</u>)tocarryoutthefollowingexperiments:

- RegularLanguage-Create:DFA,NFA,RegularGrammar,andRegularExpression.
- RegularLanguage–conversions:NFAtoDFAtoMinimalDFA,NFAtoregularexpression &viceversa.
- NFAtoregulargrammar&vice-versa.
- Context-freelanguage–create:push-downautomaton,context-freegrammar.
- Context-free language – transform: PDA to CFG, CFG to PDA (LL parser), CFG to PDA(SLR Parser), CFG to CNF, CFG to LL parse table and parser, CFG to SLR parse tableandparser.
- Recursively Enumerable language: Turing machine (1 tape), Turing machine (multi tape),Turingmachine(buildingblocks),unrestrictedgrammar.

Core XV   **PythonProgramming**

CourseObjectives:
ToacquireprogrammingskillsincorePython.ToacquireObjectOrientedSkillsinPython.Tode veloptheabilitytowritedatabaseapplicationsin Python.

Course Outcome:
On completion of this course, the students will be able to
- ExplainbasicprinciplesofPythonprogramminglanguage.
- Implementobject-orientedconcepts.
- ImplementdatabaseandGUIapplications

Unit-I:

Python: Features of Python , Installing Python for windows and setting up paths, writing andExecuting of a python programs, Python Virtual machine, Frozen binaries, Comparison betweenC,Javaandpython,Comments,Docstrings,Howpythonseesvariables,DatatypesinPyt hon,builtintypes,sequencesinpython,sets,literalsinPython,userdefineddatatypes, identifiers

&reserved words,Naming conventioninpython.

Outcome: Students will be able to understand the syntax and basic concepts of python programming language.

Unit-II:

VariousOperatorsinPython,Input&Output,Controlstatements,ifstatements,whileloop,forloop, infinite loop, nested loop, else suit, break, continue, pass, assert, return statements, commandlinearguments.
Arraysinpython,advantagesusingarrays,creatingarrays,importingthearraymodule,indexing andslicingonarrays,Processingthearrays,Comparingarrays.
Strings in Python, creating strings, Length of a string, indexing in strings, slicing strings,ConcatenationandComparingstrings,FindingSubStrings, ReplacingaString.

Outcome: Students will be able to build basic programs using fundamental programming constructs

Unit-III:

Functionsin
Python,defineafunction,callingafunction,returnfromfunction,passbyobjectReference, Positionalarguments,Defaultarguments,   Recursivefunctions.
IntroductiontoOOP,featuresofOOP,creatingclasses,theself-
variable,constructor,typesofvariables,namespaces,typesofmethods.

Outcome: Students will be able to articulate the OOPs concepts as well as use of functions.

Unit-IV:

Inheritance: Defineinheritance,typesofinheritance,and constructorsininheritance,overridingsuperclassconstructors&methods,thesuper   () method,MRO
Polymorphism:DucktypingphilosophyofPython,operatoroverloading,methodoverriding,interfacesin python.
Exceptions: Errors in a python program, Exceptions, Exception handling, Types of Exceptions,theExceptionblock,theassertstatement,userdefinedexceptions.

Python Database Connectivity: DBMS, types of databases used with Python, installation ofMySQL database, setting path, verifying MySQL, installing MySQL connector, working withMySQL database, Using MySQL from python, retrieving rows, deleting rows, updating rows in atable.

Outcome: Students will be able to articulate the OOPs concepts such as inheritance and able to know how to handle exception and python database connectivity.

TextBooks:
✓ *T.Budd,ExploringPython,TMH,1stEd,2011.*

✓ *CorePythonProgramming,Dr.R.NageswarRao,DreamtechPress.*
✓ *PythonProgrammingforAbsoluteBeginners,MichaelDawson,CENGAGELe arning.*

ReferenceBooks:

✓ *Allen Downey, Jeffrey Elkner, Chris Meyers, How to think like a computer scientist: LearningwithPython,Freelyavailable online.2012.*

OnlineReferences:

✓ *Python Tutorial/Documentation www.python.or 2015*
✓ *http://docs.python.org/3/tutorial/index.html*
✓ *http://interactivepython.org/courselib/static/pythonds*
✓ *http://www.ibiblio.org/g2swap/byteofpython/read/*

Core XV- SoftwareLabbasedonPythonProgramming

- Write a menu driven program to convert the given temperature from Fahrenheit to Celsiusandviceversadependinguponuser'schoice.

- Write a Program to calculate total marks, percentage and grade of a student. Marksobtained ineach of the threesubjects are to be input by the user. Assign grades accordingtothefollowing criteria: GradeA:Percentage>=80, GradeB:Percentage>=70and<80GradeC:Percentage>=60and<70GradeD:Percentage>=40and<60GradeE:Percentage<40.

- Write a menu-driven program, using user-defined functions to find the area of rectangle,square,circleandtrianglebyacceptingsuitableinput parametersfromuser.

- WriteaProgramtodisplaythefirstntermsofFibonacciseries.

- WriteaProgramtofindfactorialofthegivennumber.

- WriteaProgramto findsumofthefollowing seriesfornterms:1–2/2! +3/3! -----

- WriteaProgramtocalculatethesumandproductoftwocompatiblematrices.

- InstallMySQLandconnector   and writePythonprogramstoretrieve,inserting,delete,updaterowsin atable.

Core XVI   **AdvancedComputerArchitecture**

Course Objectives:

The students will understand the Concept of Parallel Processing and its applications. The students will able to implement the Hardware for Arithmetic Operations and can analyze the performance of different scalar Computers. Also, they can develop the Pipelining Concept for a given set of Instructions.

Course Outcomes:

On completion of this course, the students will be able to

- Demonstrateconceptsofparallelism inhardware/software.
- Discussmemoryorganizationandmappingtechniques.
- Describearchitecturalfeaturesofadvancedprocessors.
- Interpretperformanceofdifferentpipelinedprocessors.
- Explaindataflowinarithmeticalgorithms
- Developmentofsoftwaretosolvecomputationallyintensiveproblems

Unit-I:

Digital Electronics: Boolean algebra, Combinational circuits, Karnaugh map, Flip-flops,Sequentialcircuits.RISCprocessors,RISCvsCISC,ClassificationofInstructionsetArchitecture, Performance measurement, Basic parallel processing techniques: Instructionlevel,ThreadlevelandProcesslevel. Classificationofparallelarchitecture.

Outcome: The students can implement Boolean algebra and be able to understand combinational and sequential circuits, design and implementation of parallel processing techniques.

Unit-II:

Pipeline: Arithmetic pipeline, Instruction pipeline. Hazards in a pipeline: Structural, data andcontrol hazard, Overview of hazard resolution techniques. Dynamic instruction scheduling,Branchpredictiontechniques,Instruction-levelparallelismusingsoftwareapproaches,Superscalartechniques.

Outcome: The students can interpret the performance of different pipelined processor and significance of superscalar techniques.

Unit-III:

Basic concept of hierarchical memory organization, Main memories, Cache memory designand implementation, Cache coherence problem and synchronization mechanisms, Virtualmemorydesignandimplementation, Secondarymemorytechnology,RAID. Bus structures and standards, Synchronous and asynchronous buses. Types and uses of storagedevices.

Outcome: The students will familiar with fundamentals of memory organization, design and implementation of cache memory, structural representation of bus architecture

Unit-IV:

Interfacing I/O to the rest of the system, Reliability and availability, I/O systemdesign,Platformarchitecture.
Centralizedvs.distributedsharedmemory,Interconnectiontopologies,Multiprocessorarchitecture,Symmetricmultiprocessors,Cachecoherenceproblem,Synchronization,Memoryconsistency,Multicorearchitecture.Distributedcomputers,Clusters,Grid,Mainframecomputers.

Outcome: Students will know about the importance of multiprocessor and multi computers.

TextBooks:

- ComputerOrganizationandDesign:TheHardware/SoftwareInterfacebyDavid   A PattersonandJohnL. Hennessy.5thEdition, MorganKaufmann, 2013.
- Computer System Architecture by M.Mano, 3rdEdition, Pearson Education, 2007.

Reference Books:

- Computer Architecture: A Quantitative Approach by J.Hennesseyand D.Patterson, 5thEdition, MorganKaufman.
- AdvancedComputerArchitecture: AdesignSpaceApproachbyD.Sima,Addison-Wesley,1987

Core XVII   ComputerGraphics

Course Objectives:

This course is intended to understand the principles of computer graphics including two-dimensionaltransformation,three-dimensionaltransformation,clippingalgorithms,polygonfilling,linedrawingalgorithms,rendering,projectionofobjectsanddemonstratesitsapplicationinvariousfieldsofcomputerscience.

Course Outcomes: After completion of this course, students will be able to

- Understand the basicsofcomputergraphics,differentgraphicssystemsandapplicationsofcomputergraphics.
- Useofgeometric transformationsongraphicsobjectsandtheirapplicationincompositeform.
- Extractscenewithdifferentclippingmethodsanditstransformationtographicsdisplaydevice.
- Explore projections andvisiblesurfacedetectiontechniquesfordisplayof3Dsceneon2Dscreen.
- Renderprojectedobjectstonaturalizethescenein2Dviewanduse ofilluminationmodelsforthis.

Unit-I:

A survey of computer graphics: Computer Aided Design, Presentation Graphics, ComputerArt, Entertainment, Education Training, Visualization, Image Processing, Graphical UserInterface. **Overview of graphics system:** Video Display Devices, Raster Scan Systems,Random Scan Systems, Input Devices, Hard-copy Devices, Graphics Software. **Outputprimitives:** Points and lines, DDA and Bresenham's Line Drawing Algorithm, Midpointcircle algorithm, Filled area primitives. **Attributes of output primitives:** Line attributes,Curveattributes,Colourandgrayscalelevels,Area-fillattributes,Characterattributes,Bundledattributes.

Outcome: The students will have the idea of basics of computer graphics and different primitives used to draw different shapes in graphics.

Unit-II:

Two dimensional geometric transformations: Basic Transformation (Translation, Rotation,Scaling), Matrix representation and homogenous coordination, Composite Transformation,Reflection, Shear. **Two-dimensional viewing:** The viewing Pipe-line, Viewing CoordinateReferenceframe,Window-to-viewportcoordinatetransformation.**Clipping:**LineClipping (CohenSutherlandAlgorithm),Polygonclipping(Sutherland-HodgemanAlgorithm).

Outcome: The students will be able to understand how to transform and represent objects in two-dimensional geometry and different clipping methods to fit the objects inside a window.

Unit-III:

Threedimensionalgeometricandmodelingtransformations: Translation,Rotation,Scaling,Reflections,Shears,CompositeTransformation.**Three-dimensional viewing:**Viewingpipeline,Viewingcoordinates,Projections(ParallelandPerspective).

Three-dimensional object representation: Polygon Surfaces, Quadratic surfaces, SplineRepresentations, BezierCurvesandsurfaces,B-SplineCurvesandsurfaces

Outcome: The students will be able to understand how to transform and represent objects in three-dimensional geometry.

Unit-IV:

Visible-surface detection methods: Classification ofvisible-surface detection algorithms,back-face detection, Depth-Buffermethod, A-Buffermethod, Scan-line method, Depth-sortingmethod.**IlluminationModels:**Basicilluminationmodels,Displayinglightintensities, HalftonePatternsandDitheringTechnique,PolygonRenderingMethods(Gouraudand Phong shading)

Outcome: The students will come to know about how to detect visible parts of an object and different illumination models to shine the objects.

TextBooks:

✓ *ComputerGraphicsCVersion,byD.HearnandM.P.Baker,2ndEdition,PearsonEducation, 2002.*

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**Core XVII-
ComputerGraphics Lab**

</div>

- Background concept of enabling graphics mode in C and usage of various graphic functionsavailable in graphics.h.
- Simple animation programs using graphics library.
- Implementation ofDDAandBresenham'slinedrawing.
- Midpointcirclealgorithms.
- Implementation of translation,rotation,scaling,lineclipping,polygonclipping.

Core XVIII Project Management

CourseObjectives:

Tohelpthestudentstounderstandthevariousaspectsofprojects;projectIdentification,   project Appraisal, project planning and scheduling, project implementation,project evaluation of the projects. It touches the practical aspects of project analysis andimplementation.

Course Outcome: After completion of this course, the students will be

- Able to know the concept of project and project management and types of projectstoknowall thestagesintheproject lifecyclefromconcepttocompletion.
- Knowthewholeconceptsofprojectsthatcanbefitintothegamutof findingagapintermsofcustomers'needsforgoodsand fillingthegap.
- Knowthevariousaspectsofprojectappraisallikeeconomic,commercial,financial,man agementappraisal.
- Knowtheestimationofcostofaprojectandtoidentifythegapbetweenconventionalfinancing andprojectfinancing.
- Understandthevarioussourcesoffinanceavailableformeetingtheprojectcost.
- Knowtheprojectschedulingtechniquesindetail.
- Understandtheconceptsofevaluationofprojectsduringthecourseofimplementation.

Unit-I:

Conceptof Projects,phases of aproject- Pre-investmentphase, InvestmentPhase andoperationalphase,TypesofProjects,ObjectivesofProjectManagement,ImportanceofProjectManagement, Project Management Life Cycle, Project Identification, Project formulation,ProjectSelection.

Outcome: The students will understand project concepts, various phases and types & objective of project management, life cycle, formulation and selection process.

Unit-II:

Project feasibility studies - Opportunity studies, General opportunity studies, specificopportunitystudies,pre-
feasibilitystudy,functionalstudiesorsupportstudies,feasibilitystudy–
componentsofprojectfeasibilitystudies.

Outcome: The students will understand various types of feasibility study carried out during project & will learn various components of project feasibility studies.

Unit-III:

Projectplanningandprojectdesign,Majorcostcomponentsofprojectand Estimationof cost of project, Network analysis, PERT and CPM Techniques, Project ImplementationpracticesinIndia.

Outcome: The students will have a clear understanding of project planning and design. Brief understanding of cost estimation techniques.

Unit-IV:
Projectreport,Projectappraisal,plantlocation,designandlayout,Projectfinancialfeasibility-
breakevenanalysis,Profitabilityanalysisandsocialcostbenefitanalysis.

Outcome: The students will understand various project reports, appraisal, design layout and cost profit analysis concepts.

Text Books:

✓ *DesaiVasant,'ProjectManagement',HimalayaPublishingHouse,Mumbai*

Reference Books:

✓ *Singh Narendra, 'Project Management & Control', Himalaya Publishing House, Mumbai.*
✓ *PrasanaChandra,'ProjectPreparation,AppraisalandImplementation',TataMcGra*

wHill, NewDelhi

Core XVIII- Mini Project: Project Management

GuidelinesforProject

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developability to apply multidisciplinary concepts,tools and techniques to solve organizationalproblems.Theproject maybefromanyoneofyourareasrelatedtotheconcernedsubject.

Projectreport: TheProjectReportmusthavethefollowing:

- Cover Pagemusthavethenameandrollno.ofthestudentandthename&designationoftheguidealongwiththetitleoftheProject.
- Acknowledgement,declaration,Certificateoforiginalitysignedbytheguidewithdate
- Detailedtables&figuresofcontentswithpagenos .
- AllpagesoftheProjectReportmustbenumberedasreflectedinIndexofChapters

Index of Chapters:

- Chapter-I:Introduction&Reviewofliteratures
- Chapter-II: ResearchMethodology
- Chapter-III:Conceptual& TheoreticalDescriptions
- Chapter-IV:DataAnalysis&Interpretations
- Chapter-V:Conclusion,Findings,suggestions&Scopeforfurtherresearch.
- Chapter-VI: References, Annexures, etc.

Core XIX   **Machine Learning**

Course Objectives:

To introduce the students to the basic concepts and techniques of Machine Learning. To develop skills of using recent machine learning software for solving practical problems. To gain experience of doing independent study and research.

Course Outcomes: On completion of this course, the students will be able to
- Explain concept of machine learning, the concept of learning task, various types of learning techniques.
- Describe artificial neural networks, perceptions, learning rules, background propagation algorithms.
- Analyze various supervised learning methods.
- Assess various unsupervised learning –k means, reinforcement learning methods.

Unit-I:
Introduction – Types of Machine Learning, Designing a Learning System, Issues in Machine Learning; The Concept Learning Task - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias - Decision Tree Learning - Decision tree learning algorithm, Instance based Learning, Nearest neighbors method.

Unit-II:
Artificial Neural Networks – Perceptrons, Learning rules, Gradient descent and the Delta rule, Adaline, Madaline Network, Multilayer networks, Derivation of Backpropagation rule- Backpropagation Algorithm- Convergence, Generalization; – Evaluating Hypotheses – Estimating Hypotheses Accuracy, Basics of sampling Theory, Radial basis function networks, Support Vector Machine.

Unit-III:
Supervised Learning- Linear Regression (Gradient Descent, Normal Equations), Weighted Linear Regression (LWR), Logistic Regression, Generative Models (Gaussian Discriminant

Analysis, Naive Bayes), Learning – Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, Tree Ensembles (Decision trees, Random Forests, Boosting and Gradient Boosting).

Unit-IV:
Unsupervised Learning- K-means, Gaussian Mixture Model (GMM), Expectation Maximization (EM), Variational Auto-encoder (VAE), Factor Analysis, Principal Components Analysis (PCA), Independent Components Analysis (ICA), Linear Discriminant Analysis (LDA), Vector Quantization – Self Organizing Feature Map. Reinforcement learning: Markov decision process (MDP), Hidden Markov Model (HMM), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation, Linear Quadratic Gaussian, Q-learning, Monte Carlo Methods.

Text Books:
- ✓ *T. Mitchell, "Machine Learning" McgrawHillPublisher.*
- ✓ *T. Hastie, R. Tibshirani, J. Friedman "The Element of Statistical Learning" 2e2008*

Reference Books:
- ✓ *E. Alpaydin,: Introduction to Machine Learning. Eastern Economy Edition, Prentice Hall of India.*
- ✓ *C. M. Bishop, Pattern recognition and Machine Learning, Springer Lab Experiments*

Core XIX- Machine Learning Practical

Basic operations in Python implementation.
- Loading data from Training set and testing the Models.
- Learn to predict values with Linear Regression.
- Learn to predict states using Logistic Regression.
- Learn the definition of a Perceptron as a building block for neural networks, andthe perceptron algorithm for classification.
- Learn the definition of a Neural Network, learn to train them usingBackpropagation network.
- Train Decision Trees to predict states and classification.
- Learn the Bayes rule, and how to apply it to predicting data using the Naive Bayesalgorithm.
- Learn to train a Support Vector Machine to separate data linearly.
- Use Kernel Methods in order to train SVMs on data that is not linearly separable.
- Learn the basics of clustering Data, Cluster data with the K-means algorithm.
- Cluster data with Gaussian Mixture Models.
- Optimize Gaussian Mixture Models with Expectation Maximization.
- Learn to scale features in your data, learn to select the best features for training data.
- Reduce the dimensionality of the data using Principal Component Analysis andIndependent Component Analysis and LDA

- Learn how to define Markov Decision Processes to solve real-world problems.
- Learn about policies and value functions, Derive the Bellman Equations.
- Write your own implementations of iterative policy evaluation, policy improvement, policy Iteration, and value Iteration.
- Implement classic Monte Carlo prediction and control methods.
- Learn how to tune hyper parameters of an estimator.
- Plotting of Validation curve and learning curve to evaluate the model.
- Evaluating Estimator performance, Cross validation

Semester-VIII

Core XX   DataMining& DataWarehousing

CourseObjectives:

This course is intended to introduce the concepts of multidimensional schemassuitable for data warehousing, data warehouse architectures, data mining algorithms,functionalities to support critical thinking, business intelligence gathering, problem solvingandtoderivebusinessrulesfordecisionsupportsystem.

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

- Designadatamartordatawarehouseforanyorganization.Knowaboutdataminingtasks andissues.
- Extractknowledgeusingdataminingtechniques.
- Understand and implement classical models and algorithms for organization needs.Characterizethekindsofpatternsthatcanbediscoveredbyassociationrulemining , classificationandclusteringoflargedatasets.

Unit-I:

Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification ofDataMiningsystems,DataMiningTaskPrimitives,IntegrationofaDataMiningSystemwitha
Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing:Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, DataReduction,Discretization. Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, MultidimensionalDataModel,DataWarehouseArchitecture.
Outcome: The students will be able to differentiate between data warehousing and data mining. They will understand the steps required for data mining.

Unit-II:

Data Cube Technology. Data Generalization: Efficient Methods for Data Cube Computation, FurtherDevelopmentofDataCubeandOLAPTechnology.Mining Frequent Patterns, Associations and Correlations: Basic Concepts, Efficient andScalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, FromAssociationMiningtoCorrelationAnalysis,Constraint-Based Association Mining.

Outcome: The students will be able to understand how to represent data in multidimensional way and how are associated and correlated to each other.

Unit-III:

Classification and Prediction: Issues Regarding Classification and Prediction, ClassificationbyDecisionTreeInduction,BayesianClassification,Rule-

BasedClassification,Classification by Back propagation, Support Vector Machines, Associative Classification,Lazy Learners, Prediction, Accuracy and Error measures,EvaluatingtheaccuracyofaClassifieroraPredictor, EnsembleMethods.

Outcome: The students will come to know the importance of classifying data using different classification methods.

Unit-IV:

Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of MajorClustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods,Grid- Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data,Constraint-BasedClusterAnalysis,OutlierAnalysis.

Outcome: The students will know how to cluster data using different techniques.

TextBooks:

- ✓ *DataMining–Concepts   andTechniques– J.HanandM.Kamber,MorganKaufmannPublishers,Elsevier,2ndEdition,2006.*

Reference Books:

- ✓ *IntroductiontoDataMining–P.Tan,M.SteinbachandV.Kumar,PearsonEducation*

Core XXI   **Designand AnalysisofAlgorithm**

CourseObjective:

This course will enable to the students toknowhowtoanalyzetheasymptoticperformanceofalgorithmsanddemonstrate a familiarity with major algorithms and data structures, to apply importantalgorithmicdesignparadigmsandmethodsofanalysis, to synthesize efficient algorithms in common engineering design situations and to getidearegardingP,NPclass.

Course Outcomes: On completion of this course, the students will be able to

- Analyzetime complexitiestimesofalgorithmsusingasymptoticanalysis.
- Describethedivide-and-conquerparadigm andexplainwhenanalgorithmicdesignsituation calls for it.
- Derive and solve recurrences describing the performance of divide-and-conqueralgorithms.
- Describe the greedy paradigm and explain when an algorithmic design situation calls forit.
- Describe the dynamic-programming paradigm and explain when an algorithmic designsituation calls for it.
- Explainthemajorgraphalgorithmsandtheiranalyses.
- AnalyzethefuturestudiesofalgorithmbyusingN,NPclass.

Unit-I:

Introduction to Algorithm, Space and Time Complexity, Asymptotic notations, worst case,bestcaseandaveragecase,Substitutionmethod,Recursion-tree method,mastermethod.
Outcome: The students can argue the correctness of algorithms using inductive proofs and invariants. Also, can analyze worst-case running times of algorithms using asymptotic analysis.

Unit-II:

Divide and Conquer Technique: Quick sort, Randomized quick sort, Priority Queue, Heap Sort, Rabin-KarpStringMatching, BinarySearch, FindingMinimumMaximum.
Outcome: The students can describe, analyze and synthesize the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.

Unit-III:
GreedyMethod:
Activityselectionproblem,HuffmanCodes,FractionalKnapsack,Jobsequencewithdeadlines, MinimumCostSpanningTrees-Prim'sandKruskal's algorithm.
Outcome: The students can describe, analyze and synthesize the greedy paradigm and explain when an algorithmic design situation calls for it.

Unit-IV:

Dynamicprogramming:
Matrixchainmultiplication,LongestCommonSubsequence,Travelling Salesman Problem, Single Source Shortest Path: The Bellman Ford algorithm,Dijkstra'sAlgorithm, All pairShortest path:FloydWarshall algorithm. P,NP,NP-Hard,NPCompletenessandreducibility,PSpace,NPSpace
Outcome: The students can describe, synthesize and analyze the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.

TextBooks:

- ✓ *IntroductiontoAlgorithmsbyThomasH. Cormen,3rd Edition,MITPress.*

Reference Books:

- ✓ *Fundamentals of ComputerAlgorithms byEllis Horowitz,SartajSahani,2nd ^{Edition},UniversityPress.*
  .

Core XXI- Designand AnalysisofAlgorithm Lab

Writing an efficientsorting algorithm (Quick Sort, Heap sort). Designing efficient algorithmfor inserting, deleting and searching in a binary tree, Huffman Codes, Minimum cost
spanningtree(PrimsandKruskal),Activityselectionproblem,LongestCommonSubsequence, Travellingsalesmanproblem,TheBellmanFordalgorithm,FloydWarshallalgorithm.

Core XXII   **CryptographyandNetworkSecurity**

Course Objectives:

- TounderstandbasicsofCryptographyandNetworkSecurity.
- Tobeabletosecureamessageoverinsecurechannelbyvariousmeans.
- To make the student learn different encryption techniques along with hash functions, MAC,digital signatures and their use in various protocols for network security and systemsecurity.

Course Outcomes:
On Completion of this course, the students will be able to
- LearnabouthowtomaintaintheConfidentiality,IntegrityandAvailabilityofadata   and analyze,designclassicalencryptiontechniquesandblockciphers.
- Understand   and   analyzepublic-keycryptography,RSA   andotherpublic-keycryptosystems.DesignmessageauthenticationandanalyzeanddesignhashandMAC algorithms.
- Understand security protocols for protecting data on networks and analyze and design digitalsignature.

Unit-I:

SecurityAttacks (Interruption,Interception,ModificationandFabrication),SecurityServices (Confidentiality,Authentication,Integrity,Non-repudiation,AccessControland availability)andmechanisms,OSISecurityArchitecture,Cryptography,Cryptanalysis,Symmetric Cipher Model, Substitution Technique: Monoalphabetic Ciphers, Polyalphabetic Ciphers(Playfair,Vigenere,Hill), TranspositionTechnique.
Outcome: The students will know about basics of security and different models of cryptography.

Unit-II:

Data Encryption Standard (DES), Block Cipher Principles, Stream Cipher, Block Cipher,StrengthandWeaknessofDES,AdvancedEncryptionStandard(AES). Modular Arithmetic, Euclid's Algorithm.

Outcome: The students will be understanding about data encryption standards and types of ciphers.

Unit-III:

Finite Fields of the form GF(P), Principle of PublicKey Cryptosystems, Applications for Public Key Cryptosystems, The RSA Algorithm, DiffieHellmanKeyExchange. AuthenticationRequirement,AuthenticationFunctions:MessageEncryption,MessageAuthe nticationCode,HashFunction, MessageDigestAlgorithm: MD5.

Outcome: The students will come to know why authentication is required and use of crypto systems.

Unit-IV:

Digital Signatures: Direct Digital Signature, Arbitrated Digital Signature, AuthenticationProtocol: Mutual Authentication, Symmetric Encryption Approach, Public Key EncryptionApproach,Digital SignatureStandard,Kerberos (Version4).

Outcome: The students will be able to understand the importance of digital signatures.

TextBooks:

✓ *CryptographyandNetworkSecuritybyBehrouz A. Forouzan*

Reference Books:

✓ CryptographyandNetworkSecurityPrinciplesandPracticesbyWilliamStallings.
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Core XXIII- ProjectWork

Exam/Viva Mark-100
Project Guidelines:

Project is an assignment tostrengthen the understanding of fundamentals through effectiveapplication of theoretical concept. The objective of the project course is to help the student developability to apply multidisciplinary concepts, tools and techniques to solve organizational problems.Theproject maybefromanyoneofyourareasrelatedtotheconcernedsubject.

Projectreport: TheProjectReportmusthavethefollowing:

- Cover Page–musthavethenameandrollno.ofthestudentandthename&designationoftheguidealong withthetitleoftheProject.
- Acknowledgement,declaration,Certificateoforiginalitysignedbytheguidewithdate
- Detailedtables&figuresofcontentswithpagenos.
- AllpagesoftheProjectReportmustbenumberedasreflected.

Note: Project Guidelines are mentioned at the end of the syllabus.

SAMPLE QUESTIONS

C-1: PAPER-1: Data Structure using C'

1.	What is a literal in C language?	1 Mark
2.	Explain pointer to pointer.	2 Marks
3.	Write algorithms for PUSH and POP operations of stack.	5 Marks
4.	Write a C' program to implement Quick Sort.	8 Marks

C-2: PAPER-2: OPERATING SYSTEMS

1. Define multi-threading.   1 Mark
2. What are the necessary conditions for deadlock?   2 Marks
3. List out different services of operating systems and explain each service.   5 Marks
4. Explain Banker's deadlock-avoidance algorithm with an illustration.   8 Marks

C-3: PAPER-3: PRINCIPLES OF MANAGEMENT

1. Define the term Management.   1 Mark
2. Explain the advantages and limitations of forecasting in the planning process. 2 Marks
3. Compare and contrast the leadership styles based on Tannenbaum& Schmidt's Model and Blake & Mouton's Model.   5 Marks
4. Discuss the concept of coordination in management. Explain its importance, principles,
   and techniques of implementation, highlighting its role in achieving organizational harmony and efficiency.   8 Marks

C-4: JAVA PROGRAMMING

1. What is Object Oriented Programming?   1 Mark
2. Explain this keyword with an example.   2 Marks
3. How does Java support inter thread communication?   5 Marks
4. Explain with an example to handle multiple catch blocks for a nested try block.
       8 Marks

C-5: DIGITAL LOGIC

1. Convert $(67A9)_{16}$ into decimal.   1 Mark
2. Implement OR gate using NAND gates only.   2 Marks
3. Differentiate between Latch and flip flop ad explain JK Flip with truth table.   5 Marks
4. Write short notes on (Any Two)   (4*2=8 Marks)
   a. RAMBUS Memory
   b. Programmable Array Logic (PAL)
   c. Tri-State Buffers.

C-6: COMPUTER NETWORKS

1. What is a topology?   1 Mark
2. Write two benefits of data link layer.   2 Marks
3. What is CSMA/CD? Explain.   5 Marks
4. Explain IP V4. How does it differ from IP V6?   8 Marks

C-7: BUSINESS ACCOUNTING

1. What is the purpose of preparing Trading and Profit & Loss Account in financial accounting?   1 Mark

2. Explain the difference between Accounting and Bookkeeping.   2 Marks
3. Walk through the steps involved in preparing Trading and Profit & Loss Account and Balance Sheet for a sole proprietary business. Discuss the importance of each statement in financial analysis.   5 Marks
4. Compare and contrast manual accounting systems with computerized accounting systems. Discuss the advantages and disadvantages of each system, considering their impact on financial management and decision-making.   8 Marks

C-8: DATABASE MANAGEMENT SYSTEMS

1. Define entity set.   1 Mark
2. Explain select operation in Relational algebra.   2 Marks
3. Explain two-phase locking protocol for concurrency control.   5 Marks
4. With suitable example describe various normal forms.   8 Marks

C-9: ORGANIZATION BEHAVIOUR

1. Define Perception in the context of individual behaviour.   1 Mark
2. Explain the foundations of Organizational behaviour and their significance in understanding workplace dynamics.   2 Marks
3. Compare and contrast Formal and Informal groups, and discuss their impact on organizational dynamics.   5 Marks
4. Discuss the nature and importance of leadership in organizational settings. Compare and contrast Trait Theory, Behaviour Theory and Contingency Theory of leadership, highlighting their strengths and weaknesses in different situations.   8 Marks

C-10: FOUNDATION TO DATA SCIENCE AND ANALYTICS

1. Define big data.   1 Mark
2. What is business intelligence?   2 Marks
3. Explain basic data types in R.   5 Marks
4. What is the role of data scientist in big data ecosystem?   8 Marks

C-11: WEB TECHNOLOGY

1. Write the characteristics of DHTML.   1 Mark
2. Differentiate between the 'BITWISE AND' and the 'LOGICAL AND' operator in PHP.
       2 Marks
3. Write the differences between GET and POST methods.   5 Marks
4. Define CSS. Explain inline, internal, external and embedded style sheets with examples.   8 Marks

C-12: SOFTWARE ENGINEERING

1. What is software engineering?   1 Mark
2. What is cohesion in software design?   2 Marks
3. Describe RAD model in software development.   5 Marks

4. What is software design? Explain various criteria for good software design.

8 Marks

C-13: DIGITAL MARKETING

1. State the objective of pricing in marketing. 1 Mark
2. Compare Traditional Marketing with Digital Marketing, highlighting their key differences. 2 Marks
3. Discuss the Marketing Environment and its impact on marketing strategies. Also, explain the factors influencing consumer decision-making. 5 Marks
4. Explore YouTube Advertising as a digital marketing strategy. Discuss YouTube channels, ads, types of videos used in advertising, buying models, targeting and optimization strategies, and how to design and monitor successful video campaigns.

8 Marks

C-14: THEORY OF COMPUTATION

1. Define Regular Language. 1 Mark
2. Design a DFA which recognize strings having odd numbers of zeros. 2 Marks
3. Design PDA for $a^n b^n$. 5 Marks
4. State and prove Pumping lemma for regular grammar. 8 Marks

C-15: PYTHON PROGRAMMING

1. What is the purpose of global keyword in Python? 1 Mark
2. What are the features of tuple data structure? 2 Marks
3. Explain different data types in Python. 5 Marks
4. Explain the use of join() and split() string methods with examples. Describe why strings are immutable with an example. 8 Marks

C-16: ADVANCED COMPUTER ARCHITECTURE

1. What is control hazard? 1 Mark
2. Differentiate between RISC and CISC. 2 Marks
3. Explain Cache coherence problem. 5 Marks
4. Why does Hazard occur? Define types of Hazard and briefly discuss hazard resolution techniques. 8 Marks

C-17: COMPUTER GRAPHICS

1. What is a frame buffer? 1 Mark
2. What is the 2-D rotation transformation? Write the matrix formula. 2 Marks
3. What is Bezier curve? Derive the formula of it. 5 Marks
4. Explain Z-Buffer. How does it differ from A-Buffer? 8 Marks

C-18: PROJECT MANAGEMENT

1. Define feasibility study. 1 Mark

2. What is Project appraisal? 2 Marks
3. What is project? Explain objective of project management. 5 Marks
4. What is project management? Explain project management life cycle in details.
8 Marks

C-19: MACHINE LEARNING

1. A decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility is called as _____. 1 Mark
2. Define Machine learning. 2 Mark
3. How to choose a target function explain with an example. 5 Marks
4. Give three computer applications for which machine learning approaches seem appropriate and three for which they seem inappropriate. 8 Marks

C-20: DATA MINING AND DATA WAREHOUSING

1. Define data mart. 1 Mark
2. Describe Dataware House architecture. 2 Marks
3. Explain Bayesian classification method. 5 Marks
4. Compare and contrast the features of among partition methods. 8 Marks

C-21: DESIGN AND ANALYSIS OF ALGORITHMS

1. Write the complexity of Quick sort? 1 Mark
2. Define an algorithm. 2 Marks
3. What is greedy method? How does it differ from divide & conquer method? 5 Marks
4. Explain different asymptotic notion with example. 8 Marks

C-22: COMPUTER NETWORK SECURITY

1. What is the use of cipher? 1 Mark
2. Distinguish between cryptography and cryptoanalysis. 2 Marks
3. Explain Euclid's algorithm. 5 Marks
4. What is digital signature? What are its types? Briefly describe the standards of it.
8 Marks

LIST OF ORGANIZATIONS FOR INTERNSHIP

Odisha Mining Corporation
National Aluminum Company
OPTCL
Mahanadi Coal Fields Ltd.
Steel Plants (Govt. & Private)
Airport Authority of India
IFFCO
Paradeep Port Trust
DRDO
& All Govt and Private owned Organizations