Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION
& SYLLABUS

of

B.Sc Computer Science

(Bachelor in Computer Science)

UNDER

Faculty of Information Technology

w.e.f. Session 2021-22

Kalinga University, Naya Raipur (CG)

B.Sc. (Computer Science) 3 Years Programme

W.e.f 2021-22 Session

Semester – I					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS101	Programming for Problem Solving Using 'C/C++'	4	30	70	100
BCS102	Discrete Structures	4	30	70	100
BCS103	Fundamentals of Information Technology & Office Automation	4	30	70	100
	(Choose Any One) 104A/104B	2	15	35	50
BCS104A	Environmental Studies				
BCS104B	NCC				
BCS105P	Programming for Problem Solving Using 'C/C++' Lab	2	20	30	50
BCS106P	Fundamentals of Information Technology & Office Automation Lab	2	20	30	50
		18	305	145	450

Semester – II					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS201	Database Management Systems (DBMS)	4	30	70	100
BCS202	Data Structures	4	30	70	100
BCS203	Computer Graphics	4	30	70	100
	(Choose Any One) 204A/204B	2	15	35	50
BCS204A	English				
BCS204B	NCC				
BCS205P	Database Management System (DBMS) Lab	2	20	30	50
BCS206P	Data Structures Lab	2	20	30	50
BCS206P	Computer Graphics Lab	2	20	30	50
		20	165	335	500

* Student has to undergo for Internship Assessment completion of 2nd Semester which is to be evaluated in 3rd Semester

Semester – III					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS301	Operating System	4	30	70	100
BCS302	Programming in Java	4	30	70	100
BCS303	Design and Analysis of Algorithm	4	30	70	100
BCS304	**Elective – I**	4	30	70	100
BCS304A	Information Security				
BCS304B	Network Programming				
BCS304C	Digital Electronics				
BCS305P	Operating System Lab	1	20	30	50
BCS306P	Programming in Java Lab	1	20	30	50
BCS307P	Internship Assessment	2	20	30	50
		20	180	370	550

Semester – IV					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS401	Computer System Architecture	4	30	70	100
BCS402	Software Engineering and Testing	4	30	70	100
BCS403	Theory of Computation	4	30	70	100
BCS404	**Elective –II**	4	30	70	100
BCS404A	Computational Linguistics				
BCS404B	Digital Image Processing				
BCS404C	Machine Learning				
BCS405P	Computer System Architecture Lab	1	20	30	50
BCS406P	Software Engineering and Testing Lab	1	20	30	50
BCS407P	Elective –II Lab	1	20	30	50
		19	180	370	550

* Student has to undergo for Internship Assessment completion of 4th Semester which is to be evaluated in 5th Semester

Semester – V					
Subject Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS501	Computer Network	4	30	70	100
BCS502	Programming in Python	4	30	70	100
BCS503	Operational Research	4	30	70	100
BCS504	**Elective-III**	4	30	70	100
BCS504A	Introduction to Data Science				
BCS504B	Cloud Computing				
BCS504C	Numerical Method				
BCS506P	Computer Network Lab	1	20	30	50
BCS507P	Programming in Python Lab	1	20	30	50
BCS508P	Elective-III Lab	1	20	30	50
BCS509P	Internship Assessment/ Mini Project	2	20	30	50
		21	200	400	600

Semester – VI					
Course Code	**Subject Name**	**Credit**	**Internal**	**External**	**Total**
BCS601	Artificial Intelligence and Machine Learning	4	30	70	100
BCS602	Digital Marketing and Business Analytics	4	30	70	100
BCS603	**Elective-IV**	4	30	70	100
BCS603A	Ethical Hacking				
BCS603B	Green Computing				
BCS603C	Data Mining and Warehousing				
BCS604	**Elective-V**	4	30	70	100
BCS604A	Big data Analytics				
BCS604B	Soft Computing				
BCS605P	Artificial Intelligence and Machine Learning Lab	2	20	30	50
BCS606P	Project Work & Dissertation	4	150	50	200
		22	290	360	650

SEMESTER – I

Programming for Problem Solving Using 'C/C++'

(BCS101)

Course Objectives:

- Have Understanding of Programming Language Standards, Problem Solving Techniques, IDE and Compilers for C and C++.
- To have in depth knowledge of Writing, Compiling and Running Programs.
- To understand and Practice Programming Construct: Variable, Operators, Control Structures, Loop, Functions with C and C++.
- To understand and Practice basics of arrays, pointers, pre-processor, Structure and Union
- To learn difference in procedural and Object oriented programming language with understanding of OOPs features and Practice beginner level of Pointers, Pre-processor, Programming

Course Outcomes:

- List and Demonstrate Basic Terminology Used in Computer Programming Write, Compile and Debug Programs in C and C++ Language.
- Understand and Apply Variable, Conditional Statements, Loops, Functions in C and C++.
- Practice Pointers, Structure, Union and Class in Programming.
- Explain and Differentiate the Process of Problem Solving Using Procedural and Object Oriented Programming Language.
- Understand and Practice Object Oriented Programming Concepts in C++

UNIT-I

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code. Introduction to C Language, Language Standards, Features of Procedural Language specific to C, Structure of C and C++ Program, Introduction to Compilers, Creating, Compiling and Executing C and C++ Programs, IDE Features of Turbo Compiler. Keywords , Identifiers, Variables, Constants, Scope and Life of Variables, Local and Global Variable, Data Types, Expressions. Operators - Arithmetic, Logical, Relational, Conditional and Bit Wise Operators, Precedence and Associativity of Operators, Type Conversion. Library Function, Character Input/Output- getch( ), getchar( ). getche( ), putchar( ). Formatted Input/Output-printf( ) and scanf( ), Mathematical & Character Functions in C and C++.

UNIT- II

Control Structures: Declaration Statement, Conditional Statement - if Statement, if-else Statement, Nesting of if Statement, else if Ladder, The?: Operator, switch Statement. Iteration Statements - For Loop, While Loop, Do-While Loop. Jump Statements: break, continue, goto,exit( ). Arrays - Concept of Single and Multi-Dimensional Arrays, Array Declaration and Initialization. Strings: Declaration, Initialization, String Functions Using C and C++.

UNIT- III

The Need of Functions, User Defined and Library Function, Prototype of Functions, Prototype of main( ) Function, Calling of Functions, Function Arguments, Argument Passing: Call By Value and Call By Reference, Return Values. Nesting of Function, Recursion, Array asFunction Argument, Command Line Arguments, Basics of Pointers, Pointers Operators, Pointer Arithmetic, Pointers and Function, Pointer and Strings. Preprocessor and its Advantages.

UNIT- IV

Storage Class Specifier- Auto, Extern, Static, Register. Defining Structure, Declaration of Structure Variable, Type def, Accessing Structure Members, Member Access Operator, Nested Structures, Array of Structure, Structure Assignment, Structure as Function Argument, Function that Return Structure, Union. Pointer to Structure, Pointers within Structure, Introduction to Static and Dynamic Memory Allocation, The Process of Dynamic Memory Allocation, DMA Functions : malloc( ), calloc( ), free( ), realloc( ), sizeof( ) Operator. C++Classes and Object.

UNIT- V

Constructor and its Types, Array of Objects, Object as Argument, Reference Variable, Default Argument, Destructor Function, Object Oriented Programming Concepts. Polymorphism (Operator Overloading, Function Overloading) . Inheritance and its Types. Access Specifier, Virtual Functions, Abstract Base Classes and Pure Virtual Function. Virtual Base Classes.

References:

- Kerninghan& Ritchie “The C Programming Language”, PHI
- Schildt “C:the Complete Reference”, 4th Ed TMH.
- Kanetkar Y. “Let Us C”, BPB.
- Kanetkar Y.: “Pointers in C”,BPB
- Gottfried : “Problem Solving in C”, Schaum Series
- Balagurusami “Programming in ANSI C”,7thed McGraw Hill Education.
- Herbertz Shield, "C++ The Complete Reference "TMH Publication ISBN 0-07-463880-7
- R. Subburaj, 'Object Oriented Programming WithC++ Vikas Publishing House, New Delhi.Isbn 81-259-1450-1
- E. BalgurUswamy, "C++ '' TMH Publication ISBN O-07-462038-X
- M. Kumar 'Programming InC++'' TMH Publications
- R. Lafore, 'Object Oriented Programming C++"
- Ashok. N. Kamthane, "Object Oriented Programming WithANSi& Turbo C++ ", Pearson Education Publication,ISBN-8j-7808-772-3

Programming for Problem Solving Using 'C and C++' Lab

(BCS105P)

1. Write a Program in C to calculate Simple Interest when the values of Principal, Rate and Time are given.
2. Write a Program in C++ to calculate Temperature in Centigrade when temperature is in Fahrenheit.
3. Write a Program in C to determine whether an input Year is Leap Year or not.
4. Write a program to calculate the Factorial of a number input from Keyboard using Recursive method.
5. Write a Program in C++ to show how to pass an Array to a user defined function.
6. Write a Program in C to swap two numbers using Call by Value and Call by Address.
7. Write a Program in C to read Name, Roll No, and Percentage of five Students and display them using Array of Structures.
8. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by the user. Assign grades according to the following criteria :
    a. Grade A: Percentage >=80
    b. Grade B: Percentage>=70 and <80
    c. Grade C: Percentage>=60 and <70
    d. Grade D: Percentage>=40 and <60
    e. Grade E: Percentage<40
9. Write a Program in C++ to display the first n terms of Fibonacci series.
10. Write a Program in C to calculate the sum of two compatible matrices.
11. Write a Program in C++ to calculate the product of two compatible matrices.
12. Write a C program to pass an entire array to a user-defined function and multiply each element by 3 inside the function and print the elements of the array in main().
13. Write a C program to show usage of pointer to structure using arrow operators
14. Write a C program to show usage of pointer to function
15. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.
16. Create a class Employee with basic information of Employees as data members and member function to get these information and display employee information.

Discrete Structures

(BCS102)

Course Objective:

- Outline an equivalent logical proposition for a real world statement by applying predicates and quantifiers and Interpret.
- Apply logic rules of inference to check the validity of the predicate calculus statements and to prove theorems.
- Apply the concepts of sets, functions and relations to solve the given problem.
- Construct the Automata to reduce the complexity of a model.

Course Outcomes:

- Prove implication problems using truth table method, replacement process, analyzation method, truth table technique, rules of inference. Obtain PCNF and PDNF of given logical expression.
- Construct verbal arguments with predicates in symbolic form after validate them using inference.
- Represent the different types of relation in matrix, digraph and vice versa.
- Find inverse and composition of functions.
- Prove the properties of lattices and Boolean algebra.
- Construct DFA and NDFA which accepts a given language.
- Modify the given grammar into language and vice-versa

UNIT - I

Propositional Logic: Introduction – statements and notation, connectives- Conjunction, Disjunction, Negation, Conditional and biconditional,-Implications and Equivalence, Tautology and Contradictions, Normal forms: Conjunctive Normal Form,Disjunctive NormalForm - Principal Conjunctive Normal Forms - Principal Disjunctive Normal Form, Rules of Inference: P,T,CP,AP rules –Consistency of premises.Validity by truth table technique.

Predicate Logic: Predicates- Statement Function, Variables and Quantifiers, Predicate formulas – Free and Bound Variables,–Theory of inferences on one place predicate using P,T,CP rules.

UNIT - II

Set Theory: Basic Concepts of set theory and Cartesian products, Relations, Binary relations, Equivalence relations and Partitions, Composition of relations. Functions: Types of functions, Inverse of a function, Composition of functions, Recursive functions.

UNIT - III

Partially ordered set: Definition of Partially ordered set(PO Set), Hasse Diagram, LUB, GLB, Meet and Join of elements of PO set.Lattices as partially ordered sets:Definition and basic properties of lattices, Sub lattices, Special lattices.

UNIT - IV

Boolean algebra: – Definition and examples – Boolean functions –– Minimization of Boolean functions.

UNIT - V

Automata Theory and Grammar :Deterministic and Non-Deterministic finite Automaton, NDFA to DFA,NDFA with ε-moves, Regular language and Regular Expression, NFA and Regular Expressions, Pushdown Automaton, Introduction to Turing Machine.Pumping Lemma (without proof) and its applications,, Grammar, Types of Grammars – Language to Grammar –Grammar to Language.

Reference Books

1. Trembly and Manohar, —Discrete mathematical structures with applications to Computer Sciencell, Tata McGrawHill, 2002.
2. Kenneth H. Rosen, —Discrete mathematics and its applicationsll, McGrawHill International Editions 1999.
3. Dr. M.K.Venkataraman.,Dr.N.Sridharan and N.Chandrasekaran, Discrete Mathematics,National Publishing Company,Chennai.of India(2004)
4. John E.Hopcraft,RajeevMotwani,JefferyD.Ullman, `` Introduction to Automata Theory, Languages and Computation —, Pearson Education, Asia, 2001.
5. John C.Martin, `` Introduction to Languages and the theory of Computationll, Tata McGraw-Hill Publishing Company Limited,New Delhi.
6. http://www.research.ibm.com/haifa/dept/svt/papers/Mathematical_Logic.pdf
7. Mathematical Logic and its Application to Computer Science - Lecture Notes EitanFarchi, Ben-Chaim, March 3, 2010

Fundamentals of Information Technology & Office Automation (BCS103)

Course Objectives:

- To know computer evolution with features of each generation.
- Identify various devices used in Computer system with specific use of each.
- To know the place of computer in our day to day life, its characteristics, its usage, Limitations and benefits etc.
- To know types of software and languages with specific use of each.
- To understand Computer Network and Management Information System basics.
- To familiarize student with Office Automation and Component of Office Automation.
- To make them comfortable to evaluate, select and use Office Software appropriate to specific task.
- To make them work on Open Software for Office Automation.
- To develop expertise in Word Processing, Spreadsheet, and Presentation Skills.

Course Outcomes:

- Describe Computer System evolution, Characteristics and Types.
- Select Need base System Hardware and Software.
- Describe the OS, Types of OS, Batch File and features.
- Describe the Use, Process, Types and Topologies of Computer Communication.
- Outline Office Suit components with specific application.List Open Office Software.
- Apply Word Processing Tools including Document Formatting, Using Graphics, Working with Macro and Mail Merge.
- Apply Spread Sheet Tools including Worksheet formatting, Using Functions, Graphics and Charts.
- Create effective Presentation Using Animation and Transition.

UNIT - I

Introduction to Computers: Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers. Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary And Secondary) RAM, ROM, PROM, EPROM. Secondary Storage Devices (FD, CD, HD, Pen drive)I/O Devices (Scanners, Plotters, LCD, Plasma Display) Number Systems Introduction to Binary, Octal, Hexadecimal system Conversion.

UNIT - II

Operating System and Services in O.S. Dos – History, Files and Directories, Internal and External Commands, Batch Files, Types of O.S.Windows Operating Environment Features of MS – Windows, Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush etc.Use of communication and IT, Communication Process, Communication types-

Simplex, HalfDuplex, Full Duplex, Communication Protocols, Communication Channels - Twisted, Coaxial, Fiber Optic, Serial and Parallel Communication, Modem - Working and characteristics, Types of network Connections - Dialup, Leased Lines, ISDN, DSL, RF, Broad band, Types of Network - LAN, WAN, MAN, Internet, VPN etc., Topologies of LAN - Ring, Bus, Star, Mesh and Tree topologies, Components of LAN -Media, NIC, NOS, Bridges, HUB, Routers, Repeater and Gateways.

UNIT - III

Introduction to Office Automation Suit, Elements of Office Suit & Area of Use. WordProcessing, Spreadsheet, Presentation Graphics, Database. Introduction of various Office Suites Open Office, Libre Office, WPS Office, Microsoft Office. Word Basics Using MSOffice : Starting Word Processor, The parts of a Word Processor Window, Menus & Commands, Toolbars & Buttons, Shortcut Menus, Creating a New Document, Different Page Views and Layouts, Applying various Text Enhancements, Formatting Text and Documents:Auto Format, Text Attributes, Paragraph and Page Formatting, Line Spacing, Margins, Borders and Shading, Tabs and Indents, Text Editing using various features, Bullets, Numbering, Working with Styles, Printing & various print options, Spell Check ,Working with Headersand Footers, Tables: Creating a Simple Table, Creating a Table using the Table Menu, Entering and Editing Text in a Table, Selecting in Table, Adding Rows, Changing Row Heights, Deleting Rows, Inserting Columns, Deleting Columns, Changing Column Width.

UNIT – IV

Spreadsheet Basics: Overview of Spreadsheet, Features, Creating a New Worksheet, Selecting Cells, Entering and Editing Text, Entering and Editing Numbers, Entering and Editing Formulas, Referencing Cells, Moving Cells, Copying Cells, Sorting Cell Data, Inserting Rows,Columns, Inserting Cells, Deleting Parts of a Worksheet, Clearing Parts of a Worksheet. Formatting: Page Setup, Changing Column Widths and Row Heights, Auto Format, Changing Font Sizes and Attributes, Using Border Buttons and Commands, Changing Colors andShading, Hiding Rows and Columns.Function in Spreadsheet, Functions by category: Date and Time functions, Statistical functions, Text functions. Spreadsheet Charts: Chart parts and Terminology, Instant Charts with the Chart Wizard, Creation of different types of Charts, Printing Charts, Deleting Charts, L:inking in Spreadsheet. Spreadsheet Graphics: Creating and Placing Graphic Objects, Resizing Graphics, Drawing Lines and Shapes.

UNIT - V

Creating Presentations: Using Blank Presentation Option, Using Design Template , Adding Slides, Deleting a Slide, Importing Images from Outside, Transition and Build Effects, Deleting a Slide, Numbering a Slide, Saving Presentation, Closing Presentation, Printing Presentation.

Reference:

- Pradeep K Sinha, Priti Sinha, Computer Fundmentals, Sixth Edn. BPB Publications
- S.K.Basandra, “Computers Today “, Galgotia Publications.
- Alexis Leon & Mathews Leon, “Fundamentals of Information technology “, Vikas Publishing House, New Delhi.
- V.Rajaraman, NeeharikaAdabala, Computer Fundamentals, PHI

- Microsoft Office Ste by Step Beth Melton,Mark Dodge , Published with the authorization of Microsoft Corporation by: O'Reilly Media.
- Office 2013 Bible: The Comprehensive Tutorial Resource Paperback – by Lisa A. Bucki (Author), John Walkenbach (Author), Michael Alexander.
- Learning Microsoft Office 2013 by Ramesh Bangia, Khanna Publishers
- www.openoffice.org/documentation/manuals/.../0100GS3- GettingStartedOOo3.pdf
- Open Office for Dummies (https://whc.es/OpenOffice%20org%20For%20Dummies.pdf)
- https://www.libreoffice.org/get-help/documentation/Libre Office 5.1 Writer, Calc, Math Formula Book- Vol 1 by Lalitmali

Fundamentals of Information Technology and Office Automation Lab

(BCS106P)

Practical will be based on Paper Fundamentals of Information Technology and Office Automation Lab: Covers UNIT-III, UNIT-IV, and UNIT-V, of Syllabus.

Environmental Studies

(BCS104A)

Unit 1 : Introduction to Environmental Studies **(6 Lecture)**

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

Ecosystems

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
  a) Forest ecosystem
  b) Grassland ecosystem
  c) Desert ecosystem
  d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 2 : Natural Resources : Renewable and Non---renewable Resources **(6 Lecture)**

- Land resources and landuse change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 3 : Biodiversity and Conservation **(5 Lecture)**

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega---biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In---situ and Ex---situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 4 : Environmental Pollution **(9 Lecture)**

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 5 : Human Communities and the Environment **(4 Lecture)**

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36---37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29---64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. *Tripathi 1992*.
14. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.

15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006.*The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987.*Our Common Future*. Oxford University Press.

SEMESTER – II

Database Management System

(BCS201)

Course Objectives:

- To understand need of DBMS.
- To understand conceptual and physical design of a database.
- To understand RDBMS and to design Relational database.
- To know basic database backup and recovery mechanism.
- To know advances in DBMS.

Course Outcomes:

- Understand Data, Database system and its architecture.
- Apply ER modeling and Relational Database design using Normalization.
- Apply concepts of database storage and querying.
- Understand Concurrency, Recovery and Security mechanism in DBMS.
- Understand Current advances in DBMS.

UNIT - I

Introduction To Database System : Data - Database Applications - Evolution of DB & DBMS - Need for data management, Introduction and applications of DBMS, File systems versus Database systems, Data Models, DBMS Architecture, Data Independence, Data Modelingusing Entity-Relationship Model, Enhanced ER Modeling.

UNIT - II

Relational Database Concept and Design: Introduction to relational database, Structure of Relational Database, Relational model terminology domains, Attributes, Tuples, Relations, relational DB schema. Relational algebra: Basic operations selection and projection, Set Theoretic operations Union, Intersection, set difference and division, Join operations: Inner, Outer, Left outer, Right outer and full outer join. Relational Database design, Functional Dependency, definition, trivial and nontrivial FD, Normalization 1Nf, 2NF, 3NF, Decomposition using FD dependency preservation, BCNF, Multi valued dependency, 4NF, Join dependency and 5NF.

UNIT - III

Database storage and querying -Basic Concepts of Indexing and Hashing Query Processing, Measures Of Query Cost, Query Processing for Select, Sort Join Operations, Basics of Query Optimization, Transformation of Relational Expression Estimating Statistics of Expression, Choice of Evaluation Plan.

UNIT - IV

Concurrency, Recovery and Security -Concurrency Control: Definition of concurrency, lost update, dirty read and incorrect summary problems due to concurrency. Concurrency Control Techniques: Overview of Locking, 2PL, Timestamp ordering, multi-versioning, validation Recovery concepts,

Shadow paging, Log Based Recovery, Elementary concepts of Database security: system failure, Backup and Recovery Techniques, authorization and authentication.

UNIT - V

Introduction to Current Trends – Centralized and Client Server Architectures, Distributed Databases, Object Oriented Database, Spatial & Temporal Databases, Data Mining & Warehousing, Data Visualization, Mobile Databases, OODB & XML Databases, Multimedia& Web Databases.

References:

- Abraham Silberschatz, Henry Korth, S. Sudarshan, “Database Systems Concepts”, 7th Edition, McGraw Hill .
- Rajesh Narang “Database management System” PHI.
- Ramakrishnan and Gherke, “Database Management Systems”, TMH.
- R. Elmarsi and SB Navathe, “Fundamentals of Database Systems”, Pearson,5th Ed.
- Singh S.K., “Database System Concepts, design and application”, Pearson Education
- Bipin Desai, “An Introduction to database Systems”, Galgotia Publications

Practical List on DBMS
(BCS205P)

1. Draw an ER diagram to University Database.
2. Draw an ER diagram to Library management System.
3. Create a Library management Schema/ database and search anomalies in it.
4. Assume a video library maintains a database of movies rented out. Without any normalization, all information is stored in one table as shown below.
    a. Normalize the following Schema with given Constraints.
    b. books(accessionno, isbn, title, author, publisher)
    c. users(userid,name, deptid, deptname)
    d. accessionno ->isbn
    e. isbn -> title
    f. isbn -> publisher
    g. isbn ->title
    h. userid -> name,
    i. userid ->deptid
    j. deptid -> department

5. Compare 3NF and BCNF with appropriate example.
6. Give exercise on DDL and DML .
7. Create a database named “school.mdb” and perform the following tasks using MS Access or My SQL
8. Create a table named “studentinfo” having following table structure.

Field Name	Data Type	Structure
Class	Number	
Section	Text	
Roll No.	Number	
Name	Text	40 Characters Long
Status	LookUp Wizard	Two Value: Senior and Junior
Photo	OLE Object	Photos of Student
DOB	Date/Time	Date of Birth Of students
Remarks	Memo	

9. Fill atleast 5 records.
   Prepare a query to display all records and Name should be in ascending order.
   Prepare a query named “senior” to display records including fields name, class, sec, rollno, status, photo and value of “status” field must be senior.
   Prepare a form of above query “senior”. Prepare a report of all the fields of above table.
10. Create a database named “library.mdb” and perform the following tasks:
11. Create a table named “Book” having following structure:

Field Name	Data Type
Bookid	Text
BName	Text
WName	Text
PYear	Date/Time
PName	Text
Price	Currency

Add at least 5 records.

Data Structures

(BCS202)

Course Objectives:

- To learn Several data structure concepts like stack, queue, linked list, trees and graphs
- To learn the Applications of data structures.
- To improve the Problem solving quality using data structure techniques

Course Outcomes:

- Understand the concept and usage of data types, dynamic memory management and data structures.
- Implement stack and queues algorithms
- Implement linked list data structures
- Implement graphs data structures
- Implement tree and sorting in data structures
- Choose the appropriate data structures to solve complex real life problems

UNIT I - INTRODUCTION TO DATA STRUCTURES

Definition – types of data structure-abstract data type-array as an abstract data type representation of array- sparse matrices- asymptotic notation.

UNIT II - STACKS AND QUEUES

Stacks- queue- mazing problem- evaluation of expression- postfix notation- infix to post fix- multiple stack and queue.

UNIT III - LINKED LIST

Singly linked list- representation of linked singly list- operations on singly linked list, doubly linked list- representation of doubly linked list- operations on doubly linked listdifferentiate singly and doubly linked list- circularly singly and doubly linked list

UNIT IV - TREES

Tree Terminology- representation of tree- binary tree- binary tree traversaloperations on tree- applications- Sorting: selection sort- bubble sort- quick sort

UNIT V - GRAPHS

Definition- representation of a graph- operations- breadth first search- depth first search- minimum cost spanning trees- kruskal's algorithm and prim's algorithmshortest path and transitive closure- single source- floyds algorithm- all pair dijikstra's algorithm.

TEXT BOOK

- Ellis Horowitz, Sahni, Dinesh Mehta (1999), “Fundamentals of Data Structures in C++”, Golgotha publication, New Delhi.

REFERENCE

- Weiss Mark Allen (2006), “Data Structure and algorithm analysis”, Pearson Education.

Data Structures Lab

(BCS206P)

Practical List on Data Structures

1. Program to maintain a Linked List.
2. Program to add a new node to the ascending order Linked List.
3. Program to maintain a Doubly Linked List.
4. Program to implement Stack as an Array.
5. Program to implement Stack as a Linked List.
6. Program to convert an A.E. from Infix form to postfix form.
7. Program to evaluate an Expression entered in Postfix form.
8. Program to Implement Non-Recursive function for Factorial of a Number.
9. Program to Implement Recursive function for Factorial of a Number.
10. Program to implement a Queue as an Array.
11. Program to implement a Queue as a Linked List.
12. Program to implement a Circular Queue as an Array.
13. Program to implement a Circular Queue as a Linked List.
14. Program to implement a Deque using an Array.
15. Program to implement Linear Search in an unsorted Array.
16. Program to implement Binary Search in a sorted Array.
17. Program to implement Selection Sort.
18. Program to implement Insertion Sort (The program should report the number of Comparisons).
19. Program to implement Bubble Sort.
20. Program to implement Quick Sort.

Computer Graphics

(BCS203)

Course Objective:

The objective of the course is to provide the understanding of the fundamental graphical operations and the implementation on computer, the mathematics behind computer graphics, including the use of spline curves and surfaces. It gives the glimpse of recent advances in computer graphics, user interface issues that make the computer easy, for the novice to use.

UNIT - I: Introduction to Graphics and Graphics Hardware System

Application of computer graphics, Video Display Devices, Raster Scan Display, Random Scan Display, Input Devices, Graphic Software and graphics standards, Numerical based on Raster and Random scan display, Frame buffer, Display processor.

UNIT - II: Output Primitives and Clipping operations

Algorithms for drawing 2D Primitives lines (DDA and Bresenham„s line algorithm), circles (Bresenham„s and midpoint circle algorithm), Antialiasing and filtering techniques. Line clipping (cohen-sutherland algorithm), Curve clipping algorithm, and polygon clipping with Sutherland Hodgeman algorithm, Area fill algorithms for various graphics primitives: Scanline fill algorithm, boundary fill algorithm, flood fill algorithm, Polygon representation, various method of Polygon Inside test: Even-Odd method, winding number method, Character generation techniques.

UNIT - III: 2D & 3D Geometric transformation

2D Transformation: Basic transformat ion, Translation, Rotation, Rotation relative to an arbitrary point, scaling, Matrix Representations and Homogeneous coordinates, window to viewport transformation. 3D Concepts: Parallel projection and Perspective projection, 3D Transformations, composite 3D transformation, co-ordinate transformation, Inverse transformation

UNIT - IV: object modeling and Visible Surface detection

fractal geometry methods, fractal dimensions, Geometric construction of deterministic self-similar fractals, Iterated function system to generate fractals. Bezier curves and Bezier surfaces, Bspline curves and surfaces, Visible surface detection method: Basic illumination, diffuse reflection, specular reflection, shadows. Ray tracing method, Depth-buffer method, A-buffer method, Depth-sorting method (painter„s algorithm), Binary search partition method, Scan line method.

UNIT - V: Introduction to multimedia

Design of animation sequences, Computer Animation languages, Elementary filtering techniques and elementary Image Processing techniques, graphics library functions used in animation design.

Text/References Books:

- Foley et. al., “Computer Graphics Principles& practice”, 2nded. AWL, 2000.
- D. Hearn and P. Baker, “Computer Graphics”, Prentice Hall, 1986.

- R. Plastock and G. Kalley, “Theory and Problems of Computer Graphics”, Schaum‟s Series, McGraw Hill, 1986
- R.H. Bartels, J.C. Beatty and B.A. Barsky, “An Introduction to Splines for use in Computer Graphics and Geometric Modeling”, Morgan Kaufmann Publishers Inc., 1987.
- C.E. Leiserson, T.H. Cormen and R.L. Rivest, “Introduction to Algorithms”, McGraw-Hill Book Company, 1990.
- W. Newman and R. Sproul, “Principles of Interactive Computer Graphics, McGraw-Hill, 1973.
- F.P. Preparata and M.I. Shamos, “Computational Geometry: An Introduction”, Springer-Verlag New York Inc., 1985.
- D. Rogers and J. Adams, “Mathematical Elements for Computer Graphics”, MacGraw-Hill International Edition, 1989
- David F. Rogers, “Procedural Elements for Computer Graphics”, McGraw Hill Book Company, 1985.
- Alan Watt and Mark Watt, “Advanced Animation and Rendering Techniques”, Addison-Wesley, 1992

Computer Graphics Lab
(BCS206P)

1. Write a program to implement Bresenham‟s line drawing algorithm.
2. Write a program to implement mid-point circle drawing algorithm.
3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.
4. Write a program to clip a polygon using Sutherland Hodgeman algorithm.
5. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates).
6. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.
7. Write a program to draw Hermite/Bezier curve.

English

(BCS204A)

Course Objective

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

CONTENTS

Unit I: Introduction: **06**

Theory of Communication, Types and modes of Communication, *Mediums and channels of communication, barriers to communication, English as a Global language, the Lingua Franca, Social influences on English*

Unit II: Language of Communication: **06**

Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication, *Varieties of English, Language, Accent, Dialect, Colloquialism, Historical influences on English*

Unit III: Speaking Skills: **06**

Monologue Dialogue Group Discussion Effective Communication/ Mis- Communication Interview Public Speech, *Regional influences on English, Convergence and divergence, Linguistic Imperialism,*

Unit IV: Reading and Understanding- **06**

Close Reading, *Reading analysis of a text - Audience and purpose, Content and theme, Tone and Mood, stylistic devices, structure* Comprehension- Analysis and Interpretation Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts

Unit V: Writing Skills **06**

Documenting Report Writing Making notes Letter writing, *Writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters*

Course outcome:

It will enhance Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, notetaking etc. While, to an extent, the art of communication is natural to all living beings, intoday's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions.

Recommended Readings:

1. Fluency in English - Part II, Oxford University Press, 2006.

2. Business English, Pearson, 2008.

3. Language, Literature and Creativity, Orient Blackswan, 2013.

4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, DrRanjanaKaul, DrBrati Biswas

SEMESTER – III

Operating Systems

(BCS301)

Course Objectives:

- To understand the services provided by operating system
- To understand the working and organization of process and its scheduling and synchronization.
- To understand different approaches of memory management techniques.
- To understand the structure and organization of the file system.

Course Outcomes:

- Understand, identify and describe the services provided by operating systems.
- Understand and solve problems involving process control, mutual exclusion, synchronization and deadlock.
- Implement processor scheduling, synchronization and disk allocation algorithms for a given scenario.
- Understand different types of operating system.

UNIT-I

Operating Systems - Definitions, functions, Types of operating system - Multiprogramming, Batch, Time Sharing, Single user and Multiuser, components, Operating system Services, System Calls, programs, System structure.

UNIT –II

Process management - process concepts, process state & process control block, process scheduling, scheduling criteria, scheduling algorithms, multiple processor scheduling, realtime scheduling, threads.

UNIT –III

Critical section problem, semaphores, classical problem of synchronization,, deadlock characterizations, method for handling deadlocks, deadlock prevention, deadlock avoidance,deadlock detection, recovery from deadlock .

UNIT –IV

Memory management - logical versus physical address space, contiguous allocation, fixed partition, variable partition, swapping, paging, segmentation, virtual memory, demand paging, page replacement, page replacement algorithms

UNIT –V

Disk scheduling, disk management, swap space management, disk reliability, stable storage implementation. File concepts, directory structure, and protection.

References:

- Operating system concepts by Silberschatz, Galvin, Gagne, Wiley Student Edition
- Operating system concepts & design by Milan Milenkovic, TMH publication

Operating Systems Lab

(BCS305P)

1. WRITE A PROGRAM (using fork() and/or exec() commands) where parent and child execute:
    a) Same program, same code.
    b) Same program, different code.
    c) Before terminating, the parent waits for the child to finish its task.
2. WRITE A PROGRAM to report behaviour of Linux kernel including kernel version, CPU type and model. (CPU information)
3. WRITE A PROGRAM to report behaviour of Linux kernel including information on configured memory, amount of free and used memory. (memory information)
4. WRITE A PROGRAM to print file details including owner access permissions, file access time, where file name is given as argument.
5. WRITE A PROGRAM to copy files using system calls.
6. Write program to implement FCFS scheduling algorithm.
7. Write program to implement Round Robin scheduling algorithm.
8. Write program to implement SJF scheduling algorithm.
9. Write program to implement non-pre-emptive priority based scheduling algorithm.
10. Write program to implement pre-emptive priority based scheduling algorithm.
11. Write program to implement SRJF scheduling algorithm.
12. Write program to calculate sum of n numbers using thread library.
13. Write a program to implement first-fit, best-fit and worst-fit allocation strategies.

Programming in Java

(BCS302)

Course Objectives:

- Understand the usage of Java SDK environment and apply to create, debug and run simple java programs.
- Understand and apply the basic concept of java programming such as character set, variables, data types, conditional and iterative execution, methods, etc.
- Understand and implement the Object-Oriented Programming (OOPs) concepts in java, through defining classes, invoking methods, using class libraries, etc.
- Learn the creation and the usage of arrays and threads in java.
- Learn and demonstrate java applets.

Course Outcomes

- Explain the object oriented concepts and apply them for solving real problems.
- Demonstrate and apply the various features Java SDK to develop, run and debug java programs.
- Apply java technology to develop the small applications, utilities, and web applications.
- Apply events management and layout managers using awt, swing, jdbc and servlet for developing the software for various problems.

UNIT-I

C++ vs java, java and internet and WWW, java support systems, java environment, java program structure, tokens, statements, java virtual machine, constants & variables, data types, type casting, operators, expressions & its evaluation, decision making and branching, loops,jumps in loops, labeled loops.

UNIT-II

Defining a class, adding variables and methods, creating objects, accessing class members, constructors, method overloading, static members, nesting of methods, inheritance: extending a class, overriding methods, final variables and method~, final classes, finalizes methods, abstract methods and classes, visibility control.

UNIT-III

Arrays, one dimensional & two dimensional, strings, vectors, wrapper classes, defining interfaces, extending interfaces, implementing interfaces, accessing interface variables, system packages, using system packages, naming conventions, creating packages, accessing apackage, using package, adding a class to a package, hiding classes.

UNIT-IV

Threads, creating threads, extending the threads class, stopping and blocking a thread, life cycle of a thread, using thread methods, thread exceptions, thread priority, synchronization, implementing the unable interface.

UNIT-V

Applets, local and remote applets, applets VS applications, writing applets, applets life cycle, creating an executable applet, designing a web page, applet tag, adding applet to HTML file, running the applet, passing parameters to applets, aligning the display, HTML tags & applets, getting input from the user interface.

References:

- E. Balagurusamy, "Programming with Java, a Primer",TMH, ISBN-13: 978-0-07- 061713-1, ISBN-10: 0-07-061713-9.
- Patrick Naughton and Herbert Schildt, "Java: the Complete Reference", TMH Publication, ISBN 0-07-463769-X.
- Yashavantkanetkar, "Let us Java", BPB Publications.
- Cay Horstmann, "Big Java", Wiley Publication
- Peter Norton, "Java Programming", Techmedia Publications.
- Joseph Weber, "Using Java 1.2", PHI, ISBN -81-203-1558-8.

Practical List on Programming in JAVA

(BCS306P)

1. Write a program to find the largest of n natural numbers.
2. Write a program to find whether a given number is prime or not.
3. Write a menu driven program for following:
    a. Compute Factorial of a number
    b. Check whether a given number is odd or even.
    c. Check whether a given string is Palindrome or not.
4. Write a program to print the sum and product of digits of an Integer and reverse the Integer.
5. Write a program to create an array of 10 integers. Accept values from the user in that array.Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.
6. Write a program that will prompt the user for a list of 5 prices. Compute the average ofthe prices and find out all the prices that are higher than the calculated average.
7. Write a program in java to input N numbers in an array and print out the Armstrongnumbers from the set.
8. Write java program for the following matrix operations:
    a. Addition of two matrices
    b. Multiplication of two matrices
    c. Input the elements of matrices from user.
9. Write a java program that computes the area of a circle, rectangle and a triangle usingfunction overloading.
10. Write a Java for the implementation of Multiple inheritance using interfaces to calculatethe area of a rectangle and triangle.
11. Write a java program to create a frame window in an Applet. Display your name, addressand qualification in the frame window.
12. Write a java program to draw a line between two coordinates in a window.
13. Write a java program to display the following graphics in an applet window.
    a. Rectangles
    b. Circles
    c. Ellipses
    d. Arcs
    e. Polygons
14. Write a program for the following string operations:
    a. Compare two strings
    b. Concatenate two strings
    c. Compute length of a string
15. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate constructors and methods. If the denominator becomes zero, throw and handlean exception.
16. Write a program to Display Fibonacci series.

Design and Analysis of Algorithm

(BCS303)

Course Objective:

The designing of algorithm isan important component of computer science. The objective of this course is to make students aware of various techniques used to evaluate the efficiency of a particular algorithm. Students eventually should learn to design efficient algorithm for a particular program.

Course Outcomes:

- To learn a strong foundation about algorithms.
- To learn different techniques for writing algorithm.
- To apply the techniques for producing algorithm for different problems.

UNIT - I: Introduction

Algorithm Design paradigms - motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Recurrences- substitution method, recursion tree method, master method

UNIT - II: Divide and conquer

Structure of divide-and-conquer algorithms: examples; Binary search, quick sort, Merge sort, Strassen Multiplication; Analysis of divide and conquer run time recurrence relations. Greedy Method: Overview of the greedy paradigm examples of exact optimization solution (minimum cost spanning tree), Approximate solution (Knapsack problem), Single source shortest paths, traveling salesman

UNIT - III: Dynamic programming

Overview, difference between dynamic programming and divide and conquer, Applications: Shortest path in graph, chain Matrix multiplication, Traveling salesman Problem, longest Common sequence, knapsack problem

UNIT - IV: Graph searching and Traversal

Overview, Representation of graphs, strongly connected components, Traversal methods (depth first and breadth first search), Back tracking: Overview, 8-queen problem, and Knapsack problem, Brach and bound: LC searching Bounding, FIFO branch and bound, LC branch and bound application: 0/1 Knapsack problem, Traveling Salesman Problem

UNIT - V: Computational Complexity

Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

References/Text Books:

- E. Horowitz, S. Sahni, and S. Rajsekaran, “Funadmentals of Computer Algorithms,” Galgotia Publication
- T. H. Cormen, Leiserson, Rivest and Stein, “Introduction of Computer algorithm,”
- Sara Basse, A. V. Gelder, “Computer Algorithms,” Addison W
- J.E Hopcroft, J.D Ullman, “Design and analysis of algorithms”
- D. E. Knuth, “ The art of Computer Program

Information Security

(BCS304A)

Course Objectives:

- Understand the fundament concepts of Cyber and Information Security
- Gain the knowledge of different types and working of malware and security hazards incident of real-world.
- Understand cryptography techniques and apply them for secure data communication and authentications
- Understand the working and implementation of Firewall.
- Understand the concept of cyberspace and cybercrime and digital signature.

Course Outcomes:

- Explain various security concepts and apply them in daily cyber use.
- Configure firewall and other security setting in computer
- Perform the malware and spam email identification, analysis, virus scanning and cleaning and other services using security tools
- Explain and practice the Cyber Law, Ethics, and Intellectual Property Rights, Patent and Trademark and Design Law

UNIT-I

Information security: overview, information security importance, information security components. Threats to information system- external and internal thread, security threat and vulnerability- overview, malware, type of malware: virus, worms, trojans, rootkits, robots, adware's, spywares, ransom wares, zombies etc., desktop security.

UNIT-II

Application security- database security, e- mail security, internet security, principles of security- confidentiality, integrity, vailability, introduction to cryptography- symmetric key cryptography, asymmetric key cryptography, message authentication, applications of cryptography. Security technology- firewall, type of firewall, firewall benefits, VPN, antivirus software.

UNIT-III

Cyberspace- cloud computing &security, social network sites security, attack preventionpasswords, protection against attacks in social media, securing wireless networks, security threats.

UNIT-IV

Cybercrime-concept of cybercrime, type of cybercrime, phishing, cybercrime prevention, case study, security threats to e- commerce- electronic payment system, Digital Signature– digital signature process.

UNIT-V

ISO- international organization for standardization, world intellectual property organization, cyber law- cyber law in India, IT act 2000, intellectual property rights- definition, intellectual property, categories of intellectual property, rights protected under intellectual property,copyright, patent and trademark, design- design law in India.

References:

- Allan Friedman and P. W. Singer, Cyber Security and Cyber war: What Everyone Needs to Know by Published Oxford University
- Don Franke, Cyber Security Basics: Protect Your Organization by Applying the Fundamentals by Publisher CreateSpace Independent Publishing Platform, 2016
- MayankBhushan, Fundamental of Cyber Security

Network Programming

(BCS304B)

Course Objective:

Exposes students to UNIX/Linux systems and network programming with an emphasis on practical programming problemsand experience. Help students prepare for future programming careers by exposing them to Python. Knowledge of conceptsrelated to networking, low level (sockets based) network programming, as well as a variety of web programming concepts.Strong programming skills, specifically in the development of sockets based network programs. Introduce students toconcurrent programming models that are used for building scalable servers, including an emphasis on synchronization ofthreads and processes using both semaphores and message passing.

UNIT - I: Python Basic

Installing python,Scope and uses of python, Accessing python interpreter,importing modules and getting helps, Basic datatypes: number, string, list, tuple, dictionary and sets. Python input and output, Decision making and looping in Python(if,elif, else, while, for). Functions, class and object, Exception handling, Files and Directories; reading and writing text files,creating and removing directories.

UNIT - II: Network Programming Fundamentals

Network architecture, protocol stack and layering, ip addressing and subnet mask, OSI and TCP/IP model, Internetarchitecture, application programming interface (API), Network addressing, Standard ports, UNIX Networking Commands;netstat, ifconfig, ping, traceroute, tcpdump, sock, telnet, rlogin,sshetc, client server concepts.

UNIT - III: Sockets Programing

Introduction to sockets, Type of sockets(Steam and Datagram), address and port, TCP Socket call and UDP Socket callblock diagram, Python Socket Module; socket, bind, listen, accept, connect, read, write, close ,Basic example: TCPechoserver and TCP echoclient, UDP echoserver, UDP echoclient, Python Chat server and Chat client, Handling multipleclients at once; the select module, python Threading module.

UNIT - IV: Advanced Network Programing

Python and the web, CGI, Twisted (networking framework for Python), some popular python modules: smtplib, httplib,poplib, Programming for the Web; Retrieving web pages with http, Parsing HTML data, XML and XMLRPC, Electronicmail; sending mail, Developing Network server program.

UNIT - V LABORATORY:

1. Familiarization on python interpreter.
2. Implementation of list, tuple and dictionaries.

3. Object oriented programing in Python (concept of class and object).
4. Simple echo-server and echo-client implementing both TCP and UDP socket.
5. Write a program to Obtain The Local & Remote Socket Address.
6. Write a program to Write A Telnet Client.
7. Write a program to Make An FTP Client
8. Implement basic chat server and client.
9. Write a program to Obtain The Information About The (A) Host (B) Network (C) Protocols (D) Domains
10. Chat server and client with select and threading module.
11. Design TCP client and server application to transfer file .
12. Design a RPC application to add and subtract a given pair of integers
13. Implement the web server in python.
14. You will use Python to build a simple peer-to-peer file transfer program called ZapTorrent.

References: Books:

- Foundations of Python Network Programming, By: JOHN GOERZEN, APPRESS Publication
- Beginning Python, By: James Payne, Wiley India Pvt. Ltd, Publication
- Learning Python, By David Ascher, Mark Lutz, O'Reilly Publication

Digital Electronics

(BCS304C)

Course Objectives:

- To understand data representation for digital logic
- To understand the basic blocks of digital logic
- To understand the fundamental organization of a digital computer
- To design simple combination & sequential circuits
- To Know application of Registers.

Course Outcomes:

- Apply the principles of Number System, Binary Code and Boolean Algebra.
- Acquire Knowledge about Logic Gates.
- Design various Combinational and Sequential Circuits.
- Describe various Memory System and Shift Register.
- Understand Processor Organization and Design of Simple Computer.

UNIT-I

Data representation Data Types and Number Systems, Binary Number System, Octal &HexaDecimal Number System, Fixed Point Representation, 1's & 2's Complement, Binary, Arithmetic Operation on Binary Numbers, Overflow & Underflow, Floating PointRepresentation, Codes, ASCII, EBCDIC Codes, Gray Code, Excess-3 & BCD, Error Detection & Correcting Codes Binary Storage and Registers.

UNIT–II

Boolean algebra and digital logic circuits -Logic Gates, AND, OR, NOT,, NOR, NAND & XOR Gates and their Truth Tables, Boolean Algebra, Basic Definition and Properties, Basic Boolean Law's, Demorgan's Theorem, Minimization Techniques, K Map – Two, Three andMore Variables maps, Sum of Product & Product of Sums, Don't care conditions.

UNIT–III

Combination Circuits - Half adder & Full adder, Full Subtractor, decimal adder, Code Conversion, Multilevel NAND and NOR Circuits, Decimal adder, decoders, Multiplexers and De-multiplexers.

UNIT–IV

Sequential logic- Flip-Flops - RS, D, JK & T Flip-Flop, Triggering in flip flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, flip flop excitation tables, Design procedure and design of counters. Design with equations.

UNIT–V

Registers, Counters and the memory unit, Shift registers, Ripple counters and Synchronous counters, Inter-register Transfer, Arithmetic Logic and Shift Micro Operation, Conditional Control Statement, Instruction Codes, Processor organization, design of a simple computer.

References:

- Digital Logic and Computer Design by Morris mano
- Computer System Architecture by Morris Mano
- Digital Electronics by Anil Kumar Maini publisher :Wiley and Sons
- Modern Digital Electronics by R. P. Jain publisher Tata Mcgraw-Hill education
- Digital Fundamentals by Thomas l. Floyd publisher: Pearson Education India

SEMESTER – IV

Computer System Architecture

(BCS401)

COURSE OBJECTIVES:

- To impart basic concepts of computer architecture and organization,
- To explain key skills of constructing cost-effective computer systems.
- To familiarize the basic CPU organization.
- To help students in understanding various memory devices.
- To facilitate students in learning IO communication

COURSE OUTCOMES:

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

- Identify various components of computer and their interconnection
- Identify basic components and design of the CPU: the ALU and control unit.
- Compare and select various Memory devices as per requirement.
- Compare various types of I/O mapping techniques
- Critique the performance issues of cache memory and virtual memory

UNIT - I

STRUCTURE OF COMPUTERS: Computer types, Functional units, Basic operational concepts, VonNeumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes.COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.

UNIT - II

BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC.

UNIT - III

REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit. MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

UNIT - IV

MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID.

UNIT – V

INPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA. MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.Pipeline Processing:Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline

TEXT BOOKS:

- M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India. REFERENCE BOOKS:
- Carl Hamacher, ZvonksVranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.
- William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
- Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
- John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

Computer System Architecture Lab

(BCS405P)

List of Experiments

- To study and perform about logic gates.
- To study and perform about De'Morgan's Theorem.
- To study and perform about NAND and NOR as a universal gates.
- To design and implement circuit that converts binary code to gray code.
- To study and perform about Half Adder and full Adder.
- To study and perform about Halfsubstractor and full substractor.
- To design 3-bit odd/even parity generator and checker.
- To study and perform about R-S and D flip flop.
- To study and perform about J-K and T flip flop.
- To study and perform about Master slave JK flip flop.
- To realize Boolean functions using multiplexer.
- To study and perform about Decoder and Demultiplexer.
- To study the use of decoder for BCD to seven segment LED display.
- To study universal shift register

SOFTWARE ENGINEERING AND TESTING

(BCS402)

Course Objectives:

- Understand, learn and apply the theoretical and practical knowledge of software development such as software development paradigms, process, models, tools and techniques.
- Understand and learn the process of software requirements identification, analysis, review, and learn recording requirements in the standard format of the SRS document.
- Understand the various types and levels of software testing and basic approaches of test case designing.

Course Outcomes:

- To classify the various Software Process Models
- To understand the Software Testing Concepts.
- To implement the Software Quality and Control Concepts
- To Design the Test cases and to get familiarity over Automated Testing tools

UNIT I - THE PRODUCT AND THE PROCESS

The Evolving Role of Software– Software Characteristics– Software Applications– Software: A Crisis on the Horizon?- Software Myths- Software Engineering: A Layered Technology– The Software Process– Software Process Models– The Linear Sequential Model– The Prototyping Model- The RAD Model- Evolutionary Software Process Models- Component-Based Development.

UNIT II - SYSTEM ENGINEERING AND ANALYSIS CONCEPTS

Computer-Based Systems– The System Engineering Hierarchy – Business Process Engineering: An Overview– Product Engineering: An Overview– Requirements Engineering– System Modeling– Requirement Analysis- Requirements Elicitation for Software- Software Prototyping- Specification- Specification Review.

UNIT III PRINCIPLES OF TESTING

PRINCIPLES OF TESTING: Introduction - Phases of software – Quality assurance and Quality control - Testing verification and validation - TECHNIQUES: White box - static testing - structural testing - challenges in white box testing - Black box testing.

UNIT IV - TYPES OF TESTING

TYPES OF TESTING: Integration testing - Top-Down Integration – Bottomup integration-Bi-Directional Integration - System - Integration – SYSTEM ACCEPTANCE TESTING: Functional versus Non Functional Testing - Functional System Testing - Non Functional Testing Acceptance Testing.

UNIT V - PERFORMANCE TESTING

PERFORMANCE TESTING: Introduction - Factors of governing - performance testing - Methodology for performance testing - Tools for performance testing - Process for performance Testing – REGRESSION TESTING: Introduction - Types regression testing - Best pratice in regression testing.

TEXT/REFERENCES BOOKS

- Roger S. Pressman, (2001), “Software Engineering “, Fifth edition, McGraw-Hill Higher Education - A Division of The McGraw-Hill Companies.
- Srinivasan Desikan and Gopalasamy Ramesh, "Software Testing for Principles and Practices", Person Education,.
- William E. Perry (2006), “Effective Methods of Software Testing”, 3rd Ed, Wiley
- India.
- RenuRajani, Pradeep Oak (2007), “Software Testing”, TMH.

Software Engineering and Testing Lab

(BCS406P)

Practical will be based on Paper Software Engineering and Testing Lab: Covers Units of Syllabus.

Theory of Computation

(BCS403)

Course Objectives:

The theoretical foundations of computer science have expanded substantially in recent years. The objective of this course is to introduce students to this fundamental area of computer science which enables students to focus on the study of abstract models of computation. These abstract models allow the students to assess via formal reasoning what could be achieved through computing when they are using it to solve problems in science and engineering. The course exposes students to the computability theory, as well as to the complexity theory. The goal is to allow them to answer fundamental questions about problems, such as whether they can or not be computed, and if they can, how efficiently. The course introduces basic computation models and their properties, and the necessary mathematical techniques to prove more advanced attributes of these models. The students will be able to express computer science problems as mathematical statements and to formulate proofs. Upon completion of this course the students are expected to become proficient in key topics of theory of computation, and to have the opportunity to explore the current topics in this area.

Course Outcome:

- Be familiar with Regular and Non regular Language and Finite automata.
- Examine the properties of formal language and automata, their equivalence and conversion techniques.
- Understand the concept of Context Free Grammars and Pushdown Automata.
- Be familiar with Turing machines.

UNIT - I

Introduction to theory of computation and basic Mathematical objects: Sets, Logic, Function, Relation, LanguagesMathematical Induction and Recursive definition. Types of proof, The Principle of Mathematical Induction, The Strong principle of Mathematical Induction, Recursive Definition, Structural Induction.

UNIT - II

Regular Language and Finite automata: Regular Languages and Regular expressions, Finite automata and Memory required to recognize a Language, Distinguishing one string from another, Union, Intersections and Complements, Non deterministic Finite Automata, Nondeterministic Finite Automata with ^ - transition, Kleenstheorms, Conversions from NFA-^ to NFA,NFA to DFA.

UNIT - III

Regular and Non regular Languages: A Criterion for Regualarity, Minimal Finite Automata, The Pumping Lemma for Regular Languages, Decision Problems.

UNIT - IV

Context Free Grammars and Pushdown Automata: Introduction to grammars, Derivation trees and Ambiguity, An unambiguous CFG for Algebric Expressions,Simplified Forms and normal

Forms.Definations,Deterministics Push down Automata,A PDA corresponding to Given Grammar, A CFG corresponding to given PDA, Introduction to Parsing. Introduction to Puming lemma for Context free Languages

UNIT - V

Turing machines: Definitions and ExamplesCombiningturing machines, Multitape TM, Universal Turing Machines – Halting Problemof Turing Machines – Church's Thesis. Introduction to Recursively Enumerable Languages and Computable Functions: Definitions

Text Books:

- Theory of Computation by John C Martin.
- Theory of Computation by V Sarthi.
- Formal Languages and automata theory by C K Nagpal.

Computational Linguistics

(BCS404A)

Course Objective:

The aim of the course is to make students understand syntactic and semantic elements natural language processing and to conceive basics of knowledge representation and inference.

Course Outcome:

- Explain the approaches for syntax and semantics in NLP.
- Understand the concepts of morphology, syntax, semantics and pragmatics of the language.
- Apply machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars.
- Analyze the current methods for statistical approaches to machine translation.
- Compare and contrast the clustering and unsupervised methods, log-linear and discriminative models and the EM algorithm as applied within NLP.
- Identify the applications of NLP in real world scenario.

UNIT - I

INTRODUCTION: Applications of NLP techniques and key issues - MT - grammar checkers – dictation - document generation - NL interfaces - Natural Language Processing key issues - The different analysis levels used for NLP: morpho-lexical - syntactic – semantic - pragmatic - markup (TEI, UNICODE) - finite state automata - Recursive and augmented transition networks – open problems.

UNIT - II

LEXICAL LEVEL: Error-tolerant lexical processing (spelling error correction) - Transducers for the design of morphologic analyzers Features - Towards syntax: Part-of-speech tagging (Brill, HMM) - Efficient representations for linguistic resources (lexica, grammars,...) tries and finite-state automata.

UNIT - III

SYNTACTIC LEVEL: Grammars (e.g. Formal/Chomsky hierarchy, DCGs, systemic, case, unification, stochastic) - Parsing (top- down, bottom-up, chart (Earley algorithm), CYK algorithm) - Automated estimation of probabilistic model parameters (inside-outside algorithm) - Data Oriented Parsing - Grammar formalisms and treebanks - Efficient parsing for context-free grammars (CFGs) - Statistical parsing and probabilistic CFGs (PCFGs) - Lexicalized PCFGs.

UNIT - IV

SEMANTIC LEVEL: Logical forms - Ambiguity resolution - Semantic networks and parsers - Procedural semantics - Montague semantics- Vector Space approaches - Distributional Semantics - Lexical semantics and Word Sense Disambiguation - Compositional semantics. Semantic Role Labeling and Semantic parsing.

PRAGMATIC LEVEL: Knowledge representation – Reasoning - Plan/goal recognition - speech acts/intentions - belief models- discourse – reference.

UNIT - V

NATURAL LANGUAGE GENERATION: content determination - sentence planning - surface realization.

SUBJECTIVITY AND SENTIMENT ANALYSIS: Information extraction - Automatic summarization - Information retrieval and Question answering - Named entity recognition and relation extraction - IE using sequence labeling - Machine translation: Basic issues in MT - Statistical translation - word alignment - phrase-based translation and synchronous grammars.

Reference Books

1. Daniel Jurafsky and James H. Martin, ―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, Prentice Hall, 2009.
2. Ian H. Witten and Eibe Frank, Mark A. Hall, ―Data Mining: Practical Machine Learning Tools and Techniques‖, Morgan Kaufmann, 2013.
3. Christopher Manning and HinrichSchütze, ―Foundations of Statistical Natural Language Processing‖, MIT Press, 2008.
4. James Allen, ―Natural Language Understanding‖, Addison Wesley, 1995. Steven Bird, Ewan Klein, and Edward Loper, ―Natural Language Processing with Python - Analyzing Text with the Natural Language Toolkit‖, O'Reilly Media, Sebastopol, 2009.

Computational Linguistics Lab

(BCS407P)

List of Experiments:

1. Implementing word similarity.
2. Implementing simple problems related to word disambiguation.
3. Simple demonstration of part of speech tagging.
4. Lexical analyzer.
5. Semantic analyzer.
6. Sentiment Analysis

Digital Image Processing

(BCS404B)

Course Objectives:

- Study the fundamental concepts of Digital Image processing and to discuss mathematical transforms.
- Study image enhancement techniques and explore DCT and DFT techniques
- Expose students to various image enhancement, restoration methods and morphological operations.
- Analyze Image Data Compression and morphological Operation
- Explain various Applications of Image Processing

Course Outcomes

- Explain the fundamental concepts of a digital image processing System
- Apply techniques for enhancing digital images
- Examine the use of Fourier transforms for image processing in the frequency domain
- Compare various Image compression standards and morphological Operation
- Identify various Applications of Image Processing

UNIT - I

Introduction to Image Processing Systems: Image representation, basic relationship between pixels, elements of DIP system, elements of visual perception-simple image formation model Vidicon and Digital Camera working principles Brightness, contrast, hue, saturation, mach band effect, Colour image fundamentals-RGB, CMY, HSImodels 2D sampling,quantization.

UNIT - II

Image Enhancement in the Spatial domain: Spatial domain methods: point processing- intensity transformations, histogram processing, image subtraction, image averaging Spatial filtering-smoothing filters, sharpening filters Frequency domain methods: low pass filtering, high pass filtering, homomorphic filter.

UNIT - III

Discrete Fourier Transform: Discrete Fourier Transform: Introduction , DFT and its properties, FFT algorithms ñ direct, divide and conquer approach, 2-D DFT &FFTImage Transforms : Introduction to Unitary Transform, DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform,Hadamard Transform, Discrete Cosine Transform, Discrete Wavelet Transform: Haar Transforms, KL Transform

UNIT - IV

Image Restoration and Image Segmentation: Image degradation, Classification of Image restoration Techniques, Image restoration Model, Image Blur, Noise Model : Exponential, Uniform, Salt and Pepper, Image Restoration Techniques : Inverse Filtering, Average Filtering,Median Filtering. The detection of discontinuities - Point, Line and Edge detections: Prewit Filter, Sobel Filter, Fri-Chen

Filter Hough Transform, Thresholding Region based segmentation Chain codes, Polygon approximation, Shape numbers.

UNIT - V

Image Data Compression and morphological Operation: Need for compression, redundancy, classification of image compression schemes,Huffman coding, arithmetic coding, dictionary based compression, transform Based compression, Image compression standards- JPEG &MPEG,vector quantization, wavelet based image compression.Morphological Operation: Introduction, Dilation, Erosion, Opening, Closing.

Applications of Image Processing: Case Study on Digital Watermarking, Biometric Authentication (Face, Finger Print, Signature Recognition), Vehicle Number Plate Detection and Recognition, Object Detection using Correlation Principle, Person Tracking using DWT, Handwritten and Printed Character Recognition, Contend Based Image Retrieval, Text Compression.

Reference:

- R.C.Gonzalez&R.E.Woods, Digital Image Processing, Pearson Education, 3rd edition, ISBN. 13:978-01316872882 S.
- Jayaraman Digital Image Processing TMH (McGraw Hill) publication, ISBN- 13:978-0-07-0144798
- Gonzalez, Woods & Steven, Digital Image Processing using MATLAB, Pearson Education, ISBN-13:978-0130085191
- William K. Pratt, “Digital Image Processing”, John Wiley, NJ, 4th Edition,200
- Sid Ahmed M.A., “Image Processing Theory, Algorithm andArchitectures”, McGraw-Hill, 1995.Umbaugh, “Computer Vision”.
- Anil K.Jain,Fundamentals of Digital Image Processing,Prentice Hall of India,2nd Edition,2004.

Digital Image Processing Lab

(BCS407P)

1. Write program to read and display digital image using MATLAB or SCILAB
    a. Become familiar with SCILAB/MATLAB Basic commands
    b. Read and display image in SCILAB/MATLAB
    c. Resize given image
    d. Convert given color image into gray-scale image
    e. Convert given color/gray-scale image into black & white image
    f. Draw image profile
    g. Separate color image in three R G & B planes
    h. Create color image using R, G and B three separate planes
    i. Flow control and LOOP in SCILAB
    j. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
    a. Obtain Negative image
    b. Obtain Flip image
    c. Thresholding
    d. Contrast stretching
3. To write and execute programs for image arithmetic operations
    a. Addition of two images
    b. Subtract one image from other image
    c. Calculate mean value of image
    d. Different Brightness by changing mean value
4. To write and execute programs for image logical operations
    a. AND operation between two images
    b. OR operation between two images
    c. Calculate intersection of two images
    d. Water Marking using EX-OR operation
    e. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
    a. Standard MATLAB function
    b. Program without using standard MATLAB functions
    c. C Program
6. To write and execute program for geometric transformation of image
    a. Translation
    b. Scaling
    c. Rotation
    d. Shrinking
    e. Zooming
7. To understand various image noise models and to write programs for
    a. image restoration
    b. Remove Salt and Pepper Noise
    c. Minimize Gaussian noise
    d. Median filter and Weiner filter
8. Write and execute programs to remove noise using spatial filters

a. Understand 1-D and 2-D convolution process
b. Use 3x3 Mask for low pass filter and high pass filter

9. Write and execute programs for image frequency domain filtering
    a. Apply FFT on given image
    b. Perform low pass and high pass filtering in frequency domain
    c. Apply IFFT to reconstruct image
10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detection mask
11. Write and execute program for image morphological operations erosion and dilation.
12. To write and execute program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

Machine Learning

(BCS407C)

Course Objective:

The course aims to provide an understanding of machine learning's role in data-driven modeling, prediction, and decision-making.

Course Outcomes:

- Gain knowledge about basic concepts of Machine Learning develop an appreciation for what is involved in learning from data.
- Develop learning algorithms based on logistic regression, Support Vector Machines to predict discrete-valued output given a training data comprising of features and corresponding class labels.
- Design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.
- Develop Linear Models for Regression using Bias-Variance Decomposition, Bayesian Linear Regression.
- Design Linear Models for Classification using Probabilistic Discriminative Models, The Laplace Approximation, Bayesian Logistic Regression.
- Construct algorithms based on neural networks to perform simple learning tasks like speech recognition, digit recognition, optical character recognition and similar cognitive applications.

UNIT - I

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

UNIT - II

Algebra Overview: Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as MATLAB.

UNIT - III

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

UNIT - IV

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

UNIT - V

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

Neural Networks: Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

Suggested Books:

1. EthemAlpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

Machine Learning Lab

(BCS407P)

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

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

SEMESTER – V

Computer Networks

(BCS501)

Course Objectives:

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking.
- Preparing the student for entry in advanced courses of computer networking.
- To gain knowledge of various protocols for network design and maintenance.

Course Outcomes:

- Understand and explain Data Communications System and its components.
- Understand Computer Network basics and OSI and TCP/IP model.
- Understand Networks switching, error detection and error correction techniques.
- Identify the different types of network devices and their functions.
- Familiarity with the various protocols of computer networks.

UNIT-I

Basic concepts: network definition, components of data communication, distributed processing, topology, transmission mode, categories of networks. OSI and TCP/IP models: layers and their functions, comparison of models. Digital transmission: modems, modems, cable modems. Analog and digital signal; data-rate and limits; digital to digital line encoding schemes; parallel and serial transmission; modulation scheme, multiplexing techniques FDM, TDM, transmission media.

UNIT-II

Networks switching techniques and access mechanisms, circuit switching; packet switching, message switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber, data link layer functions and protocol, error detection and error correction techniques, data -link control framing and flow control, error recovery protocols - stop and wait ARQ, go-back-n ARQ; point to point protocol.

UNIT-III

Multiple access protocol and networks, ALOHA, SLOTTED ALOHA, CSMA/CD, protocols; Ethernet LANS, Token Ring, Token Bus, back-bone networks, network adapters cards, repeaters, hubs, switches, bridges, types of bridges, router and gateways.

UNIT-IV

Networks layer functions and protocols, routing: routing algorithms distance vector routing; shortest path routing, network layer protocol, IP protocol, internet control protocols, Unicasting, multicasting, broadcasting, ISDN: services, historical outline, PRI, BRI.

UNIT-V

Transport layer functions and protocols, overview of TCP and UDP, transport services error and flow control, connection establishment and release, three way handshake, overview of session layer and presentation layer, overview of application layer protocol overview of DNS protocol, overview of internet, WWW,HTTP, FTP, SNMP protocol. Internet services, email services, www services, search service etc.

References:

- B. A. Forouzan: Data Communications and Networking, Fourth edition, THM,
- A.S. Tanenbaum: Computer Networks, Fourth edition PHI.
- Ames Chews Charles Perkins, Matthew Strebe "Networking Essentials: Study Guide "MCSE BPB Publications.
- K.Basandra& S. Jaiswal "Local Area Network" Galgotia Publications
- William Stalling "Data and Computer Communication" Pearson Prentice Hall
- Prakash C Gupta " Data Communication and Computer Network " PHI

Computer Network Lab
(BCS506P)

1. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
2. Simulate and implement stop and wait protocol for noisy channel.
3. Simulate and implement go back n sliding window protocol.
4. Simulate and implement selective repeat sliding window protocol.
5. Simulate and implement distance vector routing algorithm
6. Simulate and implement Dijkstra algorithm for shortest path routing.

Programming in Python

(BCS502)

Course Objectives:

- To Introduce Python Programming Language as Multipurpose Programming Language with Features and Applications.
- To Learn Installing Python and Introducing Cross Multiplatform Usage of Python.
- To Practice Basic Language Features of Python and Implement Oops Concepts Using Python.
- Learn core python structures and flow control, Create and run python functions
- Explore the python library functions for various purpose

Course Outcomes:

- Install and use Python on Various Platform.
- Understand and Explain various features of Python language
- Design and Develop Python applications for data analysis using object-oriented concept
- Build package and modules in Python with reusability and exception Aspect
- Write and execute Simple programs for sorting and searching in Python.

UNIT - I

Introduction to python: python interpreter, using python as calculator, python shell, indentation. Atoms, identifiers and keywords, literals, strings, operators (arithmetic operator, relational operator, logical or Boolean operator, assignment, operator, ternary operator, bit wiseoperator, increment or decrement operator).

UNIT - II

Creating python programs: input and output statements, control statements(branching, looping,conditional statement, exit function, difference between break, continue and pass.), defining functions, default arguments, errors and exceptions. Iteration and recursion: conditional execution, alternative execution, nested conditionals, the return statement.

UNIT - III

Recursion, stack diagrams for recursive functions, multiple assignment, the while statement, tables, two-dimensional tables. Strings and lists: string as a compound data type, length, traversal and the for loop, string slices, string comparison, a find function.

UNIT - IV

Looping and counting, list values, accessing elements, list length, list membership, lists and for loops, list operations, list deletion. Cloning lists, nested lists Object oriented programming: introduction to classes, objects and methods, standard libraries.

UNIT - V

Data structures: arrays, list, set, stacks and queues. Searching and sorting: linear and binary search, bubble, selection and insertion sorting.

References:

- T. Budd, Exploring Python, TMH, 1st Ed, 2011
- How to think like a computer scientist: learning with Python / Allen Downey, Jeffrey Elkner, Chris Meyers. 1st Edition – Freely available online.
- http://docs.python.org/3/tutorial/index.html
- http://interactivepython.org/courselib/static/pythonds

Programming in Python Lab

(BCS507P)

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
2. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria :
    a. Grade A: Percentage >=80
    b. Grade B: Percentage>=70 and <80
    c. Grade C: Percentage>=60 and <70
    d. Grade D: Percentage>=40 and <60
    e. Grade E: Percentage<40
2. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input paramters from user.
3. WAP to display the first n terms of Fibonacci series.
4. WAP to find factorial of the given number.
5. WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - n/n!
6. WAP to calculate the sum and product of two compatible matrices.

Operational Research
(BCS503)

Course Objective:

Operations Research now a day widely used in the area of decision making for the real life problems. Managers and decision makers get idea for optimizing and approximating industrial problems. They not only strive to devise appropriate measures for problem solving but also apply scientific techniques to monitor the organizations ongoing activities such as production mix, transportation, queuing, assignment, dynamic, Integer, goal and game problem.

Course Outcome:

1. Students will be able to describe characteristics and scope of OR.
2. Students will be able to define and formulate mathematical problems.
3. Students will be able to select optimal problems solving techniques for a given problem using LP.
4. Students will be able to formulate and solve transportation, travelling sales man and transshipment problems.
5. Students will be able to formulate and solve optimization problems related to job/ work assignments.
6. Students will be able to demonstrate and solve simple models of Game theory.
7. Students will be able to evaluate optimum solution using dynamic programming for different applications.
8. Students will be able to choose / devise appropriate queuing model for practical application.
9. Students will be able to solve different problems related to Network.

UNIT - I

Operations Research: Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.

Linear Programming Problem: Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation.

UNIT - II

Transportation and Assignment:Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problems and Travelling sales man Problem.

Queuing Theory: Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA.

UNIT - III

Inventory Control: Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.

Replacement theory: Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.

UNIT - IV

Game Theory:Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods.

Decision Theory: Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, hurwicz criterion, Decision tree.

UNIT - V

Project Management: Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.

Reference Books:

1. Operations Research: An Introduction by HamdyTaha, Pearson
2. Operations Research by A M Natarajan, P Balasubramani, A Tamilarasi, Pearson Education Inc
3. Operations Research by P Mariappan, Pearson
4. Operations Research by H N wagner, Prentice hall.
5. Optimization in Operations Research by Ronald Rardin, Pearson Education Inc.
6. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
7. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

Introduction to Data Science

(BCS504A)

Course Outcomes:

- Identify and execute basic tools of data science.
- Identify and execute basic syntax and programs in R.
- To understand data cleaning.
- To understand statistical techniques and visualize high-dimensional data.
- To understand the concept of Reproducible Research.

UNIT - I

Data Scientist's Tool Box: Turning data into actionable knowledge, introduction to the tools that will be used in building data analysis software: version control, markdown, git, GitHub, R, and RStudio.

UNIT - II

R Programming Basics: Overview of R, R data types and objects, reading and writing data, Control structures, functions, scoping rules, dates and times, Loop functions, debugging tools, Simulation, code profiling

UNIT - III

Getting and Cleaning Data: Obtaining data from the web, from APIs, from databases and from colleagues in various formats. basics of data cleaning and making data —tidy.

UNIT - IV

Exploratory Data Analysis: Essential exploratory techniques for summarizing data, applied before formal modeling commences, eliminating or sharpening potential hypotheses about the world that can be addressed by the data, common multivariate statistical techniques used to visualize high-dimensional data.

UNIT - V

Reproducible Research: Concepts and tools behind reporting modern data analyses in a reproducible manner, To write a document using R markdown, integrate live R code into a literate statistical program, compile R markdown documents using knitr and related tools,and organize a data analysis so that it is reproducible and accessible to others.

Reference Books

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.
2. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.
3. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.
4. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" Ist Edition by Bantam, 2007.

5. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1st Edition, by Wiley, 2013.
6. Matthew A. Russel, "Mining the Social Web: Data mining Facebook, Twitter, LinkedIn, Goole+, GitHub, and More", Second Edition, by O'Reilly Media, 2013.

Introduction to Data Science Lab

(BCS508P)

1. Write a program that prints ‗Hello World' to the screen.
2. Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
3. Write a program that prints a multiplication table for numbers up to 12.
4. Write a function that returns the largest element in a list.
5. Write a function that computes the running total of a list.
6. Write a function that tests whether a string is a palindrome.
7. Implement linear search.
8. Implement binary search.
9. Implement matrices addition , subtraction and Multiplication
10. Fifteen students were enrolled in a course. There ages were:
    a. 20 20 20 20 20 21 21 21 22 22 22 22 23 23 23
        i. Find the median age of all students under 22 years
        ii. Find the median age of all students
        iii. Find the mean age of all students
        iv. Find the modal age for all students
        v. Two more students enter the class. The age of both students is 23. What is now mean, mode and median ?
11. Obtain probability distribution of , where X is number of spots showing when a six-sided symmetric die (i.e. all six faces of the die are equally likely) is rolled. Simulate random samples of sizes 40, 70 and 100 respectively and verify the frequency interpretation of probability.
12. Make visual representations of data using the base, lattice, and ggplot2 plotting systems in R, apply basic principles of data graphics to create rich analytic graphics from available datasets.
13. Use Git / Github software to create Github account. Also, create a repo using Github.

Cloud Computing

(BCS504B)

Course Objectives:

- Basics of cloud computing.
- Key concepts of virtualization.
- Different Cloud Computing services
- Cloud Implementation and its tools
- Key components of Amazon Web Services
- Cloud Backup and solutions

Course Outcomes:

- Define Cloud Computing and memorize the different Cloud service and deployment models.
- Describe importance of virtualization along with their technologies.
- Use and Examine different cloud computing services
- Analyze the components of Google Cloud platform
- Describe the key components of Amazon web Service.
- Design & develop backup strategies for cloud data based on features.

Unit - I

Introduction to Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Biocomputing, Mobile Computing, Quantum Computing, Optical Computing, Nano-computing,Network Computing. Cloud Computing Fundamentals: Motivation, Need, Definition of Cloud Computing. Principles of Cloud computing: Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models, Cloud Ecosystem, Requirements forCloud Services. Cloud Computing Architecture: cloud Architecture, User/Client Layer, Network Layer, Cloud Management Layer, Hardware Resource Layer, , Network Connectivity in Cloud Computing, Public Cloud Access Networking, Private Cloud AccessNetworking.

UNIT – II

Cloud Computing Management: Cloud Application, Benefits and Drawbacks Applications on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure, Managing the Cloud Application, Migrating Application to Cloud, Cloud Deployment Models: Private Cloud,Outsourced Private Cloud, Community Cloud, On-Premise Community Cloud, Hybrid Cloud. Cloud Service Models: Infrastructure as a Service, : Platform as a Service, Software as a Service, Introduction to Open Source Tools for IaaS, Paas& SaaS : Apache.

UNIT - III

Technological Drivers for Cloud Computing: SOA and Cloud, SOA and SOC, Benefits of SOA, Multi-core Technology: Multi-core Processors and VM Scalability, Memory and Storage Technologies, Cloud Storage Requirements, Networking Technologies, Web 2.0 :Characteristics, Difference from Web 1.0, Applications, Social Media, Marketing, Education. Web 3.0:Components , Semantic Web, Web Services, Characteristics, Convergence of Cloud and Web

4.0, Connecting Information: Facebook. Agile Software Models: Agile SDLC forCloud Computing, Features of Cloud SDLC, Agile Software Development Process, Advantages of Agile. Cloud Application Development Platforms: Windows Azure, Google App Engine, Forcecom. IBM Cloud Computing API

UNIT - IV

Virtualization : Full Virtualization, Para virtualization, Hardware-Assisted Virtualization, Hypervisor, OS Virtualization, Server Virtualization, Memory Virtualization, Storage Virtualization, Network Virtualization, Application Virtualization, Processor Virtualization,Memory Virtualization, Storage Virtualization, Network Virtualization, Data Virtualization, Application Virtualization, Hypervisors, Types of Hypervisors, Security Issues and Recommendations, From Virtualization to Cloud Computing VMware. Microsoft Hyper-V.

UNIT - V

Cloud Service Providers ; EMC, EMC IT, Captiva Cloud Toolkit, Google, Cloud Platform, Cloud Storage, Google Cloud Connect, Google Cloud Print, Google App Engine, Amazon Web Services, Amazon Elastic Compute Cloud, Amazon Simple Storage Service, Amazon SimpleQueue Service, Microsoft Azure, Microsoft Assessment and Planning Toolkit, SharePoint, IBM SmartCloud. Security in Cloud Computing, Cloud General Challenges,

Text Books:

- Essentials of Cloud Computing, K Chandrasekaran, CRC Press [ISBN: 3: 978--4822-0544- 2]
- Raj Kumar Buyya, James Broberg and rezeiM.Goscinski, -Cloud Computing: Principles and Paradigms,-Wiley 2011.
- Srinivasan, J.Suresh,-Cloud Computing – a Practical Approach for Learning and Implementation, Pearson India, [ISBN 978131776513]
- Toby Velte, Anthony Velte, Robert Elsenpeter,-Cloud Computing, a Practical Approach - McGraw Hill, 2010 [ISBN: 0071626948]

References:

- Greg Schulz -Cloud and Virtual Data Storage Networking, Auerbach Publications [ISBN: 978-1439851739].
- Marty Poniatowski-Foundations of Green It- [ISBN: 978-0137043750].
- Learning Spring Application Development, Ravi Kant Soni, Packt Publishing.
- Michael Miller, Cloud Computing, 2008.
- Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, 2009.
- ° BorkoFurht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.

Lab based on Cloud Computing

(BCS508P)

1. Create virtual machines that access different programs on same platform.
2. Create virtual machines that access different programs on different platforms.
3. Exploring Google cloud for the following
    a) Storage
    b) Sharing of data
    c) manage your calendar, to-do lists,
    d) a document editing tool
4. Exploring Microsoft cloud
5. Exploring Amazon cloud

Numerical Methods

(BCS504C)

Course Objective:

Calculation of error and approximation is a necessity in all real life, industrial and scientific computing. The objective of this course is to acquaint students with various numerical methods of finding solution of different type of problems, which arises in different branches of science such as locating roots of equations, finding solution of systems of linear equations and differential equations, interpolation, differentiation, evaluating integration.

Course Outcome:

Students can handle physical problems to find an approximated solution. After getting trained a student can opt for advance courses in Numerical analysis in higher mathematics. Use of good mathematical software will help in getting the accuracy one need from the computer and can assess the reliability of the numerical results, and determine the effect of round off error or loss of significance.

UNIT-I

Rate of convergence, Algorithms, Errors: Relative, Absolute, Round off, Truncation. Approximations in Scientific computing, Error propagation and amplification, conditioning, stability and accuracy, computer arithmetic mathematical software and libraries, visualisation,Numerical solution of non-linear equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson method, Fixed-point Iteration method.

UNIT-II

Rate of convergence of the above methods. System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. Computing eigen-values and eigenvectors

UNIT-III

Polynomial interpolation: Existence uniqueness of interpolating polynomials.Lagrange and Newtons divided difference interpolation, Error in interpolation, Central difference & averaging operators, Gauss-forward and backward difference interpolation. Hermite and Splineinterpolation, piecewise polynomial interpolation.

UNIT-IV

Numerical Integration: Some simple quadrature rules, Newton-Cotes rules, Trapezoidal rule, Simpsons rule, Simpsons 3/8th rule, Numerical differentiation and integration, Chebyshev differentiation and FFT, Richard-son extrapolation.

REFERNCE BOOKS:

[1] Laurence V. Fausett, Applied Numerical Analysis, Using MATLAB, Pearson, 2/e (2012)

[2] M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publisher, 6/e (2012)

[3] Steven C Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Tata McGraw Hill, 2/e (2010)

Numerical Methods Lab

(BCS508P)

(i) Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ---------+ 1/N.
(ii) To find the absolute value of an integer.
(iii) Enter- 100 integers into an array and sort them in an ascending' order.
(iv) Any two of the following
  (a) Bisection Method
  (b) Newton Raphson Method
  (c) Secant Method
  (d) Regular Falsi Method
(v) Gauss-Jacobi Method
(vi) SOR Method or Gauss-Siedel Method
(vii) Lagrange Interpolation or Newton Interpolation
(viii) Simpson's rule.

Note: Programming is to be done in any one of Computer Algebra Systems: MATLAB / MATHEMATICA / MAPLE.

SEMESTER – VI

Artificial Intelligence and Machine Learning

(BCS601)

Course Objective:

- Understand different AI concepts
- Elucidate knowledge of Artificial Intelligence techniques for problem solving
- Understand Artificial intelligence search strategies and neural networks
- Provide an insight into the fundamentals of Machine Learning Techniques
- Become familiar with regression methods, classification methods, clustering methods
- Become familiar with methods to improve the learning

Course Outcome:

- Interpret Artificial Intelligence concepts intelligence concepts
- Apply Artificial intelligence techniques for problem solving
- Analyze the fundamentals of machine learning, the learning algorithms and the paradigms of supervised and un-supervised learning
- Identify methods to improve machine learning results for better predictive performance

UNIT - I

Introduction: Artificial Intelligence, Application of AI, AI Problems, Problem Formulation, Intelligent Agents, Types of Agents, AgentEnvironments, PEAS representation for an Agent, Architecture of Intelligent agents. Reasoning and Logic, Prepositional logic, First order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining

UNIT - II

Search Strategies: Solving problems by searching, Search- Issues in The Design of Search Programs, Un-Informed Search- BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, AI Algorithm, Alpha beta search algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis

UNIT - III

Artificial Neural Networks: Introduction, Activation Function, Optimization algorithm- Gradient decent, Networks- Perceptrons, Adaline,Multilayer Perceptrons ,Backpropogation Algorithms Training Procedures, Tuning the Network Size Introduction to ML: Machine Learning basics, Applications of ML,Data Mining Vs Machine Learning vs Big Data Analytics. Supervised Learning- Naïve Base Classifier, Classifying with k-Nearest Neighbour classifier, Decision Tree classifier, Naive Bayes classifier. Unsupervised Learning - Grouping unlabeled items using k-means clustering, Association analysis with the Apriori algorithm Introduction to reinforcement learning.

UNIT - IV

Forecasting and Learning Theory: Non-linear regression, Logistic regression, Random forest, Baysian Belief networks, Bias/variancetradeoff, Tuning Model Complexity, Model Selection Dilemma

Clustering: Expectation-Maximization Algorithm, Hierarchical Clustering,Supervised Learning after Clustering, Choosing the number of clusters, Learning using ANN.

UNIT - V

Kernel Machines & Ensemble Methods: Introduction, Optimal Separating Hyperplane, Separating data with maximum, margin, Support Vector Machine (SVM), Finding the maximum margin, The Non-Separable Case: Soft Margin Hyperplane, Kernel Trick, DefiningKernels Ensemble Methods : Mixture Models, Classifier using multiple samples of the data set, Improving classifier by focusing on error, weak learner with a decision stump, Bagging , Stacking, Boosting ,Implementing the AdaBoost algorithm, Classifying with AdaBoostBootstrapping and cross validation.

Dimensionality Reduction: Introduction, Subset Selection, Principal Components Analysis, Multidimensional Scaling, Linear Discriminant Analysis.

Reference:

- George F Luger, Artificial Intelligence, Fifth Edition-2009, Pearson Education Publications ,ISBN-978-81-317-2327-2
- Stuart Russell, Peter Norvig ,Artificial Intelligence – A Modern Approach, Pearson Education / Prentice Hall of India, 3rd Edition, 2009 .ISBN- 13: 978- 0136042594
- Elaine Rich, Kevin Knight, S.B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw Hill-2008., ISBN 10: 0070087709 / ISBN 13: 9780070087705
- Anandita Das ,Artificial Intelligence and Soft Computing for Beginners-,2nd Edition, ShroffPublication, ISBN- 9789351106159
- Nils J. Nilsson, —Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers, Harcourt Asia Pvt. Ltd., 2000, ISBN-1-55860-535-5
- Kumar Satish ,Neural Networks, Second edition Tata McGraw Hill-,2013, ISBN1259006166, 9781259006166
- EthemAlpaydın, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203-5078-6. (this can be made the text book)

Artificial Intelligence and Machine Learning Practical List

(BCS605P)

1. Implementation of Logic programming using LISP /PROLOG-DFS for water jug problem / BFS for tic-tac-toe problem/ Hill-climbing to solve 8- Puzzle Problem.
2. Introduction to Python Programming: Learn the different libraries - NumPy, Pandas, SciPy, Matplotlib, Scikit Learn.
3. Implementation of Linear Regression, Logistic regression, KNN- classification.
4. Implementation of dimensionality reduction techniques: Features Extraction and Selection, Normalization, Transformation, Principal Components Analysis.
5. Implementation of K-Means and K-medoid clustering algorithm.
6. Implementation of Classifying data using Support Vector Machines (SVMs).
7. Implementation of Bagging Algorithm: Decision Tree, Random Forest.
8. Implementation of Boosting Algorithms: AdaBoost, Stochastic Gradient Boosting, Voting Ensemble.
9. Deployment of Machine Learning Models.

Digital Marketing and Business Analytics

(BCS602)

Course Objective:

1. Examine and explore the role and importance Digital Marketing in the current business scenario.
2. Familiarize with the various Digital Marketing Tools.
3. Apply Digital Marketing tools for formulating a Digital Marketing Strategy.
4. Understand Digital Marketing Campaigns using various Tools and measure their effectiveness.

Course Outcome:

1. Understand the role of Digital Marketing Remembering
2. Demonstrate use of various Digital Marketing Tools.
3. Discuss key element of Digital Marketing Strategy.
4. Understand use of Digital Marketing Tools for Digital Marketing Campaigns
5. Assess / Measure the effectiveness of the Digital Marketing Campaigns.
6. Demonstrate practical skills using common digital marketing tools like SEO, SEM, Content Marketing

Unit - I

Fundamentals of Digital Marketing: Digital Marketing. Digital Marketing Strategy. Skills Required in Digital Marketing, Digital Marketing Plan, Digital Marketing: Introduction to Display Marketing, Types of Display Ads, Buying Models, Display Plan, Analytics Tools. Dignified Digital Marketing – Ethics and Data Privacy.

Unit - II

Search Engine Advertising: Introduction, Understanding Ad Placement, Understanding AdRanks, Creating First Ad Campaign, Enhance Your Ad Campaign, Performance Reports. Social Media Marketing: Building a Successful Strategy, Facebook Marketing: Facebook Marketing for Business, Anatomy of an Ad Campaign, Adverts, Facebook Insights, Other Marketing Tools, Other Essentials. Instagram Mobile Marketing: Mobile Usage, Mobile Advertising, Mobile Marketing Toolkit, Mobile Marketing Features, Campaign Development Process, Mobile Analytics.

Unit - III

LinkedIn Marketing: Importance of LinkedIn Presence, LinkedIn Strategy, Sales Leads Generation Using LinkedIn, Content Strategy, LinkedIn Analytics, Targeting, Ad Campaign. Twitter Marketing: Getting Started with Twitter, Building a Content Strategy, Twitter Usage, Twitter Ads, Twitter Analytics, Twitter Tools and Tips for Marketers.

Unit - IV

SEO: Search Engine, Concept of Search Engine Optimization (SEO), SEO Phases, On Page Optimization, Off Page Optimization, Social Media Reach, Maintenance.

Unit - V

Web Analytics: Data Collection, Key Metrics, Making Web Analytics Actionable, MultiChannel Attribution, Types of Tracking Codes, Mobile Analytics, Universal Analytics, Competitive Intelligence.

Reference Books:

1. Digital Marketing, Seema Gupta, McGraw Hill Education (India) Private Limited
2. Social Media& Mobile Marketing: Includes Online Worksheets Puneet Singh Bhatia,ISBN: 9788126578078
3. Digital Marketing for Dummies, Ryan Deiss& Russ Henneberry, John Wiley & Son, Inc.
4. Social Media Marketing All-In-One, Jan Zimmerman, Deborah Ng, John Wiley & Sons Inc.
5. Epic Content Marketing, Joe Pulizzi, McGraw Hill Education
6. Youtility, Jay Baer, Gildan Media, LLC
7. Hit Makers : The Science Age of Dice of Popularity in an Age of Distraction, Derek Thompson, Penguin Press
8. The Art of SEO, Eric Enge, Stephan Spencer, Jessie Stricchiola, O'Reilly Media Inc,Digital Marketing 2020, Danny Star,

Ethical Hacking

(BCS603A)

Course Objective:

- Teach students to think like an ethical hacker and at the same time follow the code of professional ethics and the prescribed cyber laws.
- Make oneself aware of the cybercrimes that are taking place in the real world.
- Learn about the different hacking tools and techniques and practically use these tools to gain better understanding of the ethical hacking concepts.
- Provide a deep understanding of security issues, threats and concerns in the cyber world and provide countermeasures to curb hacking.

Course Outcome:

- Recall the networking, sql, and encryption algorithm concepts to further study ethical hacking techniques, threats, tools and
- prevention against attacks.
- Understand ethical hacking concepts, cases, ethics and cyberlaws.
- Apply available hacking tools to find a solution to a given hacking issue.
- Analyze and classify the real-world hacking cases and situations.

UNIT - I

Introduction to ethical Hacking: What is ethical hacking? Types of hacking, advantages, disadvantages and purpose of hacking, Types of hackers, Code of ethics, Types of attacks and attack vector types, Prevention from hackers, The Indian IT Act 2000 and 04Amendments to the Indian IT Act(2008) ,Phases of hacking.

Footprinting and Reconnaissance:What is footprinting? Active and passive footprinting, purpose of footprinting, objectives of footprinting, footprinting threats, Types of footprinting, footprinting countermeasures.

UNIT - II

Scanning networks, Enumeration and sniffing: Scanning networks: Network scanning and its types, objectives of network scanning, scanning live systems, scanning techniques-TCP Connect / Full Open Scan, Types of Stealth scans, port scanning countermeasures, IDS evasion techniques, Banner grabbing and its tools, vulnerability scanning, proxy servers, anonymizers, IP spoofing and its countermeasures.

Enumeration and Sniffing: What is Enumeration? Enumeration techniques, Enumeration types, Enumeration countermeasures, what is sniffing? Wiretrapping and its types, packet sniffing, sniffing threats, how sniffers work?, sniffing methods-ARP spoofing and MAC flooding, active and passive sniffing, types of sniffing attacks, sniffing countermeasures, sniffing detection techniques.

UNIT - III

Trojans and other Attacks: Worms, viruses, Trojans, Types of worms, viruses and worms, Preventing malware attacks, types of attacks: (DoS /DDoS), Waterhole attack, brute force, phishing and fake WAP, Eavesdropping, Man-in-the-middle, buffer overflow, DNS poisoning, ARP poisoning, Identity Theft, IoT Attacks, BOTs and BOTNETs, Steganography - text, image and audio and video, types of Social Engineering: Physical social engineering, Remote social engineering and hybrid social engineering.

UNIT - IV

Hacking web servers, web applications and sql injection: Session hijacking: What is session hijacking? , why session hijacking is successful? session hijacking techniques, session hijacking process, Types of session hijacking,session hijacking countermeasures: protecting and preventing, Hacking web servers and web applications: Causes of webservers being compromised, web server attacks, stages of webserver attacks, defending against web server attacks, web application components, its working, architecture, web server attack vectors, web application threats and counter measures. SQL Injection: What is SQL injection, SQL injection threats, SQL injection attacks, SQLinjection detection, Types of SQL injection, SQL injection methodology, SQL injection prevention and countermeasures.

UNIT - V

Wireless network hacking, cloud computing security, cryptography, Pen testing: Types of wireless Architecture, wireless encryption techniques-WEP and WPA, breaking WEP/WPA and defending WPA encryption, wireless Sniffing, Characteristics, types of cloud computing services, models and benefits, threats and attacks, cryptography and its objectives, cryptography types, cryptography attacks, what is Pen Testing, need for pen testing, types and techniques of pen testing, phases of pen testing.

Reference:

1. Matt Walker, All-In-One-CEH-Certified-Ethical-Hacker-Exam-Guide.
2. Manthan Desai Basics of ethical hacking for beginners.
3. SunitBelapure and Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives.
4. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson.
5. Sean-Philip Oriyano, Sybex, Certified Ethical Hacker Study Guide v9, Study Guide Edition,2016.
6. Emmett Duley and Chuck Easttom ,Comptia Security+ Study Guide.
7. Alana Maurushat, Ethical Hacking.
8. TutorialsPoint Professionals, Ethical Hacking by TutorialsPoint.

Green Computing

(BCS603B)

Course Objective:

- Explain why Green IT is important to the enterprise over all
- Create awareness among stakeholders and promote green initiatives in their environments leading to a green movement.
- Adopt special skills such as knowledge about energy efficiency, ethical IT assets disposal, carbon footprint estimation.
- Create eco-friendly environment.
- Conduct basic equipment usage audits
- Improve energy efficiency of their personal computing environment as well as the enterprise-wide computing environment

Course Outcome:

- Acquire expertise for improving the energy efficiency for laptops and personal computers by reducing the power consumption requirements
- Assess enterprise-wide and personal computing and computing energy consumption
- Recognize the necessity for long-term sustainability in IT
- Formulate plans for reducing IT heating and cooling requirements
- Evaluate the regulatory and governance issues surrounding IT
- Choose the best sustainable hardware for their applications

UNIT - I

Trends and Reasons to Go Green: Overview andIssues, Consumption Issues, Minimizing PowerUsage, Cooling.

Introduction to Green IT: GreenIT, Holistic Approach to GreeningIT, Greening byIT (can be used for case study also)

- Using RFID for EnvironmentalSustainability
- SmartGrids
- Smart Buildings and Homes
- Green Supply Chain andLogistics
- Enterprise-Wide EnvironmentalSustainability

UNIT - II

Green Hardware: Introduction, Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose

Green Software: Introduction, Energy-Saving SoftwareTechniques, Sustainable Software Development

UNIT - III

Green Data Centers: Data Centre ITInfrastructure, Data Centre Facility Infrastructure: Implications for Energy, Efficiency, IT InfrastructureManagement, Green Data Centre MetricsGreen Data Storage: Introduction, Storage Media PowerCharacteristics, Energy Management Techniques for HardDisks, System-Level EnergyManagementGreen Networks and Communications: Introduction, Objectives of Green NetworkProtocols, Green Network Protocols andStandards

UNIT - IV

Enterprise GreenIT Strategy: Introduction, Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Organizational Considerations in a Green ITStrategy, Steps in Developing a Green ITStrategy, Metrics and Measurements in GreenStrategies.

Enterprise Green IT Readiness: Background: Readiness and Capability, Development of the G-Readiness Framework, Measuring an Organization's G-Readiness.

UNIT - V

Managing Green IT: Introduction, Strategizing GreenInitiatives, Implementation of GreenIT, InformationAssurance, Communication and SocialMedia.

Green Cloud Computing and Environmental Sustainability: Cloud Computing and Energy Usage Model, Features of Clouds Enabling Green Computing, Towards Energy Efficiency of Cloud Computing, Green Cloud Architecture

The Future of Green IT: Green Computing and theFuture, Megatrends for GreenComputing, Tele-presence Instead ofTravel, Tele-commuting Instead ofCommuting, Deep GreenApproach.

Reference:

- Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line,TobyVelte, Anthony Velte, Robert Elsenpeter, 2008, McGraw Hill.
- Harnessing Green IT,SanMurugesan, G. R. Gangadharan, 2013, WILEY.
- Green Computing-Tools and Techniques for saving energy, money and resources, Bud E. Smith, 2014, CRCPress.
- GREEN IT FOR SUSTAINABLE BUSINESS PRACTICE, Mark G. O'Neill, An ISEB FoundationGuide.
- Green Computing and Green IT BestPractices, Jason Harris
- The Green of IT – How Companies Can Make a Difference for the Environment, John Lamb, IBM Press (2009).
- Green Project Management, Richard Maltzman and David Shirley, CRC Press a Taylor and Francis Company (2010).
- Foundations of Green IT, Marty Poniatowski, Prentice Hall, 2009

DATA MINING AND WAREHOUSING

(BCS603C)

Course Objective:

- Explain the concept of data mining and data warehouse.
- Explain the concept of KDD, OLAP techniques, and NN with genetic algorithms.
- Explain the concept of data warehouse architecture, and database schema.
- Explain the Hardware and operational design of data warehouse, planning and testing the data warehouse.

Course Outcomes:

- To know the basic concepts of data mining
- To classify & cluster the data
- To use association rules on data.
- To introduce the concept of data warehousing
- To recover data in case of data loss

UNIT I - DATA MINING

Introduction- information and production factor- data mining Vs query tools - data mining and marketing -self learning computer system-computer learning-data learning, data mining and data warehouse.

UNIT II - KNOWLEDGE DISCOVERY PROCESS

Data selection- cleaning-enrichment-coding preliminary analysis of data set using traditional query tools-visualization techniques-OLAP tools-decision trees association rules-Neural networks genetic algorithms-KDD(Knowledge discover in databases) environment.

UNIT III - DATA WAREHOUSE – ARCHITECTURE

System process-process architecture, - design – database schema- partitioning strategy-aggregations - data marting-meta data-system and data warehouse process managers.

UNIT IV - HARDWARE AND OPERATIONAL DESIGN

Hardware and operational design of data warehouse - hardware arch-physical layoutsecurity-backup and receiver-service level agreement-operating the data warehouse.

UNIT V - PLANNING, TUNING AND TESTING

Capacity planning- tuning the data warehouse- testing the data warehouses-data warehouse features.

TEXT/REFERENCES BOOKS

- Pieter Adriaans, Dolf, Zantinge (1996), "Data mining", Addison Wesley" (Unit I & II)

- Sam Anahory, Dennis Murray "Data Warehousing in real world" (1997), Addison Wesley.(Unit III, IV & V)
- Mark Hall, Ian Witten and Eibe Frank (2011),"Data Mining: Practical Machine Learning Tools and Techniques", Third edition, Morgan Kaufmann Publisher.

BIG DATA ANALYTICS

(BCS604A)

Course Objective:

Students will gain knowledge on analyzing Big Data. It serves as an introductory course for graduate students who are expecting to face Big Data storage, processing, analysis, visualization, and application issues on both workplaces and research environments.

UNIT - I: INTRODUCTION TO BIG DATA

Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce Big Data – Apache Hadoop & Hadoop EcoSystem, MovingData in and out of Hadoop – Understanding inputs and outputs ofMapReduce -, Data Serialization.

UNIT - II: HDFS, HIVE AND HIVEQL, HBASE

HDFS-Overview, Installation and Shell, Java API; Hive Architecture, Comparison with Traditional Database, HiveQLQuerying Data, Sorting And Aggregating, Map Reduce Scripts, Joins& Sub queries, HBase concepts, Advanced Usage, Schema Design,Advance Indexing, PIG, Zookeeper , how it helps in monitoring acluster, HBase uses Zookeeper and how to Build Applications withZookeeper.

UNIT - III: SPARK

Introduction to Data Analysis with Spark, Downloading Sparkand Getting Started, Programming with RDDs

UNIT - IV: NoSQL

What is it? Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL.

Text & References:

- Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, by Chris Eaton, Paul Zikopoulos
- Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends, By Michael Minelli, Michele Chambers, AmbigaDhiraj
- Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
- BIG Data and Analytics , Sima Acharya, SubhashiniChhellappan, Wiley

Soft Computing

(BCS604B)

Course Outcome:

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.
- Use various tools to solve soft computing problems.

Unit - I: Introduction to Soft Computing and Neural Networks

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

Unit - II: Fuzzy Logic

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Unit - III: Neural Networks

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

Unit - IV: Genetic Algorithms

Goals of optimization, comparison with traditional methods, schemata, Terminology in GA – strings, structure, parameter string, data structures, operators, coding fitness function, algorithm, applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

Unit - V: Matlab/Python Lib

Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic. Recent Trends in various classifiers, neural networks and genetic algorithm.

Books and References:

- Principles of Soft computing S.N.Sivanandam, S.N.Deepa, Wiley 3rd 2019.
- Neuro-Fuzzy Computing and Soft J.S.R.Jang, C.T.Sun and E.Mizutani Prentice Hall of India 2004.
- Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications S.Rajasekaran, G. A. Vijayalakshami Prentice Hall ofIndia 2004.
- Fuzzy Logic with Engineering Applications Timothy J.RossMcGrawHill 1997.