MADHYA PRADESH BHOJ (OPEN) UNIVERSITY

PROGRAMME PROJECT REPORT

ON

BACHELOR OF SCIENCE (CYBER SECURITY)

Four Year Undergraduate Programme (Honours) offered as per NEP 2020

Submitted to

UNIVERSITY GRANTS COMMISSION

NEW DELHI

Submitted by

MADHYA PRADESH BHOJ (OPEN) UNIVERSITY

BHOPAL (M.P.)

Contents

B.Sc (Cyber Security)
(Four Year Undergraduate Programme offered as per NEP 2020)
Choice Based Credit System (CBCS)

a) Programme mission and objectives

Mission:

It provides a strong foundation in the theoretical concepts of Cyber Security as well as a firm grounding in Programming Languages. It is designed to enable one to undertake software applications for business and industry. Successful candidates could also opt for a teaching career in secondary schools.

Objectives:

The objective of a Bachelor of Science in Cyber Security program is to provide students with a comprehensive understanding of the various aspects of cyber security, including threats, vulnerabilities, and protective measures. The program aims to develop the skills and knowledge necessary for students to identify, analyze, and address cyber security issues in a wide range of contexts. Some specific objectives of a B.Sc. in Cyber Security program include:

- Understanding Cyber Security Concepts: To provide students with a comprehensive understanding of the concepts, theories, and practices of cyber security.
- Knowledge of Security Technologies: To introduce students to various security technologies such as firewalls, intrusion detection and prevention systems, and encryption technologies.
- Understanding Threats and Vulnerabilities: To teach students about various threats and vulnerabilities in cyberspace, such as viruses, malware, phishing attacks, and social engineering.
- Analyzing Cyber Security Risks: To help students identify and analyze potential cyber security risks in various settings, such as corporate networks, financial systems, and critical infrastructure.
- Developing Security Strategies: To help students develop strategies to protect against cyber attacks and to respond to security incidents.
- Communication and Collaboration: To develop the communication and collaboration skills necessary to work effectively in interdisciplinary teams to solve complex cyber security problems.
- Ethics and Law: To provide students with an understanding of ethical and legal issues related to cyber security, including privacy, intellectual property, and cybercrime.
- Career Readiness: To prepare students for a range of careers in cyber security, including security analysts, security engineers, security consultants, and security managers.

Outcome:

The outcomes of a Bachelor of Science in Cyber Security program include:

- Cyber Security Expertise: Graduates will have expertise in various areas of cyber security, including information security, network security, application security,

and data protection.

- Security Risk Assessment: Graduates will have the ability to identify, assess and mitigate risks to information systems and networks using appropriate security technologies, tools, and practices.
- Cyber Security Analysis: Graduates will be able to analyze cyber security incidents, identify the root cause of the incident and take appropriate measures to prevent future attacks.
- Security Compliance: Graduates will be able to ensure that security policies and procedures are in compliance with relevant laws and regulations.
- Cyber Security Planning: Graduates will have the ability to develop security plans that align with organizational goals, strategic objectives, and industry best practices.
- Security Awareness: Graduates will have the ability to raise awareness of cyber security risks and educate users about safe online practices.
- Collaboration: Graduates will be able to work collaboratively with stakeholders to identify, prioritize and mitigate cyber security risks.
- Ethical and Legal Responsibility: Graduates will have a strong understanding of ethical and legal responsibilities related to cyber security, including privacy, intellectual property, and cybercrime.
- Career Readiness: Graduates will be prepared for a wide range of careers in cyber security, including security analysts, security engineers, security consultants, and security managers.

b) Relevance of the program with HEI's mission and goals

HEI's mission and goals to be offered through distance mode to reach quality higher education to the rural learners. The distance mode meets the mission of HEI's like Digital India and paper-less transaction will enrich the human resources for the uplift ofthe nation.

c) Nature of prospective target group of learners

The prospective target group of learners of a Bachelor of Science in Cyber Security program includes:

- High School Graduates: Students who have recently graduated from high school and are interested in pursuing a career in cyber security.
- Career Changers: Professionals who are currently working in a related field, such as IT, but are interested in transitioning to a career in cyber security.
- Military Personnel: Military personnel who are transitioning to civilian life and want to pursue a career in cyber security.
- Information Technology Professionals: Professionals who are working in the information technology field and want to gain specialized skills in cyber security.
- Law Enforcement and Government Personnel: Law enforcement and government personnel who want to gain expertise in cyber security to combat cybercrime and protect critical infrastructure.
- Entrepreneurs and Business Owners: Entrepreneurs and business owners who want to develop cyber security strategies to protect their business and their customers' data.

- International Students: International students who are interested in pursuing a career in cyber security and want to gain specialized knowledgein the field.

Overall, the prospective target group of learners for a Bachelor of Science in Cyber Security program is diverse and includes individuals who are interested in pursuing a career in cyber security, as well as those who want to gain specialized knowledge and skills to protect their personal and business information.

d) Appropriateness of programme to be conducted in open and distance learning mode toacquire specific skills and competence:

A Bachelor of Science in Cyber Security program is well-suited for delivery through open and distance learning mode as it requires a combination of theoretical knowledge and practical skills. The program can be structured to ensure that students have access to the necessary resources and support to acquire specificskills and competencies in cyber security.

Here are some reasons why the B.Sc. Cyber Security program is appropriate foropen and distance learning:

- Flexibility: Open and distance learning provides students with the flexibility to learn at their own pace and according to their schedule. This allows students to balance their studies with work, family, and other commitments.
- Technology: Cyber security is an inherently technology-driven field, anddistance learning provides an opportunity for students to learn in a technology-rich environment that is relevant to the field.
- Resources: Open and distance learning provides students with access to a wide range of resources, including online textbooks, lecture videos, and discussion forums. These resources can help students to acquire specificskills and competencies in cyber security.
- Collaboration: Distance learning provides opportunities for students to collaborate with peers from different locations and backgrounds. This allows students to gain exposure to different perspectives and experiences, which can be particularly valuable in the field of cyber security.
- Career Advancement: The B.Sc. Cyber Security program prepares students for a variety of careers in the field of cyber security. Distance learning provides an opportunity for working professionals to acquire the necessary skills and competencies to advance their careers without taking a break from work.

Overall, the B.Sc. Cyber Security program is appropriate for open and distance learning, as it allows students to acquire the specific skills and competencies needed to succeed in the field of cyber security, while providing the flexibility and

resources needed for success in a distance learning environment.

e) Instructional Design

e.1 Regulations and curriculum design

1. The University reserves the rights to amend the regulations, schemes of examinations and syllabi from time to time based on recent IT trends
2. Every student should secure 160 credits to complete B.Sc Cyber Security programme.
3. Each theory course carries 4 credits with 70 marks in the university Term end Examination and 30 marks in the internal assessment and each practical (lab) course carries 4 credits with 70 marks in the university end semester examination and 30 marks in the internal assessment.

Programme Code: BSCCS131

COURSE OF STUDY AND SCHEME OF EXAMINATION

First Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Computer Fundamentals,Organization and Architecture	30	70	100	35	4
2		**Course-2:** Programming MethodologyAnd Data Structure	30	70	100	35	4
Minor							
3		Operating System and Security	30	70	100	35	4
Elective							
4		Fundamental of Cyber Security AndIntroduction to Python Programming	30	70	100	35	4
Vocational							
5		Web Designing	30	70	100	35	2
LAB							
6		Computer Fundamentals, Organization and Architecture Lab			100	35	2

7		Programming MethodologyAnd Data Structure Lab			100	35	2
8		Operating System and Security Lab			100	35	2
9		Fundamental of Cyber Security AndIntroduction to Python Programming Lab			100	35	2
10		Web DesigningLab			100	35	2

Second Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Advanced Python	30	70	100	35	4
2		**Course-2:** Fundamentals of Web Technology	30	70	100	35	8
Minor							
3		Cloud Computing and Security	30	70	100	35	4
Elective							
4		Data Communication & Networking	30	70	100	35	4
Vocational							
5		Network Security	30	70	100	35	4
LAB							
6		Advanced Python Lab			100	35	2
7		Fundamentals of Web Technology Lab			100	35	2
8		Cloud Computing and Security Lab			100	35	2

9		Data Communication & Networking Lab			100	35	2
10		Information Security Lab			100	35	2

Third Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Core Java Programming	30	70	100	35	4
2		**Course-2:**Essentials of Ethical Hacking	30	70	100	35	4
Minor							
3		Resource Management Techniques	30	70	100	35	4
Elective							
4		Biometric Systems	30	70	100	35	4
Vocational							
5		Data ware housing and data mining	30	70	100	35	2
LAB							
6		Core Java Programming Lab			100	35	2
7		Essentials of Ethical HackingLab			100	35	2
8		Resource Management Techniques Lab			100	35	2
9		Biometric SystemsLab			100	35	2
10		Data ware housing and data miningLab			100	35	2

Fourth Year

S. No.	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		Course- 1: Computer Forensics	30	70	100	35	4

2		Course-2: Internet of Things					
Minor							
3		Cryptography	30	70	100	35	4
Elective							
4		Incident response management	30	70	100	35	4
Vocational							
LAB							
5		Computer Forensics Lab			100	35	2
6		Internet of Things Lab			100	35	2
7		Cryptography Lab			100	35	2
8		Incident response management Lab			100	35	2
9		Project			100	35	2

Syllabus: Annexure

e.2 Duration of the Programme:

The B.Sc Cyber Security programme shall consist of a period of Four years.

e.3 Faculty and Support Staff Requirements:

The following faculty and support staff is required for this programme.

S.No	Staff Category	Numbers
1	Computer Science Subject Core Faculty*	3
2	Inter-disciplinary Subject Faculty* (Mathematics, Account & Financial Management and Communication Skills)	2
3	Lab Assistant	1
4	Clerical Assistant	1

* Faculty at least in Assistant Professor level

e.4 Instructional Delivery mechanisms

The instructional delivery mechanisms of the programme includes SLM-Study materials, Lab instruction manual, Personal contact session for both theory and practical courses of the programme, e-version of the course materials in the form of CD, e-book, e-tutorials, Massive Open Online Courses (MOOC) courses, Open Educational Resources(OER) and virtual lab.

e.5 Identification of media

The printed version of SLM – study material shall be given to the learners in addition to MOOC, E-tutorial and virtual lab.

e.6 Student Support Services

The student support services will be facilitated by the Directorate of Distance Education, Madhya Pradesh Bhoj Open University, Bhopal and its approved learning centres located in various parts of Madhya Pradesh.

The pre-admission student support services like counseling about the programme including curriculum design, mode of delivery, fee structure and evaluation methods will be explained by the staff at Directorate of Distance Education or Learning centres. The post-admission student support services like issuing Identity card, study materials will be provided thru Directorate or Learning centres. The face to face contact sessions of the programme for both theory and practical's will be held at the Directorate or Learning centres. The student support regarding the conduct of examinations, evaluations, publication of results and certificates done by the Office of the Controller of Examinations, Madhya Pradesh Bhoj Open University, Bhopal

(f) Procedure for Admissions, curriculum transaction and evaluation

f.1 Minimum qualification for admission

Candidates for admission to the B.Sc (Cyber Security) programme shall be required to have passed the following examinations. Candidates who have passed HSC or 3 yearDiploma from recognized institution shall be eligible.

Lateral Entry to II year B.Sc. (CS): 3 year Diploma in Cyber Security Engineering, Information Technology, Electronics and Communication Engineering, Electrical and Electronics Engineering

f.2 Curriculum transaction

- The face to face contact sessions in class room teaching with the support of SLM,Power Point Presentations, web based tools, audio and animated videos.
- The practical classes are based on the respective subject study materials containingrequirement for the laboratory experiments.
- Face to face contact sessions will be conducted for both theory and practical coursesin the following manner.

Course Type	**Face to face contact session per semester (in Hours)**
Theory courses (3 Courses with 4 credits each)	48
Practical courses (1 Courses with 4 credits each)	120
Total	**168**

f.3 Evaluation

The examinations shall be conducted separately for theory and practical's to assess the knowledge acquired during the study. There shall be two systems of

examinations viz., internal and external examinations. In the case of theory courses, the internal evaluation shall be conducted as Continuous Internal Assessment via. Student assignments preparation and seminar, etc. The internal assessment shall comprise of maximum 30 marks for each course. The end semester examination shall be of three hours duration to each course at the end of each semester. In the case of Practical courses, the internal will be done through continuous assessment of skill in demonstrating the experiments and record or report preparation. The external evaluation consists of an end semester practical examinations which comprise of 70 marks for each course.

Internal assessment

- Internal assessment of theory courses is through home assignment with workbook, case studies, review questions, quiz, multiple choice questions etc., for 30 marks.

- The internal assessment for the practical courses shall be through home assignment which includes workbook designing algorithm, preparing source code, PL/SQL coding etc., for 30 marks.

- The learners should submit home assignment with worksheet for each course (Theory and Practical's) to **The Director, Directorate of Distance Education (DDE), Madhya Pradesh Bhoj Open University** Only along with response sheet contains name of the programme, name of the student, enrolment number, course name and subject code.

- Learners should submit home assignments of each courses both theory and practicals at least one month before the commencement of end semester examination of every semester.

Division of Internal Marks (Assignment)

Theory		Practical	
Assignment	**Marks**	**Assignment**	**Marks**
Review questions	20	Algorithm Design	20
Workbook, case studies,multiple choice questions	10	Workbook for preparing source code, PL/SQL coding , results	10
TOTAL	30	TOTAL	30

Term End r Examination

The university end Semester Examinations shall be of three hours duration with maximum of 70 Marks for both theory and practical courses.

Learners shall prepare practical record note book according to the following guidelines; aim, algorithm, source code, input, expected output and result of the experiment and submit during end semester practical examination.

f.3.1 Minimum for a pass:

- For internal Examination, the passing minimum shall be 35% (Thirty Five Percentage) ofthe maximum marks (30) prescribed for UG and PG Courses.

- For External Examination, the passing minimum shall be 35% (Thirty Five Percentage) ofthe maximum marks (70) prescribed for UG and PG Courses.
- In the aggregate (External + Internal), the passing minimum shall be 35% for UG.

f.3.2 Question Paper Pattern - Theory

The end semester examination will be conducted in the duration of 3 Hours and maximum of 75 Marks.

Answer ALL questions

One question from each unit from the course

syllabiPart – A (10 x 2 Marks: 20 Marks)

Part – B (5 x 5 Marks: 25 Marks) (Internal

Choice)Part – C (3 x 10 Marks: 30 Marks)

(Internal Choice)

f.3.3 Procedure for Completing the Course:

A student shall be permitted to continue the programme from I to II Year irrespective of failure(s) in the courses of the earlier semesters. The candidate will qualify for the B.Sc (CS) degree only if he/she passes all the (including arrears) courses with in a period of Eight years from the date of admission.

f.3.4 Results and Classification:

Results will be declared at the end of each semester of the University examination and the marks/grade obtained by the candidate will be forwarded to them by the Controller ofExaminations, Madhya Pradesh Bhoj Open University.

f.3.4.1 Marks and grades

The following table gives the marks, grade points, letter, grades and classification to indicate the performance of the candidate

Range of Marks	Grade Points	Letter Grade	Description

90-100	9.0 - 10.00	O	Outstanding
80-89	8.0 - 8.9	D+	Excellent
75-79	7.5 - 7.9	D	Distinction
70-74	7.0 - 7.4	A+	Very Good
60-69	6.0 - 6.9	A	Good
50-59	5.0 - 5.9	B	Average
00-49	0.00	U	Reappear
ABSENT	0.00	AAA	Absent

Grade Point Average = Sum of the multiplication of Grade points by the credit of thecourses
Sum of the credit of the courses in the semester

f.4 Fees Structure

Fee Particulars	Amount in (Rs)			
	First Year	**Second Year**	**Third Year**	**Fourth Year**
Admission Processing Fees	100	--	--	--
Course Fees	9000	9000	9000	9000
ICT fees	100	100	100	100
Total Fees	9200	9100	9100	9100

The above mentioned fees structure is exclusive of examination fees.

(g) Requirement of the laboratory support and library resources

g.1 Laboratory Support

A well-equipment Computer Laboratory was established in the Madhya Pradesh Bhoj Open University, Bhopal with necessary software's as per the practical's syllabi for conducting face to face contact sessions for practical courses of this programme. Model Practical Questions is available to the learners in the university website.

g.2 Library Resources

The Madhya Pradesh Bhoj Open University provides library facility with number of books and Self Learning materials for Cyber Security programmes. The Central library of University provides the collection of volumes of Self Learning Materials, Printed books, Subscriptions to printed periodicals and Non-book materials in print form for the learner's references. All these library resources are meant for learner's reference purpose only.

(h) Cost estimate of the programme and the provisions:

Expense details	Amount in (Rs.) Approx.
Programme development(Single Time Investment)	20,00,000/-
Programme delivery(Per Year)	24,00,000/-
Programme maintenance	5,00,000/-

(i) Quality assurance mechanism and expected programme outcomes:

i.1 University's Moto: to promote education that reaches the unreached through the Open and DistanceLearning system and the motto of the University is "reaching the un-reached".

i.2 University's Vision and Mission

(a) Vision

Achieving Excellence in all spheres of Education, with particular emphasis on ' PEARL' - Pedagogy, Extension, Administration, Research and Learning.

Mission

Affording a High Quality Higher Education to the learners so that they are transformed into intellectually competent human resources that will help in the uplift of the nation to Educational, Social, Technological, Environmental and Economic Magnificence (ESTEEM).

i.3 University Objectives

1. Providing for instructions and training in such branches of Learning at the university may determine.
2. Fostering Research for the Advancement and Dissemination of Knowledge and Application.

i.4 Quality Policy

Attaining Benchmark Quality in every domain of 'PEARL' to assure Stakeholder Delight through Professionalism exhibited in terms of strong purpose, sincere efforts, steadfast direction and skillful execution.

i.5 Quality Quote : Quality Unleashes Opportunities Towards Excellence (QUOTE).

i.6. Course benchmarks

The benchmark qualities of the programme may be reviewed based on the performance of students in their end semester examinations and number of enrolments of students. Feedback from the alumni, students, parents, stakeholders and employers will be received to analyze the benchmark qualities for the further improvement of the programme.

A Bachelor of Cyber Security program typically aims to provide students with the knowledge and skills necessary to work in the field of Cyber Security. The expected program outcomes may include:

- Knowledge of Cyber Security: Graduates should have a deep understanding of the concepts, principles, and methods of Cyber Security. This includes knowledge of statistical techniques, machine learning algorithms, and programming languages commonly used in Cyber Security.
- Ability to Collect and Analyze Data: Graduates should be able to collect, clean, and transform data, and apply appropriate statistical and machine learning techniques to extract insights from the data.
- Programming Skills: Graduates should have proficiency in programming languages

such as Python, R, SQL, and other relevant tools and technologies used in Cyber Security.

- Data Visualization and Communication Skills: Graduates should be able to communicate insights and findings from data analysis effectively through visualizations, reports, and presentations.
- Domain Expertise: Graduates should have knowledge in a specific domain such as business, healthcare, or finance, and be able to apply Cyber Security techniques to solve real-world problems in that domain.
- Critical Thinking and Problem Solving Skills: Graduates should be able to analyze complex problems, identify relevant data, and use data-driven methods to solve problems.
- Ethical and Legal Considerations: Graduates should have an understanding of the ethical and legal implications of Cyber Security, including privacy, security, and bias issues.
- Lifelong Learning: Graduates should have the ability and motivation to continue learning new Cyber Security techniques and tools throughout their careers.

Bachelor of Science in Cyber Security

(B. Sc. Cyber Security)

First Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Computer Fundamentals,Organization and Architecture	30	70	100	35	4
2		**Course-2:** Programming MethodologyAnd Data Structure	30	70	100	35	4
Minor							
3		Operating System and Security	30	70	100	35	4
Elective							
4		Fundamental of Cyber Security AndIntroduction to Python Programming	30	70	100	35	4
Vocational							
5		Web Designing	30	70	100	35	2
LAB							
6		Computer Fundamentals, Organization and Architecture Lab			100	35	2
7		Programming MethodologyAnd Data Structure Lab			100	35	2
8		Operating System and Security Lab			100	35	2
9		Fundamental of Cyber Security AndIntroduction to Python Programming Lab			100	35	2
10		Web DesigningLab			100	35	2

Second Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Advanced Python	30	70	100	35	4
2		**Course-2:** Fundamentals of Web Technology	30	70	100	35	8
Minor							
3		Cloud Computing and Security	30	70	100	35	4
Elective							
4		Data Communication & Networking	30	70	100	35	4
Vocational							
5		Network Security	30	70	100	35	4
LAB							
6		Advanced Python Lab			100	35	2
7		Fundamentals of Web Technology Lab			100	35	2
8		Cloud Computing and Security Lab			100	35	2
9		Data Communication & Networking Lab			100	35	2
10		Information Security Lab			100	35	2

Third Year

S. No	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		**Course- 1:** Core Java Programming	30	70	100	35	4
2		**Course-2:**Essentials of Ethical Hacking	30	70	100	35	4
Minor							
3		Resource Management Techniques	30	70	100	35	4
Elective							
4		Biometric Systems	30	70	100	35	4
Vocational							
5		Data ware housing and data mining	30	70	100	35	2
LAB							
6		Core Java Programming Lab			100	35	2
7		Essentials of Ethical HackingLab			100	35	2
8		Resource Management Techniques Lab			100	35	2
9		Biometric SystemsLab			100	35	2
10		Data ware housing and data miningLab			100	35	2

Fourth Year

S. No.	Course Code	Subject	Max Marks		Total Marks		Total Credits
Major			**Assign**	**Theory**	**Max**	**Min**	
1		Course- 1: Computer Forensics	30	70	100	35	4
2		Course-2: Internet of Things					
Minor							
3		Cryptography	30	70	100	35	4
Elective							
4		Incident response management	30	70	100	35	4
Vocational							
LAB							
5		Computer Forensics Lab			100	35	2
6		Internet of Things Lab			100	35	2
7		Cryptography Lab			100	35	2
8		Incident response management Lab			100	35	2
9		Project			100	35	2

Detailed Syllabus

First Year

Paper-I: Course- 1:Computer Fundamentals, Organization and Architecture

Unit-I: Fundamentals of computers: Definition, Characteristics, capabilities and limitations.Types of Computers: Analog, Digital, Micro, Mini, Mainframe & Super Computers, WorkStation, Server computers. Generations of Computers.Smart Systems: definition, characteristics and applications.Definition of Embedded system, GIS, GPS, Cloud Computing.Uses of computers in e-governance and various public domains and services.

Unit-II: Block diagram of computer and its functional units. Concept of hardware, software andfirmware.Types of software.Input devices - keyboard, scanner, mouse, light pen, bar code reader, OMR, OCR, MICR,track ball, joystick, touch screen camera, microphone etc.Output devices: monitors classification of monitors based on technology -CRT & flat panel,LCD, LED monitors, speakers, printers - dot matrix printer, ink jet printer, laser printer, 3DPrinters, Wi-Fi enabled printers, plotters and their types, LCD/LED projectors.Computer memory and its types, Storage devices: Magnetic tapes, Floppy Disks, Hard Disks, CompactDisc - CD-ROM, CD-RW, VCD, DVD, DVD-RW, usb drives, Blue Ray Disc, SD/MMC Memory
Cards.

Unit- III: Fundamentals of Digital Electronics: Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Binary and other Codes, Error Detection Codes.Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Sequential Circuits,simple combinational circuit design problems.Combinational Circuits- Adder- Subtractor, Multiplexer, Demultiplexer, Decoders, EncodersSequential Circuits - Flip-Flops, Registers, Counters.

Unit-IV: Basic Computer Organization: Instruction codes, Computer Registers, Computer Instructions,Timing & Control, Instruction Cycles, Memory Reference Instruction, Input - Output & InterruptsInstruction formats, Addressing modes, Instruction codes, Machine language, Assemblylanguage.Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus &Memory Transfer, Arithmetic Micro- operations, Logic Micro-operations, Shift Micro-operations.

Unit-V: Processor and Control Unit: Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, ProgramControl, Introductory concept of RISC, CISC, advantages and disadvantages of both.Pipelining concept of pipelining, introduction to Pipelined data path and control - Handling Datahazards & Control hazards.

Unit-VI: Memory and I/O Systems - Peripheral Devices, I/O Interface,Data Transfer Schemes - Program Control, Interrupt, DMA Transfer. I/O Processor.Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Main memory &its types, Auxiliary memory, Cache Memory, Associative Memory, Interleaving, concept ofVirtual Memory, Hardware support for Memory Management.

Unit-VII: Indian contribution to the field - Contributions of reputed scientists of Indian origin - like Dr. Vinod Dham Father of Intel Pentium Processor, Dr. Ajay Bhat - Co-Inventor of USBTechnology, Dr. Vinod Khosla- co-founder of Sun Microsystems, Dr. Vijay P Bhatkar -architect of India's national initiative in supercomputing, and many others. ParallelComputing projects of India PARAM, ANUPAM, FLOSOLVER, CHIPPS etc.Other relevantcontributors and contributions.

Textbooks,

Textbooks:

1. M.Morris Mano, "Computer System Architecture", PHI.
2. Heuring Jordan, "Computer System Design & Architecture" (A.W.L.)
3. म□□देशिहंदी□ंथअकादमीसे□काि◌शतिवषयसेसंबं◌िधतपु□क□।

Reference Books:

1. William Stalling, "Computer Organization & Architecture", Pearson Education Asia.
2. V. Carl Hamacher, "Computer Organization", TMH
3. Tannenbaum, "Structured Computer Organization", PHI.
4. Er. Rajiv Chopra, "Computer Architecture", Revised 3rd Edition, S. Chand & Company Pvt. Ltd

Suggestive digital platform web links

https://www.youtube.com/watch?v=4TzMyXmzL8M
https://nptel.ac.in/courses/106/106/106106166/
https://nptel.ac.in/courses/106/106/106106134/

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Paper-II: Programming Methodology & Data Structures

Unit- I

Introduction to Programming - Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies. Basics of C++: A Brief History of C++, Application of C++, Compiling & Linking, Tokens, Keywords, Identifiers & Constants Basic Data Types, User-Defined Data Types, Symbolic Constant, Type Compatibility, Reference Variables, Operator in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator. Functions In C++: The Main Function, Function Prototyping, Call by Reference Call by Address,Call by Value, Return by Reference, Inline Function, Default Arguments, Constant Arguments,Function Overloading, Function with Array.

Unit- II

Classes & Objects: A Sample C++ Program with class, Defining Member Functions, Making an Outside Function Inline, Nesting of Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member, Functions, Array of Objects, Object as FunctionArguments, Friend Functions, Virtual functions, Returning Objects, Constant member functions, Pointer toMembers, Local Classes.Constructor & Destructor: Constructor, Parameterized Constructor, Multiple Constructors in aClass, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor,Dynamic Constructor and Destructor.

Unit- III

Inheritance: Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable,Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructor in Derived Classes, Nesting of Classes. Operator Overloading & Type Conversion, Polymorphism, Pointers, Pointers with Arrays C++, Streams, C++Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output withManipulators, Exception Handling.

Unit- IV

Data Structure: Basic concepts, Linear and Non-Linear data structures Algorithm Specification:Introduction, Recursive algorithms, Data Abstraction, Performance analysis.Arrays: Representation of single, two-dimensional arrays, triangular arrays, sparse matrices-arrayand linked representations. Stacks: Operations, Array and Linked Implementations, Applications-Infix to Postfix Conversion, Infix to Prefix Conversion, Postfix Expression Evaluation, RecursionImplementation.Queues: Definition, Operations, Array and Linked Implementations. Circular Queue-Insertion andDeletion Operations, Dequeue (Double Ended Queue), Priority Queue- Implementation.

Unit- V

Linked Lists: Singly Linked Lists, Operations, Concatenating, circularly linked lists-Operations forCircularly linked lists, Doubly Linked Lists- Operations, Doubly Circular Linked List, Header Linked ListTrees: Representation of Trees, Binary tree, Properties of Binary Trees, Binary TreeRepresentations-Array and Linked Representations, Binary Tree Traversals, Threaded BinaryTrees. Heap: Definition, Insertion, Deletion.

Unit- VI

Graphs: Graph ADT, Graph Representations, Graph Traversals, Searching.Hashing: Introduction, Hash tables, Hash functions, Overflow Handling.Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort,

Merge Sort, Comparison of SortingMethods,Search Trees: Binary Search Trees, AVL Trees- Definition and Examples.

Unit- VII:

Indian Contribution to the field: Innovations in India, origin of Julia Programming Language, IndianEngineers who designed new programming languages, open source languages, Dr.SartajSahnicomputer scientist pioneer of data structures, Other relevant contributors and contributions.

Reference Books:

- R. Lafore, 'Object Oriented Programming C++"
- N. Dale and C. Weems, "Programming and problem solving with C++: brief edition", Jones & Bartlett Learning.
- Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning.
- SartajSahani, "Data Structures, Algorithms and Applications with C++", McGraw Hill.
- Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- D.S. Malik, "Data Structure using C++", Second edition, Cengage Learning.
- M. A. Weiss, "Data structures and Algorithm Analysis in C", 2nd edition, Pearson.
- Lipschutz, "Schaum's outline series Data structures", Tata McGraw-Hill

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Paper-III: Operating System

Unit-I
Introduction to Operating System: What is Operating System? History and Evolution of OS,Basic OS functions, Resource Abstraction, Types of Operating Systems- Batch Systems,Multiprogramming Systems, Multiprocessing Systems, Time Sharing Systems, Distributed OS,Real time systems.Operating System for Personal Computers, Workstations and Hand-held Devices.Applications of various operating systems in real world.Some prevalent operating systems Windows, UNIX/Linux, Android, MacOS, Blackberry OS,Symbian, Bada etc.

Unit- II
Process Management: Process Concepts, Process states & Process Control Block.Process Scheduling: Scheduling Criteria, Scheduling Algorithms (Preemptive& Non-Preemptive) - FCFS, SJF, SRTN, RR, Priority, Multiple-Processor, Real-Time, Multilevel Queueand Multilevel Feedback Queue Scheduling.
Deadlock - Definition, Deadlock Characterization, Necessary and Sufficient Conditions forDeadlock.
Deadlock Handling Approaches: Prevention, Avoidance, Detection and Recovery.

Unit- III:
Memory Management: Introduction, Address Binding, Logical versus Physical Address Space,Swapping, Contiguous & Non-Contiguous Allocation, Fragmentation (Internal & External), Compaction, Paging, Segmentation, Virtual Memory, Demand Paging, Performance ofDemand Paging, Page Replacement Algorithms.File Management: Concept of File System(File Attributes, Operations, Types), Functions of
File System, Types of File System, Access Methods (Sequential, Direct & other methods), Directory Structure (Single-Level, Two-Level, Tree-Structured, Acyclic-Graph, General Graph),Allocation Methods (Contiguous, Linked, Indexed)

Unit-IV
Disk Management: Structure, Disk Scheduling Algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK),
Swap Space Management, Disk Reliability, Recovery.Security: Security Threats, Security policy mechanism, Protection, Trusted Systems,Authentication and Internal Access Authorization, Windows Security.

Unit- V
LINUX: Introduction, History and features of Linux, advantages, hardware requirements forinstallation, Linux architecture, file system of Linux - boot block, super block, inode table,data blocks.Linux standard directories, Linux kernel, Partitioning the hard drive for Linux, installing theLinux system, system - startup and shut-down process, init and run levels. Process, Swap,Partition, fdisk, checking disk free spaces.Difference between CLI OS & GUI OS, Windows v/sLinux, Importance of Linux Kernel, Files and Directories. Concept of Open Source Software

Unit- VI
Indian contribution to the field the BOSS operating system, open source softwares, growth ofLINUX, Aryabhatt Linux, contributions of innovators RajenSheth, Sunder Pichai etc.

Reference Books:

- G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education.
- W. Stallings, Operating Systems, Internals & Design Principles, 8th Edition, Pearson Education.
- M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill.
- Operating System design and Concepts by Milan Milenkovic.

Paper- IV: Fundamental of Cyber Security & Introduction to Python Programming

Unit-I

Introduction of Cyber Crime, Challenges of cyber crime, Classifications of Cybercrimes: E-Mail Spoofing, Spamming, Internet Time Theft, Salami attack/Salami Technique, Web jacking, Online Frauds, Software Piracy, Computer Network Intrusions, Password Sniffing, Identity Theft, cyber terrorism, Virtual Crime, Perception of cyber criminals: hackers, insurgents and extremist group etc. Web servers were hacking, session hijacking.

Unit-II

Cyber Crime and Criminal justice: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cheating, Defamation, Harassment and E-mail Abuse, Other IT Act Offences, Monetary Penalties, jurisdiction and Cyber Crimes, Nature of Criminality, Strategies to tackle Cyber Crime and Trends. The Indian Evidence Act of 1872 v. Information Technology Act, 2000: Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and ProbativeValue of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving ElectronicMessages.

Unit- III

Tools and Methods in Cybercrime: Proxy Servers and Analysis, Password Cracking, Key loggers and Spyware, virus and worms, Trojan Horses, Backdoors, DoS and DDoS Attacks, Buffer and Overflow, Attack on Wireless Networks, Phishing: Method of Phishing, Phishing Techniques.

Unit- IV

Introduction to python language: Basic syntax, Literal Constants, Numbers, Variable and Basic data types, String, Escape Sequences, Operators and Expressions, Evaluation Order, Indentation, Input, Output, Functions, Comments. Data Structure: List, Tuples, Dictionary, Data Frame and Sets, constructing, indexing,slicing and content manipulation.

Unit-V

Control Flow: Conditional Statements - If, If-else, Nested If-else. Iterative Statement - For, While, Nested Loops. Control statements - Break, Continue, and Pass.Python-Functions: Syntax for defining a function, Calling a Function, Function Arguments, AnonymousFunctions.

Unit-VI

Object oriented programming: Class and Object, Attributes, Methods, Scopes and Namespaces, Inheritance, Overloading, Overriding, Data hiding, Exception: Exception Handling, Except clause, Try finally clause, User Defined Exceptions.

Suggested Books:

1. Principles of Cyber crime, Jonathan Clough Cambridge University Press
2. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005
3. Cyber Law Simplified, VivekSood, Pub: TMH.
4. Cyber Security by Nina Godbo le, SunitBelapure Pub: Wiley-India
5. Information Warfare: Corporate attack and defense in digital world, William Hutchinson, Mathew Warren, Elsevier.
6. Cyber Laws and IT Protection, Harish Chander, Pub: PHI.
7. Timothy A. Budd: Exploring python, McGraw-Hill Education.
8. R.NageshwarRao,"PythonProgramming",Wiley India
9. Think Python: Allen B. Downey, O'Reilly Media, Inc.

Paper- V: Web Designing

Unit-I

Introduction to Internet- World Wide Web, Internet Addressing, Browser, URL, Web server, website,homepage, Domain Name. Basic concepts.Softwares for Web Designing - Notepad/Notepad++, Dreamweaver, Blue Griffon, Net beans, SeaMonkey, Word press, Sublime.Introduction to HTML: HTML Tags and Attributes, HTML Basic Tags, Formatting Tags, HTML ColorCoding, Div and Span Tags for Grouping. Lists: Unordered Lists, Ordered Lists, Definition list.Images: Image and Image Mapping
Hyperlink: URL - Uniform Resource Locator, URL Encoding. Table: <table>, <th>, <tr>, <td>,<caption>, <thead>, <tbody>, <tfoot>, <colgroup>, <col>. Attributes Using Iframe as the Target Form: <input>, <textarea>, <button>, <select>, <label>Headers: Title, Base, Link, Styles, Script HTML Meta Tag, XHTML, HTML Deprecated Tags & Attributes

Unit-II

CSS: Introduction, Features and benefits of CSS, CSS Syntax, External Style Sheet using <link>,
Multiple Style Sheets, Value Lengths and Percentages. Selectors: ID Selectors, Class Selectors,
GroupingSelectors, Universal Selector, Descendant/Child Selectors, Attribute Selectors, CSS - Pseudo Classes.Color Background Cursor: background-image, background-repeat, background- position, CSS CursorText Fonts: color, background-color, text-decoration, text-align, vertical-align, text-indent, texttransform,white-space, letter-spacing, word-spacing, line-height, font-family, font-size, font-style, fontvariant,font-weight.

Unit-III

Lists Tables: list-style-type, list-style-position, list-style-image, list-style, CSS Tables (border, width &
height, text-align, vertical-align, padding, color)Box Model: Borders & Outline, Margin & Padding, Height and width, CSS Dimensions.Display Positioning: CSS Visibility, CSS Display, CSS Scrollbars, CSS Positioning (Static Positioning,Fixed Positioning, Relative Positioning, Absolute Positioning), CSS Layers with Z-Index.Floats: The float Property, The clear Property, The clearfix Hack.

Unit-IV

The JavaScript: Nature of JavaScript, Script Writing Basics, Enhancing HTML Documents with
JavaScript, The Building Blocks.Introduction to JavaScript, JavaScript Engines, Values, Variables and Operators, Variable Mutation,Basic Operators, Operator Precedence, JavaScript Types, Types Definition, Types in JavaScript,Objects, Type Conversion and Coercion, Static vs Dynamic Type Checking.
JavaScript Conditionals: Introduction to Conditionals, Conditionals in JavaScript, Ternary Operatorsand Conditionals. Conditional Ladder & Switch statement.JavaScript Arrays: Introduction to Arrays, Declaring and Mutating Arrays, Array Methods andProperties, Replication with Array Methods, Multi-dimensional Arrays.

Unit-V

JavaScript Loops: Introduction to Loops, Loops in JavaScript, While and Do/While Loops, For Loops,
Break and Continue in Loops, Iterating Arrays, Iterating Objects.JavaScript Functions: Introduction to Functions, Functions in JavaScript, Nested Functions inJavaScript, Arrow Functions in JavaScript, Function as an Argument, Function as the Returned Object,JavaScript Scope: Scope Introduction, Scope in JavaScript, Lexical Scope, Module Scope.Method of Adding Interactivity to a Web Page, Creating Dynamic Web Pages; Concept of JavaScripting the Forms.Java Scripting the Forms, Basic Script Construction, Talking to the Form Objects, Organizing theObjects and Scripts, Field-Level Validation, Check Required Fields like Validating Zip Code,Automated Formatting, Format Phone, Format Money, Automatic Calculation, Calculate ExpirationDate, Calculate Amount etc.

Second Year

Paper-I: Advanced Python

Unit- I: Object Oriented Python:

- Decorators,
- Generators,
- Iterators

Threading in Python:

- Creation,
- Execution of threads using threading module.

Unit-II: Database programming using Python :

- Connecting to a database (sqlite) using Python
- Sending DML and DDL queries and processing the result from a Python Program.

Unit- III: Network programming using Python:

- An introduction to client-server programming.
- Basics of TCP and UDP protocols Introduction to socket programming.
- Building an HTTP client and server.

Unit- IV: GUI in Python:

Introduction to GUI building libraries:-

Widgets, Button, Canvas , Check button, Entry, Frame, Label, Listbox, Menubutton, Menu, Message, Radio button, Scale, Scrollbar, Text, Toplevel, Spinbox, Paned, Window, LabelFrame, tkMessage Box.

Unit- V: Basic image processing using Python :Introduction to digital image processing: Basic operations on an image

- Crop
- Scale
- Rotate
- Flip
- Changing contrast, brightness and color
- Edge detection, blur, sharpening.

Unit- VI: Basic numerical processing using Python:Introduction to numpy, Creation of vectors and matrices, Matrix manipulation.

Basic data analysis using Python:Introduction to Pandas: Pandas data structures – Series and DataFrame, Data wrangling using pandas,Loading a dataset into a dataframe, Selecting Columns from a dataframe, Selecting Rows from a dataframe, Adding new data in a dataframe, Deleting data from a dataframe.

Unit-VII: Basic data visualization using Python: Introduction to Matplotlib: Scatter plot, Line plot, Bar chart, Histogram, Box plot.Regular expression: RE package, Web Scrapping, Beautiful Soup.

Paper- II: Fundamentals of Web Technology

UNIT I:

Introducing PHP – Basic development Concepts – Creating first PHP Scripts – Using Variable and Operators – Storing Data in variable – Understanding Data types – Setting and Checking variables Data types – Using Constants – Manipulating Variables with Operators.

UNIT II:

Controlling Program Flow: Writing Simple Conditional Statements - Writing More Complex Conditional Statements – Repeating Action with Loops – Working with String and Numeric Functions.

UNIT III:

Working with Arrays: Storing Data in Arrays – Processing Arrays with Loops and Iterations – Using Arrays with Forms - Working with Array Functions – Working with Dates and Times.

UNIT IV:

Using Functions and Classes: Creating User-Defined Functions - Creating Classes – Using Advanced OOP Concepts. Working with Files and Directories: Reading Files- Writing Files-Processing Directories.

UNIT V:

Working with Database and SQL : Introducing Database and SQL- Using My SQL- Adding and modifying Data- Handling Errors – Using SQLite Extension and PDO Extension. Introduction XML - Simple XML and DOM Extension.

Paper- III: Cloud Computing and Security

UNIT I:

Cloud Computing Foundation: Introduction to Cloud Computing–Move to Cloud Computing–Types of Cloud – Working of Cloud Computing

UNIT II:

Cloud Computing Architecture: Cloud Computing Technology–Cloud Architecture– Cloud Modelling and Design - Virtualization: Foundation –Grid, Cloud and Virtualization – Virtualization and Cloud Computing

UNIT III:

Data Storage and Cloud Computing: Data Storage–Cloud Storage–Cloud Storage from LANs to WANs –Cloud Computing Services: Cloud Services –Cloud Computing at Work.

UNIT IV:

Cloud Computing and Security: Risks in Cloud Computing–Data Security in Cloud–nCloud Security Services –Cloud Computing Tools: Tools and Technologies for Cloud – Cloud Mashaps–Apache Hadoop –Cloud Tools

UNIT V:

Cloud Applications: Moving Applications to the Cloud –Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services –Cloud Applications.

Text Books:

A.Srinivasan and J.Suresh, “Cloud Computing –A Practical Approach for Learning and Implementation”, Pearson India Publications2014.

Reference Books:

1. RajkumarBuyya, James Broberg, Andrzej, “Cloud Computing: Principles and Paradigms”,Wiley India Publications 2011.

2. ArshdeepBahga and Vijay Madisetti, “Cloud Computing –A Hands on Approach”, Universities Press (India) Pvt Ltd. 2014.

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Paper- IV: Data Communication & Networking

UNIT I:

Introduction: A Brief History– Applications– Computer Networks– Categories of Networks – Standards and Standards Organizations – Network Architecture – Open Systems and OSI Model – TCP/IP Architecture. Communication Media and Data Transmission: Fourier Analysis–Analog and Digital Data Transmission – Modulation and Demodulation – Transmission Media – Wireless Communications – Data Transmission Basics – Transmission Mode – Interfacing– Multiplexing. Error Detection and Correction: Types of Errors – Error Detection – Error Correction. Data Link Control and Protocol Concepts: Flow Control–Error Control– Asynchronous Protocols – Synchronous Protocols – High-Level Data Link Control (HDLC).

UNIT II:

Local Area Networks: Types of Networks and Topology–LAN Transmission Equipment – LAN Installation and Performance. Ethernet: IEEE Standard 802.3 Token Bus: IEEE Standard 802.4 Token Ring: IEEE Standard 802.5 – Fiber Distributed Data Interface (FDDI) – Distributed Queue Dual Bus (DQDB): IEEE Standard 802.6–LAN Operating Systems and Protocols – Ethernet Technologies. Wide Area Networks: WAN Transmission Methods–WAN Carrier Types–WAN Transmission Equipments – WAN Design and Multicast Considerations – WAN Protocols.

UNIT III:

Integrated Services and Routing Protocols: Integrating Services–ISDN Services –ISDN Topology – ISDN Protocols – Broadband ISDN – Asynchronous Transfer Mode (ATM) – Principal Characteristics of ATM – Frame Relay – Comparison of ISDN, ATM and Frame Relay.Wireless LANS: WLAN Applications–Wireless LAN Requirements– Planning forWireless LANs – Wireless LAN Architecture – IEEE 802.11 Protocol Layer – IEEE 802.11 Physical Layer – Designing the Wireless LAN Layout – WAP Services.

UNIT IV:

Internet Working: Principles of Internet Working–Routing Principles–Internetwork Protocols (IP) – Shortcomings of IPv4 – IP Next Generation. TCP Reliable Transport Service: Transport Protocols–The Service TCP Provides to Applications – End –to-End Service and Datagrams – Transmission Control Protocol – User Datagram Protocol.

UNIT V:

Network Applications: Client-Server Model–Domain Name System (DNS)–Telnet – File Transfer and Remote File access – Electronic Mail – World Wide Web (WWW) Network Management: Goal of Network Management–Network Management Standards – Network Management Model – Infrastructure for Network Management – Simple Network Management Protocol (SNMP).

Reference Books:

1. Data Communications and Computer Networks, BrijendraSingh,Third Edition, PHI, 190, 2011.

2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

3. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.

4. Computer Networks, Andrew S Tanenbaum, 4th Ed, Prentice Hall of India, 2006.

5. Data Communications and Computer Networks ,Prakash C. Gupta, Prentice Hall of India, 2005.

6. Data and Computer Communications, William Stallings, PHI, 2007.

Paper-V: Network Security

UNIT I:

Introduction: Security Goals – Attacks – Services and Mechanism – 642 Techniques. Mathematics of Cryptography: Integer Arithmetic – Modular Arithmetic – Matrices – Linear Congruence - Traditional Symmetric Key Ciphers: Instruction – Substitution Ciphers – Transposition Ciphers – Stream and Block Ciphers. Introduction to Modern Symmetric Key Ciphers: Modern Block Ciphers – Modern Stream Ciphers.

UNIT II:

Data Encryption Standard (DES): Introduction – DES Structure – DES Analysis – Multiple DES – Security of DES. Advanced Encryption Standard (AES): Introduction – Transformations – Key Expansion – Ciphers – Examples – Analysis of AES.

UNIT III :

Asymmetric Key Cryptography: Introduction – RSA Crypto System. Message Integrity and Message Authentication: Message Integrity – Random Oracle Model – Message Authentication.

UNIT IV:

Cryptographic Hash Functions: Introduction – SHA – 512 – WHIRLPOOL. Digital Signature: Comparison – Process – Services – Attacks on Digital Signature – Digital Signature Schemes. Unit V: Entity Authentication: Introduction – Passwords – Challenge Response – Zero Knowledge – Bio Metrics. Key Management: Symmetric Key Distribution – Kerberos – Symmetric Key Agreement – Public Key Distribution.

Reference Books:

1. Cryptography and Network Security – William Stallings, PHI, 2008.

2. Cryptography and Network Security – AtulKahate, McGraw Hill Education, 2013.

3. Network Security The Complete Reference – Roberta Bragg, Mark Rhodes Ousleyand Strassberg – McGraw Hill Education, 2003.

4. Cryptography and Network Security – Behrouz A. Forouzan, The McGraw Hill, 2011.

Third Year

Paper- I: Course- 1: Core Java Programming

UNIT I:

FUNDAMENTALS OF OBJECT – ORIENTED PROGRAMMING: Introduction, Object Oriented paradigm, Basic Concepts of OOP, Benefits of OOP, Applications of OOP, Java features: OVERVIEW OF JAVA LANGUAGE: Introduction, Simple Java program structure, Java tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command line arguments. CONSTANTS, VARIABLES & DATA TYPES: Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Value to Variables, Scope of variables, Symbolic Constants, Type casting, Getting Value of Variables, Standard Default values; OPERATORS & EXPRESSIONS.

UNIT II:

DECISION MAKING & BRANCHING: Introduction, Decision making with if statement, Simple if statement, if. Else statement, Nesting of if.else statements, the else if ladder, the switch statement, the conditional operator. DECISION MAKING & LOOPING: Introduction, The While statement, the do-while statement, the for statement, Jumps in loops. CLASSES, OBJECTS & METHODS: Introduction, Defining a class, Adding variables, Adding methods, Creating objects, Accessing class members, Constructors, Method overloading, Static members, Nesting of methods;

UNIT III:

INHERITANCE: Extending a class, Overloading methods, Final variables and methods, Final classes, Finalizer methods, Abstract methods and classes; ARRAYS, STRINGS AND VECTORS: Arrays, One-dimensional arrays, Creating an array, Two–dimensional arrays, Strings, Vectors, Wrapper classes INTERFACES: MULTIPLE INHERITANCE: Introduction, Defining interfaces, Extending interfaces, Implementing interfaces, Assessing interface variables;

UNIT IV:

MULTITHREADED PROGRAMMING: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Lifecycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the„ Runnable‟ Interface. MANAGING ERRORS AND EXCEPTIONS: Types of errors : Compile-time errors, Runtime errors, Exceptions, Exception handling, Multiple Catch Statements, Using finally statement.

UNIT V:

PACKAGES: Introduction, Java API Packages, Using System Packages, Naming conventions, Creating Packages, Accessing a Package, using a Package. MANAGING INPUT/OUTPUT FILES IN JAVA: Introduction, Concept of Streams, Stream classes, Byte Stream Classes, Input Stream Classes, Output Stream Classes, Character Stream classes: Reader stream classes, Writer Stream classes, Using Streams, Reading and writing files.

Reference Books:

1. Programming with JAVA, A Primer, E.Balagurusamy, 5th Edition, McGraw-Hill Company, 2015.

2. Introduction to JAVA Programming, K. Somasundaram, Jaico Publishing House, New Delhi, 2013.

3. K.Somasundaram, Do,n ‟ Learn JAVA – APractical Approach, Anuradha Publications, Chennai,2013.

4. Programming in Java, Sachin Malhotra, Oxford University Press

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Paper- II: Course-2: Essentials of Ethical Hacking

UNIT I:

Introduction To Hacking : Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre- Engagement – Rules of Engagement -Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary -Reports.

UNIT II:

Network Attacks: Vulnerability Data Resources – Exploit Databases – Network Sniffing – Types of Sniffing - Promiscuous versus Nonpromiscuous Mode – MITM Attacks – ARP Attacks – Denial of Service Attacks -Hijacking Session with MITM Attack .

UNIT III:

SSL Strip: Stripping HTTPS Traffic -DNS Spoofing – ARP Spoofing Attack Manipulating the DNS Records – DHCP Spoofing -Remote Exploitation – Attacking Network Remote Services – Overview of Brute Force Attacks – Traditional Brute Force– Attacking SMTP – Attacking SQL Servers – Testing for Weak Authentication.

UNIT IV:

Wireless and Web Hacking-Wireless Hacking – Introducing Aircrack- Cracking the WEP – Cracking a WPA/WPA2 Wireless Network Using Aircrack-ng – Evil Twin Attack – Causing Denial of Service on the Original AP – Web Hacking .

UNIT V:

Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User-Agents to Bypass Captcha and Other Protection – Authentication Bypass Attacks – Testing for the Vulnerability – Automating It with Burp Suite – Session Attacks – SQL Injection Attacks – XSS (Cross-Site Scripting) - Types of Cross-Site Scripting – Cross-Site Request Forgery (CSRF) – SSRF Attacks.

Reference Books:

1. Rafay Baloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2014.

2. Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.

3. Jon Erickson , “Hacking: The Art of Exploitation”, Second Edition, Rogunix,2007.

Paper – 3: Resource Management Techniques

UNIT I:

Development of OR: Definition of OR–Modeling - Characteristics and Phases - Tools, Techniques & Methods - scope of OR.

UNIT II:

Linear Programming Problem: Formulation - Slack & surplus variables – Graphical solution of LPP.

UNIT III:

Simplex Method: Computational Procedure - Big-M method - Concept of duality in LPP -Definition of primal dual problems - General rules for converting any primal into its dual.

UNIT IV:

Duality Theorems: (without proof) Primal dual correspondence - Duality and Simplex method - Mathematical formulation of assignment problem - Method for solving assignment problem.

UNIT V:

Mathematical formulation of Transportation Problem: Methods for finding IBFS for the Transportation Problems.

Reference Books:

1. Operation Research, Nita H. Shah, Ravi M. Gor and Hardiksoni, Prentice Hall of India Pvt. Ltd., New Delhi 2008.

2. Operation Research, R. Sivarethinamohan, Tata McGraw Hill, 2005.

3. Operations Research – An Introduction by Hamdy A. Taha. Ninth Edition, Dorling Kindersley Pvt. Ltd., Noida, India, 2012.

Paper-4: Biometric Systems

UNIT I:

Introduction: Benefits of biometric versus traditional techniques – Key biometric terms and processes – Verification and identification – Enrolment and template creation

UNIT II:

Biometric matching. Accuracy in biometric systems: False match rate – False non- match rate – Failure-to-enroll rate – Derived metrics – Equal error rate – Ability-to- verify rate

UNIT III:

Physiological biometrics: Finger scan – Facial scan – Iris scan – Components – Working principles – Competing technologies – Strengths and weaknesses – Automated fingerprint Identification systems.

UNIT IV:

Behavioural biometrics signature scan – Keystroke scan – Components – Working principles – Strengths and weaknesses. Biometric applications: Categorizing biometric applications – Criminal identification – Citizen identification – Surveillance.

UNIT V:

PC/network access – Physical access/ time and attendance – Customer facing applications – E-commerce/telephony – Retail/ ATM/point of sale applications. Biometric markets: Law enforcement – government sector – Financial sector – Healthcare – travel and immigration – Biometric standards.

Reference Books:

1. James Wayman, Anil Jain, David Maltoni, Dario Maio (Eds), “Biometric Systems”, Springer International Edition, 2004.

2. Samir Nanavati, MichaelThieme, Raj Nanavati, “Biometrics – Identity Verification in a Networked World”, Wiley-dreamtech India Pvt Ltd, New Delhi, 2003.

Paper- 5: Data ware housing and Data Mining

UNIT I:

Introduction: Data mining application–data mining techniques–data mining case studies the future of data mining – data mining software. Association rules mining: Introduction -Basics-task and a Naive algorithm- Apriori algorithm – improve the efficiency of the Apriori algorithm – mining frequent pattern without candidate generation (FP-growth) – performance evaluation of algorithms.

UNIT II:

Data warehousing: Introduction – Operational data sources- data warehousing – Data Warehousing design – Guidelines for data warehousing implementation – Data warehousing - Metadata. Online analytical processing (OLAP): Introduction – OLAP characteristics of OLAP system – Multidimensional view and data cube - Data cube implementation – Data Cube operations OLAP implementation guidelines.

UNIT III:

Classification: Introduction–decision tree–over fitting and pruning - DT rules–Naïve Bayes method- estimation predictive accuracy of classification methods – other evaluation criteria for classification method – classification software.

UNIT IV:

Cluster analysis: cluster analysis – types of data – computing distances-types of cluster analysis methods - partitioned methods – hierarchical methods – density based methods – Dealing with large databases – quality and validity of cluster analysis methods–cluster analysis software.

UNIT V:

Web data mining: Introduction- web terminology and characteristics- locality and hierarchy in the web- web content mining-web usage mining- web structure mining – web mining software. Search engines: Search engines functionality- search engines architecture–Ranking of web pages.

Text Books:

1. Introduction to Data mining with case studies, G.K. Gupta, PHI Private limited, New Delhi, 2014.

Reference Books:

1. Data Warehousing, Data Mining & OLAP, Alex Berson and Stephen J. Smith, Tata McGraw Hill Edition, Tenth Reprint 2007

2. Data Mining Concepts and Techniques, Jiawei Han and MichelineKamber, Second Edition, Elsevier, 2007

3. Insights into Data Mining K.P. Soman, ShyamDiwakar, V. Ajay, Theory and Practice, PHI Publications Eastern Economy Edition 6th Printing, 2012

Fourth Year

Paper – I: Computer Forensics

Unit-I: Cyber Crime and computer crime

Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.

Unit -II: Basics of Computer

Computer organisation, components of computer- input and output devices, CPU, Memory hierarchy, types of memory, storage devices, system softwares, application softwares, basics of computer languages.

Unit -III: Computer Forensics

Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications

Unit- IV: Forensic Tools and Processing of Electronic Evidence:

Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability, Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

References:

C. Altheide& H. Carvey Digital Forensics with Open Source Tools, Syngress, 2011. ISBN: 9781597495868.

Selected readings from various sources as assigned.

Online Course management System: https://esu.desire2learn.com/

Paper – II: Internet of Things

UNIT I:

Fundamentals OF Iot -Evolution of Internet of Things -Enabling Technologies–IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -–Fog, Edge and Cloud in IoT –Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II:

IoT Protocols - IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks –Application Transport Methods: Supervisory Control and Data Acquisition –Application Layer Protocols: CoAP and MQTT

UNIT III:

Design And Development -Design Methodology -Embedded computing logic –Micro controller, System on Chips -IoT system building blocks -Arduino -Board details, IDE programming - Raspberry Pi -Interfaces and Raspberry Pi with Python Programming.

UNIT IV:

Data Analytics And Supporting Services-Structured Vs Unstructured Data and Data in Motion Vs Data in Rest –Role of Machine Learning –No SQL Databases –Hadoop Ecosystem –Apache Kafka, Apache Spark –Edge Streaming Analytics and Network Analytics –Xively Cloud for IoT, Python Web Application Framework –Django –AWS for IoT –System Management with NETCONF-YANG106

UNIT V:

Case Studies/Industrial Applications- Cisco IoT system -IBM Watson IoT platform– Manufacturing -Converged Plant wide Ethernet Model (CPwE) –Power Utility Industry –Grid Blocks Reference Model -Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Reference Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

2. ArshdeepBahga, Vijay Madisetti, —Internet of Things –A hands-on approach‖ , Universities Press, 2015

3. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things –Key applications and Protocols‖ ,Wiley, 2012 (for Unit 2).

4. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.

Paper-III: Cryptography

UNITI (Introduction to Cryptography and Block Ciphers)

Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography - stream and block ciphers - Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion anddiffusion - fiestal structure - data encryption standard(DES) - strength of DES – differential and linearcrypt analysis of DES - block cipher modes of operations - triple DES – AES.

Unit II (Confidentiality and Modular Arithmetic)

Confidentiality using conventional encryption - traffic confidentiality - key distribution – random number generation - Introduction to graph - ring and field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing - Euclid's Algorithm -Chinese Remainder theorem - discrete algorithms.

Unit III (Public key cryptography and Authentication requirements)

Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Elgamel encryption - Message Authentication and Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks – security of hash functions and MACS.

Unit IV (Integrity checks and Authentication algorithms)

MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

Unit V (IP Security and Key Management)

IP Security: Architecture - Authentication header - Encapsulating security payloads – combining security associations - key management.

Text Books

1. William Stallings, "Crpyptography and Network security Principles and Practices", Pearson/PHI.

2. Wade Trappe, Lawrence C Washington, " Introduction to Cryptography with coding theory", Pearson.

3. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education.

4. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.

Paper-4: INCIDENT RESPONSE MANAGEMENT

Unit-I:

Cyber Incident Statistics, Computer Security Incident, Information as Business Asset, Data Classification, Information Warfare, Key Concepts of Information Security, Vulnerability, Threat and Attacks, Types of Computer Security Incidents, Examples of Incidents, Incidents Categorization, Low Level Incident, Mid Level Incident, High Level Incident

Unit-II:

Incident Prioritization, Incident Response, Incident Handling, Disaster Recovery, Technologies and Impacts,Virtualization and Impacts, Estimated Cost of an Incident, Incident Reporting Organizations, Vulnerability Reports, Incident Identification, Need fpr Incidents Response, Goals for Incident Response,

Unit -III:

Incident Response and Handling Process; Step 1: Identification; Step 2: Incident Recording; Step 3: Initial Response; Step 4: Communicating the Incident; Step 5: Containment; Step 6: Formulating a Response Strategy; Step 7: Incident Classification; Step 8: Incident Investigation; Step 9: Data Collection; Step 10: Forensic Analysis, Step 11: Evidence Protection; Step 12: Notify External Agencies; Step 13: Eradication; Step 14: System Recovery; Step 15: Incident Documentation; Step 16: Incident Damage and Cause assessment; Step 17: Review and Update the Response Policies

Unit -IV:

Incident Response Team development, Security Awareness and Training Checklist, Incident Management, Purpose of Incident management, Incident management process, Incident management team, Incident Response Team and Members, Member Goals and Responsibilities, Developing Skills in Incident Response Personnel, Incident Response Team Structure, Team Dependencies and Services.
