



**G H Raisoni College of Engineering and
Management, Pune**

(An Autonomous Institute Affiliated to Savitribai
PhulePune University)



Department of Cyber Security

**Under Graduate (UG) Course
Book**

(2020 Pattern)

T.Y. B. Tech (CS)

Semester- V &VI



G H Raisoni College of Engineering and management, Pune

(An Autonomous Institute Affiliated to Savitribai Phule Pune
University)Gat No.1200, Domkhel Road, Wagholi, Pune-



Department of Cyber Security

**Academic Year: 2022-
23**

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About IT Department

- Involvement of Experts from IITs, NITs, Govt. Colleges, Reputed Industries, Alumni and Students in development of curriculum
- Choice Based Credit System (CBCS)
- Choice of Electives
- Remedial Teaching
- Sponsorship for Publications and IPR
- Industry Internship
- Provision of Credit Transfer Scheme (CTS)
- Peer Teaching Scheme
- Teacher Guardian Scheme (TGS)
- Various Clubs and Hobby Modules
- Proficiency Courses
- Industry Supported Labs.
- MOUs with Industries.

INSTITUTE VISION AND MISSION

VISION

To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges.

MISSION

Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stakeholders. Our strength is directed to create competent professionals. Our endeavor is to provide all possible support to promote research and development activities.

DEPARTMENT VISION AND MISSION

VISION

Our vision is to prepare students to take their rightful place in the global community of computer professionals by fostering the skills and confidence to deal with challenges posed by rapidly changing technology.

MISSION

The department continuously strives

- M1: To inculcate the technical excellence in students through the dimension of technical knowledge, skills and intellectual stimulation.
- M2: Empower students to contribute for the betterment of society individually and collectively.

Program Educational Objectives

- PEO1 : To apply the basic skills in Engineering and have conceptual understanding to cater the needs of the industry.

- PEO2: To understand the requirement of the society and provide solutions by applying the technical knowledge related to their field professionally.
- PEO3: To enhance their programming skills with logical thinking for application design and deployment and be able to pursue higher studies and research.
- PEO4: To communicate and apply the acquired engineering knowledge individually & as a team, for the successful implementation of projects.
- PEO5: To understand moral, ethical, and social values to function as responsible citizens of society.

Program Specific Outcomes (PSOs)

PSO1: Apply the fundamentals of domain knowledge in developing the effective computing solutions for real world problems.

PSO2: Formulate solutions for interdisciplinary problems using latest hardware and software tools.

PSO3: Formulate solutions for interdisciplinary problems using latest hardware and software tools.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of

mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Scheme and Curriculum of B. Tech. Cyber Security

Scheme Summary

Semester	Credits	Hours	Marks	No. of Theory Heads	No. of Practical Heads	Total Heads
I	18	26	575	5	7	12
II	19	26	550	5	6	11
III	22	25	525	6	3	9
IV	23	26	650	7	4	11
V	21	28	625	6	6	12
VI	22	29	600	6	6	12
VII	20	25	500	5	2	7
VIII	15	27	475	1	1	2
Total	160	212	4500	41	35	76

Course Category Credits Summary

Semester	No. of Credits for Course Category						TOTAL
	Core (C)	Basic Science and Humanities (BS &H)	Skills (A)	Electives (EL)	Open Electives (OE)	PROJECT/INTRNSHIP (P)	
I	3	2	3				8
II	2	4	2				8
III	5	1					6
IV	4	1	3		1		9
V	5	1	1				7
VI	2	2	4	1	1		10
VII				5		1	6
VIII					1	1	2
TOTAL	21	11	13	6	3	2	56

Scheme of B. Tech. inCyber Security

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme						
			Theory		Practical			TAE	CAE	ESE	INT	EXT	Total Marks	
			L	T	P	Total Hrs								
SEMESTER-V														
UCCSL301 UCCSP301	Ethical Hacking	C	2	1	2	5	4	10	15	50	25	25	125	
UCCSL302 UCCSP302	Computer Security	C	3		2	5	4	10	15	50	25		100	
UCCSL303	Design & Analysis of Algorithm	C	4			4	4	10	15	50			75	
UCCSL304	Penetration testing	C	3			3	3	10	15	50			75	
UCCSL305 UCCSP305	Java Programming	C	2		2	4	3	10	15	50	25		100	
UHUL301	Engineering Economics and Industrial Management	H	2			2	2	10	15	50			75	
UHUP302	Aptitude	A			2	2	1				25		25	
TOTAL			16	1	8	25	21	60	90	300	100	25	575	

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme						
			Theory		Practical			TAE	CAE	ESE	INT	EXT	Total Marks	
			L	T	P	Total Hrs								
SEMESTER-VI														
UCCSL306 UCCSP306	Machine Learning Algorithm	C	2		2	4	3	10	15	50		25	100	
UCCSL307	Cyber Intelligence	C	3			3	3	10	15	50			75	
UCCSL308 UCCSP308	Elective-I	E	3		2	5	4	10	15	50	25		75	
UISL3XX	Open Elective-II	OE	2			2	2	10	15	50			100	
UHUL306X	Humanities Elective	H	2			2	2	10	15	50			75	
UHUL304	Understanding Human Values2: Understanding Harmony	H	3			3	3	10	15	50			75	
UHUP304	Employability Skills	A			2	2	1				25		25	
UHUP307	Campus Recruitment Training	A			2	2	1				25		25	
UCCSP309	Cloud Computing	C			4	4	2				25	25	50	
TOTAL			15		12	27	21	60	90	300	125	25	600	

Semester-V

UCCSL301/UCCSP301: Ethical Hacking		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 02Hrs./Week , Tutorial: 1 Hr/Week,Practical: 2Hrs/Week	4	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 25 Marks EXT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To know all basic concepts of ethical hacking.		
2. Recognize the System Hacking strategies in Ethical manner.		
3. Awareness of Webserver and Wireless Hacking and its issues.		
4. Understand the use and availability of tools to support an ethical hacking.		
5. Implement cyber defensive measures & penetration testing strategies.		
Course Outcomes: After completing this course, students will be able to		
CO1. Understand ethical hacking concept & its perspective.		
CO2. Apply the System Hacking strategies in Ethical manner.		
CO3. Analyze Webserver and Wireless Hacking issues.		
CO4. Demonstrate the use and availability of tools to support an ethical hacking.		
CO5. Elaborate cyber defensive measures & penetration testing strategies.		
Course Contents	Hrs.	
Unit I: INTRODUCTION TO ETHICAL HACKING	8	
Introduction- Ethical Hacking Terminology, Types of hacking technologies, Phases of ethical hacking, Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Foot printing, Social Engineering.		
Unit II: SYSTEM HACKING	8	
Understanding the password hacking techniques, Type of Attacks, Email Security and Privacy Rootkits, Trojans, Backdoors, Viruses and worms, Sniffers, Denial of service, Spoofing, Phishing, Session hijacking through cookies.		
Unit III: WEB SERVER AND WIRELESS HACKING	8	

Hacking web servers, Web application vulnerabilities, Buffer overflow, Wireless hacking, Physical Security, WEP, WPA, Authentication mechanism, Wireless sniffers, Physical Security, Factors affecting physical, Security honeypots, Firewall & its types. Unit IV: ETHICAL HACKING TOOLS & PREVENTION MESURES	
Intrusion Detection System (IDS), Intrusion Prevention System (IPS), Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking, Network reconnaissance tools ,WHOIS, dig, traceroute, nslookup.	8
Unit V: PENETRATION TESTING Penetration Testing phases/Testing Process, Types and techniques, Cryptography, Overview of MD5, SHA, RC4-penetration testing methodologies, Steps for pen test legal framework, Penetration testing tools.	8

Text Book	1	Tiller, J. S. (2004). The ethical hack: a framework for business value penetration testing. Auerbach publications.
	2	Simpson, M. T., Backman, K., & Corley, J. (2010). Hands-on ethical hacking and network defense. Cengage Learning
	3	EC-Council, 2016, –Ethical Hacking and Countermeasures Attack Phases , 1IndEdition, Cengage Learning.
	4	Simpson, M. T., Backman, K., & Corley, J. (2010). Hands-on ethical hacking and network defense. Cengage Learning.
Reference Book	1	Hands- On Ethical Hacking and Network Defense – By Michael T. Simpson, Kent Backman, James Corley
	2	Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen.
	3	The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series) [Paperback]
	4	Hands- On Ethical Hacking and Network Defense [Print Replica] [Kindle Edition]
Online TL Material	1	https://www.coursera.org/learn/ethical-hacking
	2	https://www.udemy.com/course/ethicalhacking/
	3	https://nptel.ac.in/courses/106/105/106105217/

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<https://courseware.cutm.ac.in/courses/penetration-testing-vulnerability->

Sr. No.	Name of Experiment (Any 10 Experiment)
1	To learn about different hacking tools and Nmap (Network Mapper), Metasploit,
2	Wireshark.
3	Installation of kali linux & learn tools like sqlmap, autopsy, social engineering toolkit
4	To scan e-mail attachments for malware.
5	To Study and implement the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars.
6	To study and implement about Foot-printing and Reconnaissance
7	To study and implement about fingerprinting & packet tracing tools
8	To study and implement about system hacking using session cookies.
9	To find vulnerabilities for any Website Using Nikto.
10	To study and implement about Sniffing & their tools.
11	To perform Deniel of Service (DoS) attack using hping3.
12	To identify phishing attacks and protect ourselves.
	To study and implement about Wireless Hacking.

UCCSL302/UCCSP302: Computer Security		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 3 Hrs./Week ,Practical: 2 Hrs/Week	4	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To introduce the principles of Crypto-Systems.		
2. To expose students to various security services and mechanisms used.		
3. To make the students aware of the security features of PGP, S/MIME, Digital Signatures, & SSL.		
4. To make the students understand the system level security issues concerning threats, intruders and use of firewalls and trusted systems.		
5. To make students to explore non-cryptographic and software vulnerabilities.		
Course Outcomes: After completing this course, students will be able to		
CO1: Understand principles of Crypto-systems.		
CO2: Compare and analyze various security services and mechanisms.		
CO3: Apply and use the features of PGP, S/MIME, DSA, SSL in their profession.		
CO4: Take precautions of their personal computing system from possible threats and attacks.		
CO5: Explore newer vulnerabilities and provide the solutions to them.		
Course Contents		Hrs.
Unit 1: Security Fundamentals:		8
Introduction, Terminology, Attacks, Security Goals : Authentication, Authorization, Cipher Techniques: Substitution and Transposition, Threats and Vulnerability, Difference between Security and Privacy, GCD, Euclidean Theorem, Multiplicative Inverse.		
Unit 2: Symmetric Key Cryptography:		8
Introduction, Block & stream Ciphers, Modes of Operations ,Data Encryption standards, Attacks on DES, Advanced Encryption standard, Chinese Remainder Theorem, Diffie- Hellman Key exchange, Stenography applications and limitations.		
Unit 3: Asymmetric Key Cryptography:		8
RSA, Key Generation and Usage, Advantages & disadvantages, Elgamal Curve Arithmetic,Elliptic Curve Arithmetic, Elliptic Curve Cryptography		
Unit 4:Message Digest & Key management:		8

Hash Algorithms: SHA-1, MD5, Key Management: Introduction, Key Management: Generations, Distribution, Updation, Digital Certificate X.509 format, Digital Signature, OneWay Authentication, Mutual Authentication, Kerberos	
Unit 5:Firewall & Intrusion Detection System:	8
Introduction, Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS: Need, Methods, Types of IDS, Password Management, Limitations and Challenges.	

Text Book	1	Cryptography and Network Security, by William Stallings - Pearson Edition
	2	Network Security and Cryptography, by Bernard Menezes - Cengage Learning
Reference Book	1	Cryptography and Network security, by Atul Kahate – TMGH
	2	Cryptography and Network Security, by B. A. Forouzan – TMGH
	3	Network Security Know It All, by Joshi et. al – Morgan Kaufmann Publisher

Sr. No.	Name of Experiment
1	Develop and program in C++ or Java based on number theory such as Extended Euclidean algorithm. (Or any other to illustrate number theory for security)
2	Write program in C++ or Java to implement Diffie Hellman key exchange algorithm.
3	Implementation of S-DES.
4	Implementation of S-AES.
5	Write program in C++ or Java to implement RSA algorithm for key generation and cipher verification
6	Generation and use of Digital Signature for real world situation.
7	Write a program in C++ or java to implement SHA1 algorithm using libraries (API)
8	Experimenting on identifying software Vulnerabilities using any tool/techniques and their analysis.

UCCSL303: Design and Analysis of Algorithms		
Teaching Scheme:	Credit:	Examination Scheme:
Theory: 04 Hrs./ Week	4	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Prerequisite (If any):		
Course Objectives:		
1. This course introduces students the general idea of analysis and design of algorithms while making them aware of basic methods of algorithm analysis and design.		
2. It is also aimed at developing skills to solve real life applications which involve algorithm development		
3. The course also provides career opportunities in analysis, design and optimization technique in algorithms		
Course Outcomes: After completing this course, student will able to		
CO1. Recall basic concepts of algorithm in analysis and Design of algorithms.		
CO2. Examine Recurrence relations, solutions of recurrence of searching sorting methods		
CO3. Analyze Greedy methods used for analysis and Design of Algorithm		
CO4. Apply Dynamic Programming concepts in designing algorithm		
CO5. Evaluate advanced techniques and tools available for algorithm analysis and development		
Course Contents	Hrs.	
Unit I: Mathematical foundations & Asymptotic Notations	8	
Algorithm, Mathematical Notations, Algorithm specification, Analysis of Algorithm-Introduction, Analyzing control structures, Asymptotic notations, space complexity, time complexity, Performance measurement, analyzing control structures, best case, worst case and average case analysis, Iterative Algorithm analysis.		
Unit II: Divide and Conquer	8	
Recurrence relations, solutions of recurrence relations by Master Methods. Divide and conquer basic strategy, binary search, quick sort, merge sort, maximum and minimum finding		
Unit III: Greedy Method	8	
Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.		
Unit IV: Dynamic Programming	8	
Dynamic Programming basic strategy, multistage graphs, all pairs shortest path, single source shortest paths, optimal binary search trees, traveling salesman problems.		

UNIT V: Traversal And Search Techniques	8
Basic Traversal and Search Techniques, breadth first search and depth first search, Backtracking basic strategy, 8-Queen's problem, graph colouring, Hamiltonian cycles.NP, P	

Problems, Optimization Algorithms.

Text Books	1. Thomas H. Cormenet. al. "Introduction to Algorithms", Prentice Hall of India. 2. Design & Analysis of Computer Algorithms by Aho, Horowitz, Sahani, Rajsekharan, Pearson education
Reference eBooks	1. "Computer Algorithms", Galgotia Publications Pvt. Ltd. Brassard, Bratley, "Fundamentals of Algorithms", Prentice Hall 2. Computer Algorithms: Introduction to Design and analysis, 3 Edition, By Sara Baase& A. V. Gelder Pearson Education.
E-Material	NPTEL course on Design and Analysis of Algorithms: 1. https://www.class-central.com/course/nptel-design-and-analysis-of-algorithms-3984

UCCSL304: Penetration Testing		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Prerequisite (If any):		
Course Objectives:		
6. Understand vulnerability and its implications.		
7. Formulate the techniques of information gathering.		
8. Discover the system hacking methods and its advancement.		
9. Advance system penetration techniques.		
10. Perform a wireless pen-testing.		
Course Outcomes: After completing this course, students will be able to		
CO6. Examine the basics of Penetration Testing.		
CO7. Study the technique information gathering		
CO8. Evaluate the risks of system penetration.		
CO9. Analyze the advancement in system penetration.		
CO10. Recognize the challenge in wireless pen-test.		
Course Contents		Hrs.
Unit I: INTRODUCTION		8
Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non-Disclosure Agreement Checklist, Phases of hacking, Open-source/proprietary Pen-test Methodologies.		
Unit II: INFORMATION GATHERING AND SCANNING		8
Information gathering methodologies- Foot printing, Competitive Intelligence DNS Enumerations- Social Engineering attacks, Port Scanning-Network Scanning VulnerabilityScanning- NMAP scanning tool- OS Fingerprinting- Enumeration.		
Unit III: SYSTEM PENETRATION		8
Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive		

sniffing-ARP Poisoning, MAC Flooding- SQL Injection – Error based, Union-based, Time-based,

Blind SQL, Out-of-band. Injection Prevention Techniques.	
Unit IV: ADVANCED PENETRATION TECHNIQUES	8
Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken AccessCode, XSS - Stored, Reflected, DOM Based	
Unit V: WIRELESS PENTEST	8

Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS- Layer1, Layer2, Layer 3, DDoS Attack, Client Misassociation, Wireless Hacking Methodology, Wireless Traffic Analysis.

Text Book	1	Kali Linux Wireless Penetration Testing Beginner's Guide by Vivek Ramachandran, Cameron Buchanan, 2015 Packt Publishing.
	2	SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, SyngressPublication.
	3	Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016Packt Publishing.
	4	Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver, June2016.
Referenc eBook	1	The Hacker Playbook 3: Practical Guide To Penetration Testing by Peter Kim
	2	Penetration Testing: A Hands-On Introduction to Hacking 1st Edition by Georgia Weidman
	3	The Basics of Hacking and Penetration Testing: Ethical Hacking and PenetrationTesting Made Easy (Syngress Basics Series)
	4	Advanced Penetration Testing: Hacking the World's Most Secure Networks 1stEdition by Wil Allsopp.
Online TL Material	1	https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics
	2	https://www.udemy.com/course/full-ethical-hacking-penetration-testing-course/
	3	https://courseware.cutm.ac.in/courses/penetration-testing-vulnerability-assessment/

UCCSL305/UCCSP305: Java Programming		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 02 Hrs./Week Practical: 02 Hrs./Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 50 Marks
Prerequisite (If any):		
Course Objectives:		
1. To adapt the usage of modern tools and recent software. 2. To evaluate problems and analyze data using current technologies 3. To learn the process of creation of data-driven web applications using current technologies 4. To understand how to incorporate best practices for building enterprise applications 5. To learn how to employ Integrated Development Environment(IDE) for implementing and testing of software solution 6. To construct software solutions by evaluating alternate architectural patterns.		
Course Outcomes: After completing this course, students will be able to		
CO1: Evaluate problems and analyze data using current technologies in a wide variety of business and organizational contexts.		
CO2: Create data-driven web applications.		
CO3: Incorporate best practices for building applications.		
CO4: Employ Integrated Development Environment (IDE) for implementing and testing of software solution.		
CO5: Construct software solutions by evaluating alternate architectural patterns.		
Course Contents	Hrs.	
Unit I: JAVA BASICS	8	
Review of Object oriented concepts, History of Java, Java buzzwords, JVM architecture, Datatypes, Variables, Scope and life time of variables, arrays, operators, control statements, type conversion and casting, simple java program, constructors, methods, Static block, Static Data, Static Method String and String Buffer Classes, Using Java API Document.		
Unit II: INHERITANCE AND POLYMORPHISM	8	
Basic concepts, Types of inheritance, Member access rules, Usage of this and Super keyword, Method Overloading, Method overriding, Abstract classes, Dynamic method dispatch, Usage of final keyword. PACKAGES AND INTERFACES: Defining package, Access protection, importing packages, Defining and Implementing interfaces, and Extending interfaces. I / O STREAMS: Concepts of streams, Stream classes- Byte and Character stream, Reading console		

Input and Writing Console output, File Handling.

Unit III: EXCEPTION HANDLING	6
Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords, Built-in Exceptions, Creating own Exception classes. MULTI THREADING: Concepts of Thread, Thread life cycle, creating threads using Thread class and Runnable interface, Synchronization, Thread priorities, Inter Thread communication.	
Unit IV: AWT CONTROLS	6
The AWT class hierarchy, user interface components- Labels, Button, Text Components, Check Box, Check Box Group, Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar. Working with Frame class, Colour, Fonts and layout managers. EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM), Handling Mouse and Keyboard Events, Adapter classes, Inner classes.	
Unit V: SWINGS	6
Introduction to Swings, Hierarchy of swing components. Containers, Top level containers - JFrame, JWindow, JDialog, JPanel, JButton, JToggleButton, JCheckBox, JRadioButton, JLabel, JTextField, JTextArea, JList, JComboBox, JScrollPane. APPLETS: Life cycle of an Applet, Differences between Applets and Applications, Developing applets, simple applet.	

Text Books	1	Herbert Schildt, "Java: The Complete Reference", TMG Publication, ISBN 9780070636774
	2	Thomas Powell, "Java Generics and collections", O'Reilly Media, ISBN: 0596527756.
Referenc eBooks	1	Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.
	2	J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
	3	Christopher M. Judd, Joseph Faisal Nusairat, and James Shingler, "Beginning Groovy and Grails From Novice to Professional", Apress, ISBN-13: 978-1-4302-1045-0

Sr. No.	Name of Experiment
1	Write a Java program to convert a octal number to a binary number
2	Print the sum, difference and product of two complex numbers by creating a class named'Complex' with separate methods for each operation whose real and imaginary parts are entered by user
3	Create an abstract class employee, having its properties and abstract function for calculating net salary and displaying the information. Derive manager and clerk class from this abstract class and implement the abstract method net salary and override the

	display method.
4	<p>Write a java program to print even and odd numbers. Create two threads T1 and T2 respectively, synchronizing on shared object.</p> <p>T1 prints message "Wel" and T2 prints message "Come"</p> <p>Program should take command line arguments for the following input for the program:</p>

	Sleep Interval for T1 and sleep interval for T2
5	To “capitalize” a string means to change the first letter of each word in the string to upper case (if it is not already upper case). For example, a capitalized version of “Now is the time to act!” is “Now Is The Time To Act!”. Write a subroutine named printCapitalized that will print a capitalized version of a string to standard output. The string to be printed should be a parameter to the subroutine. Test your subroutine with a main() routine that gets a line of input from the user and applies the subroutine to it
6	Write a java package to show dynamic polymorphism and interfaces.
7	Create a customized exception and also make use of all the 5 exception keywords.
8	Develop an analog clock using applet.
9	Develop a scientific calculator using swings.
10	Create an editor like MS-word using swings.

UHUL301: Engineering Economics and Industrial Management		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 02 Hrs./Week	2	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Prerequisite (If any):		
Course Objectives:		
1. Understanding of basic knowledge of Economics and its application.		
2. Understanding of Management as discipline and its practices.		
3. Strengthening knowledge of management in the functional area of Marketing and Finance.		
Course Outcomes: After completing this course, students will be able to		
CO1. The students should be able to understand the basic concepts of Micro-Economics, which shall behelpful in their Engineering career.		
CO2. The students should be able to understand the basics concepts of Macro-Economics and itsapplications.		
CO3. The student should be able to understand different functions of Management and its importance inmanaging an organization.		
CO4. The student should be able to understand the relevance of Marketing of Product or Services and its applicability in profit maximization.		
CO5. The student should be able to understand the importance of Financial Management and itsapplicability in Industrial scenario.		
Course Contents	Hrs.	
Unit I :	6	
Demand, Utility and Indifference curves, approach to Analysis of demand, Elasticity of demand, Measure of demand elasticity, Factors of Production, Advertising elasticity. Market and Market Structures: Price and output determination under perfect competition, monopolistic competition, oligopoly &monopoly, Depreciation and methods for its determination.		
Unit II :	6	
Functions of central and commercial banks, Inflation, Deflation, Stagflation, Direct and Indirect Taxes, New economic policy, Liberalization, Globalization, Privatization, Monetary &Fiscalpolicies of the government, Meaning and phases of business cycles.		
Unit III :	6	
Definition, nature and scope of Management, Functions of management- Planning, Organizing, Directing, Controlling, Principles of management, Communication.		
Unit IV :	7	

Meaning of Marketing management, concepts of marketing, Marketing Mix, Service Marketing,

Product Life Cycle, New Product Development, Pricing strategies, Channels of distribution,

Promotion Mix	
Unit V:	7
Meaning, nature and scope of Financial Management, Sources of Financing, Ratio Analysis. Time value of money.	

Text Book	1	Modern Economics Theory, by K.K. Dewett, S. Chand & company Ltd., 3rd Edition, 2006
	2	Essentials of Management by Harold Koontz & Hein & Weihrich Tata McGraw Hill Publishing, 7th Edition, 2008.
	3	Marketing Management by Philip Kotler, Kevin Keller, 14th Edition, 2016.
	4	Financial Management by M.Y. Khan & P.K. Jain, Tata McGraw Hill Publishing, 5th Edition, 2008.
E - Books	1.	http://164.100.133.129:81/econtent/Uploads/Managerial_Economics%20(1).pdf [Economics]
	2.	http://164.100.133.129:81/econtent/Uploads/Financial_Management.pdf [Financial Management]
Reference eBook	1	Management by Stephen P. Robbins Mary A. Coulter, 14th Edition.
	2	Marketing Management by Ramaswamy V S and Namakumari, Macmillan India Ltd.
	3	Financial Management by I M Pandey, Vikas Publishing House, New Delhi.

UHUP302: Aptitude (Skill course)		
Teaching Scheme:	Credit:	Examination Scheme:
Practical: 02 Hrs./Week	1	INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
<p>1. The Curriculum aims to equip students in order to apply quantitative reasoning and Mathematical analysis methodologies to understand and solve problems.</p> <p>2. The students shall attain conceptual clarity to comprehend reasoning questions in a simple way and arrive at decisions at a logical manner.</p> <p>3. The program intends to enhance student's Critical Thinking, Analytical, Evaluative and Creative skills that make them best fit and sustain in the corporate/competitive world.</p>		
Course Outcomes: After completing this course, students will be able to		
CO1. Students shall draw conclusions or make decisions based on analysis and critique of quantitative information. This leads them to effectively justify the conclusion and execute their plans.		
CO2. Students shall solve real life problems requiring interpretation and comparison of various probabilities to ascertain the best outcomes expected.		
CO3. Students shall Identify logical relation to analyze, comprehend and apply mathematical techniques instead of assumptions to different real time situations.		
CO4. Students shall solve the campus placements aptitude papers that qualifies them to get employed.		
Course Contents		Hrs.
Unit I :		4
Orientation on syllabus, Emerging aptitude requirement, Pre-assessment on existing knowledge		
Unit II :		6
Number System, Problem on Numbers, Ratio and Proportion, Averages, Percentage, Profit/Loss and Discount, Simple Interest and Compound Interest,		
Unit III :		6
Partnership, Mixtures and Alligations, Speed, Time & Distance, Time & Work, Boats and Stream, Pipes and Cistern, Permutation & Combination, Probability, Progression, Mensuration		

Text Book	1	Book on Aptitude and Verbal Ability- Global Education Ltd(Under Review)
E - Books	1.	Wifi study,indiabix.com,freshers world, sawal.com,unacademy
Referenc	1	Quantitative Aptitude- R S Aggarwal - 2017 Edition- S. Chand



**G H Raisoni College of Engineering and
Management, Pune**

(An Autonomous Institute Affiliated to Savitribai
PhulePune University)



Department of Cyber Security

**Under Graduate (UG) Course
Book**

(2020 Pattern)

T.Y. B. Tech (CS)

Semester- VI



G H Raisoni College of Engineering and management, Pune

(An Autonomous Institute Affiliated to Savitribai Phule Pune
University)Gat No.1200, Domkhel Road, Wagholi, Pune-



Department of Cyber Security

**Academic Year: 2022-
23**

**Under Graduate (UG) Course
Book(2020 Pattern)**

TY. B.Tech (CS)

Semester- VI

Scheme of B. Tech. inCyber Security

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme						
						Total Hrs		Theory			Practical		Total Marks	
			L	T	P			TAE	CAE	ESE	INT	EXT		
SEMESTER-V														
UCCSL301	Ethical Hacking	C	2	1	2	5	4	10	15	50	25	25	125	
UCCSP301														
UCCSL302	Computer Security	C	3		2	5	4	10	15	50	25		100	
UCCSP302														
UCCSL303	Design & Analysis of Algorithm	C	4			4	4	10	15	50			75	
UCCSL304	Penetration testing	C	3			3	3	10	15	50			75	
UCCSL305														
UCCSP305	Java Programming	C	2		2	4	3	10	15	50	25		100	
UHUL301	Engineering Economics and Industrial Management	H	2			2	2	10	15	50			75	
UHUP302	Aptitude	A			2	2	1				25		25	
TOTAL			16	1	8	25	21	60	90	300	100	25	575	

Course Code	Name of Course	Course Category	Teaching Scheme				Credits	Evaluation Scheme						
						Total Hrs		Theory			Practical		Total Marks	
			L	T	P			TAE	CAE	ESE	INT	EXT		
SEMESTER-VI														
UCCSL306	Machine Learning Algorithm	C	2		2	4	3	10	15	50		25	100	
UCCSP306														
UCCSL307	Cyber Intelligence	C	3			3	3	10	15	50			75	
UCCSL308														
UCCSP308	Elective-I	E	3		2	5	4	10	15	50	25		75	
UISL3XX	Open Elective-II	OE	2			2	2	10	15	50			100	
UHUL306X	Humanities Elective	H	2			2	2	10	15	50			75	
UHUL304	Understanding Human Values2: Understanding Harmony	H	3			3	3	10	15	50			75	
UHUP304	Employability Skills	A			2	2	1				25		25	
UHUP307	Campus Recruitment Training	A			2	2	1				25		25	
UCCSP309	Cloud Computing	A			4	4	2				25	25	50	
TOTAL			15	12	27	21	60	90	300	125	25	25	600	

Semester- VI

UCCSL306/UCCSP306: Machine Learning Algorithms		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 02 Hrs./Week Practical: 02 Hrs./Week	4	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks EXT: 25 marks
Prerequisite (If any):		
Course Objectives:		
1. The objectives of the course are to introduce students to the basic machine learning algorithms. 2. To develop skills of using recent machine learning software for solving practical problems. 3. To gain experience of doing independent study and research.		
Course Outcomes: After completing this course, students will be able to		
CO1. Recognize the characteristics of machine learning that make it useful to real-world problems.		
CO2. Characterize machine learning algorithms as supervised, semi-supervised, and unsupervised.		
CO3. Design and implement machine learning solutions to classification, regression, and clustering problems;		
CO4. Be able to evaluate and interpret the results of the algorithms		
CO5. Effectively use machine learning toolboxes.		
Course Contents	Hrs.	
Unit I: Introduction	8	
Basic definitions, Classic and adaptive machines, What is Machine Learning, Examples of Machine Learning applications, Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning, Training versus Testing		
Unit II: Classification	8	
Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity		
Unit III: Regression	8	
Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso		
Unit IV: Logic Based And Algebraic Models	8	

Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering. **Tree Based Models:** Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Unit V: Introduction to Recommendation Systems	8
Introduction to Recommendation Systems- Naïve User based systems, Content based Systems, Model free collaborative filtering-singular value decomposition, alternating least squares.	

Text Book	1	Mitchell Tom, Machine Learning. McGraw Hill, 1997.
	2	Introduction to machine learning, Ethem Alpaydin. –2nd ed., The MIT Press, Cambridge, Massachusetts, London, England.
	3	Chris Bishop, Pattern Recognition and Machine Learning
	4	Dr. Nilesh Shelke, Dr. Gopal Sakarkar, Dr N V Choudhari, Introduction to Machine Learning, Ganu Prakashan
Reference Book	1	Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Inference and Prediction
	2	Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification, Wiley, New York, 2001.
	3	Machine Learning: The Art and Science of Algorithms that Make Sense of Data(1st Edition) – Peter Falch
Online TL Material	1	https://www.coursera.org/learn/machine-learning
	2	https://www.udemy.com/course/machinelearning/
	3	https://nptel.ac.in/courses/106/105/106105152/

Sr. No.	Name of Experiment (Any 8 Experiment)
1	<p>Supervised learning regression:</p> <p>Generate a proper 2-D data set of N points. Split the data set into Training Data set and Test Data set. i) Perform linear regression analysis with Least Squares Method. ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error. iii) Verify the Effect of Data Set Size and Bias-Variance Tradeoff. iv) Apply Cross Validation and plot the graphs for errors. v) Apply Subset Selection Method and plot the graphs for errors. vi) Describe your findings in each case</p>
2	<p>Supervised Learning – Classification:</p> <p>Implement Naïve Bayes Classifier on data set of your choice. Test and Compare for Accuracy and Precision.</p>

3	Implement k-neighbours classification using python																														
4	<p>Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>VAR1</th> <th>VAR2</th> <th>CLASS</th> </tr> </thead> <tbody> <tr><td>1.713</td><td>1.586</td><td>0</td></tr> <tr><td>0.180</td><td>1.786</td><td>1</td></tr> <tr><td>0.353</td><td>1.240</td><td>1</td></tr> <tr><td>0.940</td><td>1.566</td><td>0</td></tr> <tr><td>1.486</td><td>0.759</td><td>1</td></tr> <tr><td>1.266</td><td>1.106</td><td>0</td></tr> <tr><td>1.540</td><td>0.419</td><td>1</td></tr> <tr><td>0.459</td><td>1.799</td><td>1</td></tr> <tr><td>0.773</td><td>0.186</td><td>1</td></tr> </tbody> </table>	VAR1	VAR2	CLASS	1.713	1.586	0	0.180	1.786	1	0.353	1.240	1	0.940	1.566	0	1.486	0.759	1	1.266	1.106	0	1.540	0.419	1	0.459	1.799	1	0.773	0.186	1
VAR1	VAR2	CLASS																													
1.713	1.586	0																													
0.180	1.786	1																													
0.353	1.240	1																													
0.940	1.566	0																													
1.486	0.759	1																													
1.266	1.106	0																													
1.540	0.419	1																													
0.459	1.799	1																													
0.773	0.186	1																													
5	Implement Linear Regression using Python																														
6	Implement Naïve Bayes theorem to classify the English text																														
7	Unsupervised Learning: Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence																														
8	Implement Support Vector Machine algorithm																														

UCCSL307: Cyber Intelligence

Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Prerequisite (If any):		
Course Objectives:		
<ol style="list-style-type: none"> 1. To learn basic fundamentals of cyber threat intelligence. 2. To demonstrate how cyber has changed the nature of intelligence collection. 3. To analyze the cyber threats at different levels. 4. To learn how to collect cyber threat data. 5. To validate and prioritize risks involved. 		
Course Outcomes: After completing this course, students will be able to		
CO1. Examine the history and development of cyber intelligence operations and how those operations can integrate with other intelligence collection.		
CO2. Study the technique to Develop Cyber Threat Intelligence Requirements.		
CO3. Evaluate the benefits and risks of the current cyber intelligence structure.		
CO4. Use the attributes of computer network exploitation, defense and attack within the intelligence context.		
CO5. Recognize the intelligence challenge of attribution in cyber-attacks.		
Course Contents	Hrs.	
Unit I: Introduction To Cyber Intelligence	8	
Definition, The Need for Cyber Intelligence: The menace of targeted attacks, The monitor- and-respond strategy, Why the strategy is failing, Cyber Threat Intelligence Defined, Key Characteristics: Adversary based, Risk focused, Process oriented, Tailored for diverse consumers, The Benefits of Cyber Threat Intelligence.		
Unit II: Developing Cyber Threat Intelligence Requirements	8	
Assets That Must Be Prioritized: Personal information, Intellectual property, Confidential business information, Credentials and IT systems information, Operational systems. Adversaries: Cybercriminals, Competitors and cyber espionage agents, Hacktivists. Intelligence Consumers: Tactical users, Operational users, Strategic users.		
Unit III: Collecting Cyber Threat Information	8	

Level 1: Threat Indicators, File hashes and reputation data, Technical sources: honeypots and scanners, Industry sources: malware and reputation feeds. Level 2: Threat Data Feeds, Cyberthreat statistics, reports, and surveys, Malware analysis. Level 3: Strategic

Cyber Threat Intelligence, Monitoring the underground, Motivation and intentions, Tactics, techniques and procedures.	
Unit IV: Analyzing and Disseminating Cyber Threat Intelligence	8
Information versus Intelligence, Validation and Prioritization: Risk scores, Tags for context, Human assessment. Interpretation and Analysis: Reports, Analyst skills, Intelligence platform, Customization. Dissemination: Automated feeds and APIs, Searchable knowledge base, Tailored reports.	
Unit V: Cyber Threat Intelligence Partner	8
Selecting the Right Cyber Threat Intelligence Partner: Types of Partners: Providers of threat indicators, Providers of threat data feeds, Providers of comprehensive cyber threat intelligence.	

Text Book	1	Friedman, J., & Bouchard, M. (2015). Definitive Guide to Cyber Threat Intelligence: Using Knowledge about Adversaries to Win the War against Targeted Attacks. CyberEdge Group.
	2	Friedman, J., & Bouchard, M. (2015). Definitive Guide to Cyber Threat Intelligence: Using Knowledge about Adversaries to Win the War against Targeted Attacks. CyberEdge Group.
	3	Dalziel, H. (2014). How to define and build an effective cyber threat intelligence capability. Syngress.
	4	Simpson, M. T., Backman, K., & Corley, J. (2010). Hands-on ethical hacking and network defense. Cengage Learning.
Reference Book	1	Robertson, J., Diab, A., Marin, E., Nunes, E., Paliath, V., Shakarian, J., & Shakarian, P. (2017). Darkweb cyber threat intelligence mining. Cambridge University Press.
	2	Official Certified Ethical Hacker Review Guide – By Steven DeFino, Barry Kaufman, Nick Valenteen.
	3	The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy (Syngress Basics Series) [Paperback]
	4	Gourley Bob, 2014, –The Cyber Threat , Create space Independent Pub
Online TL	1	https://www.coursera.org/learn/ibm-cyber-threat-intelligence
	2	https://www.udemy.com/course/cybersecurity-threat-intelligence-researcher/

UCCSL308(A)/UCCSP308(A): Web Application Security		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week Practical: 2 Hrs/Week	3	TAE: 10 Marks, CAE: 15 Marks, ESE :50 Marks INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To understand web services and content management		
2. To understand current client side and server-side web technologies		
3. To understand the principles and techniques of web-based development process		
4. To understand web development frameworks		
Course Outcomes: After completing this course, students will be able to		
CO1: Analyze given assignment to select sustainable web development design methodology		
CO2: Develop web-based application using suitable client side and server-side web technologies		
CO3: Develop solution to complex problems using appropriate method		
Course Contents		Hrs.
Unit I: Web Development Basic		8
Internet and Web Protocols, World wide web, components of WWW, Internet Vs WWW Client-Server Architecture, Web Software, Web Browser, Components of WWW, URL Applications of WWW. Web designing using HTML: HTML tags, Attributes, Hyperlinks CSS, and XML, Active Server Pages, JavaScript		
Unit II: Development Technologies		8
Client Side Technologies: JavaScript: Overview of JavaScript, using JS in an HTML, DOM: DOM levels, DOM Objects and their properties and methods, JQuery: Introduction to JQuery, Loading JQuery. Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, JSP: Introduction to JSP, advantages of JSP over Servlet.		
Unit III: Development Technologies		8
Client Side Technologies: JavaScript: Overview of JavaScript, using JS in an HTML, DOM: DOM levels, DOM Objects and their properties and methods, JQuery: Introduction to JQuery, Loading JQuery. Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, JSP: Introduction to JSP, advantages of JSP		

Unit IV: Web application vulnerabilities	6
Common web app vulnerabilities: Injection, Cross-site Scripting (XSS) , Broker Authentication and Session Management, Remote File Inclusion , Insecure Direct Object References, Security Misconfiguration, Insecure Cryptographic Storage Failure to Restrict URL Access, Insufficient Transport Layer Protection, Cross-site Request Forgery (CSRF) ,Unvalidated Redirects and Forwards	
Unit V: Web application security	8

Text Book	1	Achyut Godbole & Atul Kahate, Web Technologies: TCP/IP to Internet Application Architectures , McGraw Hill Education publications, ISBN 007047298X, 9780070472983
	2	Ralph Moseley & M. T. Savaliya, –Developing Web Applications , Wiley publications, ISBN 13 : 9788126538676
Reference eBook	1	Giulio Zambon, – Beginning JSP, JSF and Tomcat , Apress Publication, ISBN -10:1430246235; ISBN-13: 978-1430246237
	2	Jeremy McPeak& Paul Wilton, Beginning JavaScript , Wrox Publication,ISBN-13:978- 0470525937
	3	Adam Bretz & Colin J Ihrig, –Full Stack Javascript Development with MEAN , SPD, ISBN-13: 978-0992461256
	4	Web Application Security,by Andrew Hoffman Released March 2020 Publisher(s):O'Reilly Media, Inc.ISBN: 9781492053118
Online TL Material	1	https://www.horangi.com/blog/real-life-examples-of-web-vulnerabilities
	2	https://www.imperva.com/learn/application-security/application-security/

UCCSL308(B)/UCCSP308(B):Digital Signal Processing		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Practical: 2 Hrs/Week		INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To describe signals mathematically and understand how to perform mathematical operations on signals.		
2. It will provide knowledge of Digital filter		
3. To discuss word length issues ,multi rate signal processing and application.		
Course Outcomes: After completing this course, students will be able to		
CO1: Illustrate digital signals, systems and their significance.		
CO2: Analyze the digital signals using various digital transforms DFT, FFT etc.		
CO3: Design and develop the basic digital system		
CO4: Interpret the finite word length effects on functioning of digital filters.		
Course Contents	Hrs.	
UNIT I: Basic elements of digital signal Processing	8	
Concept of frequency in continuous time and discrete time signals –Sampling theorem – Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform – Convolution and correlation.		
UNIT II: Introduction to DFT	6	
Efficient computation of DFT Properties of DFT – FFT algorithms – Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms – Use of FFT algorithms in Linear Filtering and correlation.		
UNIT III: Structure of IIR	8	
System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain.		
UNIT IV: Symmetric & Anti-symmetric FIR filters	6	
Linear phase filter – Windowing techniques – rectangular, triangular, Blackman and Kaiser windows – Frequency sampling techniques – Structure for FIR systems.		
UNIT-V: Finite word length effects in FIR and IIR digital filters	6	

Quantization, round off errors and overflow errors. Multi rate digital signal processing:

Concepts, design of practical sampling rate converters, Decimators, interpolators.

Poly phasedecompositions. Application of DSP – Model of Speech Wave Form – Vocoder.

Text Books	<ol style="list-style-type: none"> 1. Oppenheim A V and Sehafer R W, -Discrete Time Signal Processing , Prentice Hall 2. Proakis J G and Manolakis D G, -Digital Signal Processing , Pearson Education India.
Reference eBooks	<ol style="list-style-type: none"> 1. Oppenheim A V, Willsky A S and Young I T, -Signal & Systems , Prentice Hall. 2. DeFatta D J, Lucas J G and Hodgkiss W S, -Digital Signal Processing , J Wiley and Sons, Singapore 3. Ifeachor and Jervis, -Digital Signal Processing , Pearson Education India.

UCCSL308(D)/UCCSP308(D): Recommender System		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week Practical: 2 Hrs/Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To provide students with basic concepts and its application in various domain.		
2. To make the students understand different techniques that a data scientist needs to know for analyzing big data.		
3. To design and build a complete machine learning solution in many application domains.		
Course Outcomes: After completing this course, students will be able to		
CO1. Aware of various issues related to Personalization and Recommendations.		
CO2. Learn about advanced topics and current applications of recommender systems in other realms		
CO3. Design and implement a simple recommender system		
Course Contents	Hrs.	
Unit I: Introduction	8	
Introduction, Recommender Systems Function , Data and Knowledge Sources , Recommendation Techniques , Application and Evaluation , Recommender Systems and Human Computer Interaction , Recommender Systems as a Multidisciplinary Field . Emerging Topics and Challenges .		
Unit II: Data Mining Methods for Recommender Systems	8	
Data Preprocessing ,Classification : Nearest Neighbors , Decision Trees ,Ruled based Classifiers , Bayesian Classifiers , Artificial Neural Networks , Support Vector Machines , Ensembles of Classifiers Evaluating Classifiers , Cluster Analysis . Association Rule Mining .		
Unit III: Content-based Recommender Systems: State of the Art and Trends	8	
Basics of Content-based Recommender Systems , A High Level Architecture of Content- based Systems , Advantages and Drawbacks of Content-based Filtering State of the Art of Content-based Recommender Systems , Item Representation , Methods for Learning User Profiles , The Role of User Generated Content in the Recommendation Process , Beyond Over-specializing: Serendipity		

Unit IV: Evaluating Recommendation Systems

6

Experimental Settings : Offline Experiments , User Studies , Online Evaluation , Drawing Reliable Conclusions , Recommendation System Properties , User Preference ,Prediction Accuracy , Coverage , Confidence , Trust , Novelty , Serendipity , Diversity , Utility , Risk , Robustness , Privacy ,Adaptively

Unit V: A Recommender System for an IPTV Service Provider

8

IPTV Architecture , IPTV Search Problems , Recommender System Architecture , Data Collection , Batch and Real-Time Stages , Recommender Algorithms , Overview of Recommender Algorithms , Content Based Algorithm , Item-based Collaborative Algorithm , Dimensionality-Reduction-Based Collaborative Algorithm , Recommender Services , System Evaluation , Off-Line Analysis , On-line Analysis .

Referenc eBook	1	C.C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
	2	F. Ricci, L Rokach, B. Shapira and P.B. Kantor, Recommender systems handbook, Springer 2010.
	1	J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge, 2012
	2	M. Chiang, Networking Life, Cambridge, 2010.

UCCSL308(E)/UCCSP308(E): High Performance Computing		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week Practical: 2 Hrs/Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To study parallel computing hardware and programming models. 2. To be conversant with performance analysis and modeling of parallel programs. 3. To understand the options available to parallelize the programs. 4. To know the operating system requirements to qualify in handling the parallelization.		
Course Outcomes: After completing this course, students will be able to		
CO1. Describe different parallel architectures, inter-connect networks, programming models.		
CO2. Develop an efficient parallel algorithm to solve given problem		
CO3. Analyze and measure performance of modern parallel computing systems		
CO4. Build the logic to parallelize the programming task		
Course Contents	Hrs.	
UNIT I: Introduction	8	
Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture		
UNIT II: Parallel Programming	7	
Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.		
UNIT III: Basic Communication	7	

Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction,

All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication,Circular Shift, Improving the Speed of Some Communication Operations.

UNIT IV: Analytical Models of Parallel Programs	7
Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: MatrixVector Multiplication, Matrix-Matrix Multiplication.	
UNIT V: Parallel Algorithms- Sorting and Graph	7
Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel BestFirstSearch.	

Text Books	1.	Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2 2.
	2.	Jason Sanders, Edward Kandrot, —CUDA by Example , Addison-Wesley, ISBN-13: 978-0-13-138768-3
Reference eBooks	1.	Kai Hwang, Scalable Parallel Computing , McGraw Hill 1998, ISBN:0070317984
	2.	Shane Cook, —CUDA Programming: A Developer's Guide to Parallel Computing with GPUs , Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 9780124159884
	3	David Culler Jaswinder Pal Singh, Parallel Computer Architecture: A Hardware/Software Approach , Morgan Kaufmann, 1999, ISBN 978-1-55860-343-1
	4	Rod Stephens, —Essential Algorithms , Wiley, ISBN: ISBN: 978-1-118-61210-1

UCCSL308(F)/UCCSP308(F): Elective I Data Warehousing and Mining		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week Practical: 2 Hrs/Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks INT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To understand the fundamentals of Data Mining 2. To identify the appropriateness and need of mining the data 3. To learn the preprocessing, mining and post processing of the data 4. To understand various methods, techniques and algorithms in data mining		
Course Outcomes: After completing this course, students will be able to		
CO1. Apply basic, intermediate and advanced techniques to mine the data		
CO2. Analyze the output generated by the process of data mining		
CO3. Explore the hidden patterns in the data		
CO4. Optimize the mining process by choosing best data mining technique		
Course Contents	Hrs.	
Unit I: Introduction	8	
Introduction: Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes.		
Unit II: Data Warehouse	8	
Data Warehouse: Data Warehouse, Operational Database Systems and Data Warehouses (OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model.		
Unit III: Measuring Data Similarity and Dissimilarity	8	
Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, Minkowski Distance, Euclidean distance and Manhattan distance; Proximity Measures for Categorical, Ordinal Attributes,		
Unit V: Classification	6	

Introduction to Classification and Regression for Predictive Analysis, Decision TreeInduction, Rule-Based Classification using IF-THEN Rules for Classification, Bayesian	
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Belief Networks, Training Bayesian Belief Networks.	
Unit V: Advanced Tools	8
AWS Overview, AWS History, Applications, AWS Storage Services, AWS EC2, GoogleCloud Platform Overview, GCP Applications, Microsoft Azure introduction, Comparison between AWS vs GCP vs Microsoft Azure	

Text Book	1	Han, Jiawei Kamber, Micheline Pei and Jian, -Data Mining: Concepts and Techniques , Elsevier Publishers, ISBN:9780123814791, 9780123814807.
	2	Parag Kulkarni, -Reinforcement and Systemic Machine Learning for Decision Making by Wiley-IEEE Press, ISBN: 978-0-470-91999-6
Referenc eBook	1	Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
	2	Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups: Finding connections on the social web", Shroff Publishers , ISBN: 10:1449306462

UHUL304: Universal Human Values 2 : Understanding Harmony		
Teaching Scheme:	Credit:	Examination Scheme:
Lectures: 03 Hrs./Week	3	TAE: 10 Marks ,CAE: 15 Marks, ESE :50 Marks
Prerequisite (If any):		
Course Objectives:		
1. Development of a holistic perspective based on self- exploration about themselves (human being),family, society and nature/existence		
2. Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence		
3. Strengthening of self-reflection and development of commitment and courage to act.		
Course Outcomes: After completing this course, students will be able to		
CO1. Students are expected to become more aware of themselves.		
CO2. Students are expected to become more aware of their surroundings (family, society, nature).		
CO3. Students should become more responsible in life, and in handling problems with sustainablesolutions, while keeping human relationships and human nature in mind.		
CO4. Students would have better critical ability, they would also become sensitive to their commitmenttowards what they have understood (human values, human relationship and human society).		
CO5. Students would be able to apply what they have learnt to their own self in different day-to-daysettings in real life.		
Course Contents	Hrs.	
Unit I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:	8	
Purpose and motivation for the course, Self-Exploration, Continuous Happiness and Prosperity, Right understanding relationship and physical facility, Understandinghappiness and prosperity correctly, Method to fulfill the above human aspirations.		
Unit II: Understanding Harmony in the Human Being - Harmony in Myself!	8	
Understanding human being as a co-existence of the sentient '_I' and the material '_Body',Understanding the needs of Self ('_I') and '_Body', Understanding the Body as an instrument of '_I', Understanding the characteristics and activities of '_I' and harmony in '_I', Understanding the harmony of I with the Body.		
Unit III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	8	

Understanding values in human-human relationship, Understanding the meaning of Trust, Understanding the meaning of Respect, Understanding the harmony in the society, Visualizing a universal harmonious order in society	
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Unit IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence	8
Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature, Understanding Existence as Co-existence, Holistic perception of harmony	
Unit V: Implications of the above Holistic Understanding of Harmony on Professional Ethics	8
Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics, Strategy for transition from the present state to Universal Human Order: a) At the level of individual, b) At the level of society.	

Text Book	1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
Reference eBooks	1	JeevanVidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
	2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
	3	The Story of Stuff (Book)
	4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
	5	Small is Beautiful - E. F Schumacher.
	6	Slow is Beautiful - Cecile Andrews
	7	Economy of Permanence - J C Kumarappa
	8	Bharat Mein Angreji Raj - Pandit Sunderlal
	9	Rediscovering India - by Dharampal
	10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
	11	India Wins Freedom - Maulana Abdul Kalam Azad
	12	Vivekananda - Romain Rolland (English)
	13	Gandhi - Romain Rolland (English)

UHUP304: Employability Skills		
Teaching Scheme:	Credit:	Examination Scheme:
Practical: 02 Hrs./Week	1	Internal : 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To introduce them with the current market scenarios		
2. To equip the students with the essential skills for employability		
3. To demonstrate self-sufficiency to be highly employable or venture their start-ups		
Course Outcomes: After completing this course, students will be able to		
CO1. Students shall exhibit their ability to set clear and realistic professional objective		
CO2. Enabling them to make well informed choices and commercially equipped		
CO3. Master Verbal (LSRW) and non-verbal communication skills required in the process of recruitment		
CO4. Students shall exhibit improved Interpersonal skills for better professional conduct		
CO5. Students shall exercise higher order thinking skills, creativity skills, convincing and Negotiationskills		
Course Contents		Hrs.
Unit I: Orientation - Researching Job and Company- Emerging Market Trends		4
Orientation - Researching Job and Company- Emerging Market Trends: Experience sharing of Major Campus interviews, Skill Requirements, Current Market trends, Researching the Job and company		
Unit II: Personal and Company Commercial		4
Guidelines for preparing a 30- 90 second self-introduction .Questions to think about in developing a commercial Understand " What to avoid" in a commercial		
Self-Selling Proficiency: What to say and do, How to demonstrate commercial awareness in an interview ,Post Interview activity, Telephone etiquette in a phone Interview		
Resume Building :Guidelines on framing resume and cover letterChecklist to ensure completeness , Sample resumes and cover letter references		
Basic Guidelines on Video Resume and its difference with conventional		
Unit III: Verbal and Non-Verbal Communication		4
Format of Business Correspondence, Email and Letter writing etiquette, Hands on training on email and letter writing with case study, Body Language in an Interview-Dos' and Donts', Tips and techniques on Essay Writing, How to knot the crux on Essay writing Practice on some common essay writing topics in an interview –		
Voice Versant Neutralization : Voice Modulation, Pitch and tone training and Accent Neutralization		
Unit IV: Personal Interview- Group Discussion		3

Preparation tips on GD and Extempore: Dos' and Donts', Presentation on PI Preparation and FAQs -Role Plays/ Mock Interview with Technical Faculty and Mock Interview by FacultyAssessment and feedback series	
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Text Book	1.	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
Referenc eBook	1.	Employability Skills by NIMI Chennai, First Edition Aug 2019
	2.	What employers wants by Karen Holmes, March 2017 Edition
E Learning	1.	Udemy , Coursera, Alison, Edx, WPA Apprentice, Hubspot, Codecademy

UHUP307: Campus Recruitment Training		
Teaching Scheme:	Credit:	Examination Scheme:
Practical: 02 Hrs./Week	1	Internal: 25 marks
Prerequisite (If any):		
Course Objectives:		
1. The Curriculum aims to equip students in order to apply quantitative reasoning and Mathematical analysis methodologies to understand and solve problems.		
2. The students shall attain conceptual clarity to comprehend reasoning questions in a simple way and arrive at decisions at a logical manner.		
3. The program intends to enhance student's Critical Thinking, Analytical, Evaluative and Creative skills that make them best fit and sustain in the corporate/competitive world.		
Course Outcomes: After completing this course, students will be able to		
C01. Students shall draw conclusions or make decisions based on analysis and critique of quantitative information. This leads them to effectively justify the conclusion and execute their plans.		
C02. Students shall solve real life problems requiring interpretation and comparison of various probabilities to ascertain the best outcomes expected.		
C03. Students shall identify logical relation to analyze, comprehend and apply mathematical techniques instead of assumptions to different real time situations.		
C04. Shall solve the campus placements aptitude papers that qualifies them to get employed.		
Course Contents		
Unit I: Verbal and Non-Verbal Communication		
Blood Relation, Direction, Analogy, Puzzles, Seating Arrangement, Syllogism		
Unit II: Quantitative Aptitude		
Clocks, Calendar, Cubes & Dices, Coding and Decoding, Spatial and 2-D Ability, Data Sufficiency, Number Series		
Unit III: Charts and Graphs for Analysis		
Table chart, pie chart, bar graph and line graph, problems based on the various data, such as combination of gender, city, profession, salary, sports, vehicle, problems based on Pie chart, degree of fraction occupied by the commodity, line chart and bar chart		

Text Book	1	Book on Aptitude and Verbal Ability- Global Education Ltd(Under Review)
Reference Book	1	Quantitative Aptitude- R S Agarwal - 2017 Edition- S. Chand
	2	Campus Recruitment- Paxis Group

UHUP308: Cloud Computing		
Teaching Scheme:	Credit:	Examination Scheme:
Practical :4 Hrs/Week	2	Internal : 25 Marks, EXT: 25 Marks
Prerequisite (If any):		
Course Objectives:		
1. To understand Cloud Computing concepts, technologies, architecture and application		
2. To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization		
3. To understand different cloud programming platforms and tools to develop and deploy applications on cloud		
Course Outcomes: After completing this course, students will be able to		
CO1: Develop and deploy cloud application using popular cloud platforms		
CO2: Design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud and building private cloud		
CO3: Design and deploy a cloud application in a PaaS environment		
CO4: Develop cloud computing solutions for an enterprise		
CO5: Analyze various cloud programming models and apply them to solve problems on the cloud		
Course Contents	Hrs .	
Unit I: Introduction	7	
Overview, Applications, Intranets and the Cloud. Your Organization and Cloud Computing- Benefits, Limitations, Security Concerns. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of Paas Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy, Utilizing Cloud-Based NAS Devices, Advantages, Server Types. Identity as a Service (IDaaS).		
Unit II: Virtualization	6	
Introduction, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization, Technology examples: Xen, KVM, Vmware, Microsoft Hyper-V.		
Unit III: Cloud file systems	6	

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo Cloud data stores: Datastore and Simple DB Gautam Shrauf, Cloud Storage-Overview, Cloud Storage Providers. [Anthony T.

Velté]3 Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats.

Unit IV: Cloud Infrastructure

8

Infrastructure as Service, best-of breed cloud infrastructure components, cloud ready converged infrastructure, Virtual machine provisioning and migration services, Anatomy of Cloud infrastructure, Distributed management of virtual infrastructure, scheduling techniques, SLA Commitment

Unit V: Cloud Service Level Agreement

8

Introduction and architecture for federated cloud computing, Performance prediction for HPC onCloud. SLA management: Types of SLA, Life cycle of SLA, Traditional approaches of SLA.

Management responsibilities, lifecycle management, cloud management products, Cloudmanagement standards.

Text Books	1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011.
	2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010.
	3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
Reference eBooks	1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India, 2010.
Online TL Material	1. https://onlinecourses.nptel.ac.in/noc19_cs69/preview
	2. https://onlinecourses.swayam2.ac.in/cec20_cs07/preview