Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Cryptography and Network Security
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	Understand OSI security architecture and classical encryption techniques.
2	Acquire fundamental knowledge on the concepts of finite fields and number theory.
3	Understand various block cipher and stream cipher models.
4	Describe the principles of public key cryptosystems, hash functions and digital signature.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Apply the number theory concepts to different encryption and decryption techniques to solve problems related to confidentiality and authentication.	Apply
CO2	Analyze security of network protocols and systems	Analyze
CO3	Justify various methods of authentication and access control for application of technologies to various sections of industry and society.	Evaluate
CO4	Identify and classify security threats and develop a security model to prevent, detect and recover from attack	Create

Module	**Module Contents**	**Hours**
I	**INTRODUCTION** Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography-Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis	8
II	**SYMMETRIC KEY CRYPTOGRAPHY** MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclid"s algorithm- Congruence and matrices SYMMETRIC KEY CIPHERS: Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard – RC4	6
III	**PUBLIC KEY CRYPTOGRAPHY** MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing –Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm – ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -ElGamal cryptosystem –Elliptic curve cryptography.	6
IV	**MESSAGE AUTHENTICATION AND INTEGRITY** Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions, Identity and Access Management (IAM), Digital signature–	6

	Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge protocols, Authentication applications – Kerberos, X.509.	
V	**NETWORK SECURITY** Network security basics: TCP/IP vulnerabilities, Packet Sniffing, ARP spoofing, port scanning, IP spoofing, TCP syn flood, DNS Spoofing, Denial of Service, Internet Security Protocols: SSL/TLS, IPSEC, Email Security: PGP,S/MIME.	7
VI	**SYSTEM SECURITY** Intruders, IDS, Firewalls, Honey Pots, Software Vulnerabilities, Malicious software – Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits, Wireless Security, Blockchain Cryptocurrencies and the Dark Web.	7

Text Books	
1	William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India.
2	Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India.

References	
1	"Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley.
2	"Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill.
3	Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", CRC Press.
4	Johannes A. Buchmann, *"Introduction to Cryptography",* Springer.

Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2	2	
CO2	3	2											3	2	
CO3	3	3											3	3	
CO4	3	2											3	1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks)

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	10		20	30
4	Analyze	5	10	20	35
5	Evaluate		10	10	20
6	Create	5		10	15
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Cryptography and Network Security Lab
Desired Requisites:	Computer Networking

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To learn different cipher techniques
2	To implement the algorithms DES, AES, RSA,MD5,SHA-1
3	To use network security tools and vulnerability assessment tools
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Develop code for classical Encryption Techniques to solve the real life problems	Apply
CO2	Analyze the network security system using open source tools	Analyze
CO3	Evaluate the securities of different security protocols	Evaluate
CO4	Build cryptosystems by applying symmetric and public key encryption algorithms	Create

List of Experiments / Lab Activities

List of Experiments:

1. Perform encryption, decryption using the following substitution techniques
    a. Ceaser cipher,
    b. playfair cipher
    c. Hill Cipher
    d. Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
    a. Rail fence
    b. row and Column Transformation
3. Implementation of Euclidean and Extended Euclidean Algorithm
4. Implementation of Chinese Remainder Theorem (CRT)
5. Apply DES algorithm for practical applications
6. Apply AES algorithm for practical applications
7. Implementation of RSA Algorithm
8. Implement the Diffie-Hellman Key Exchange algorithm for a given problem
9. Calculate the message digest of a text using the SHA-1 algorithm
10. Implement the SIGNATURE SCHEME – Digital Signature Standard
11. Demonstration of SSL using Wireshark
12. Automated Attack and Penetration Tools
    Exploring a Vulnerability Assessment Tool

In case of mini-projects, drawing, presentations etc, write the relevant details of the same.

Text Books	
1	William Stallings, *"Cryptography and Network Security: Principles and Practice",* Prentice Hall of India.
2	Behrouz A. Forouzan "*Cryptography And Network Security*". Tata Mcgraw-Hill, New Delhi India.
References	
1	"Applied Cryptography, Protocols Algorithms and Source Code in C", Bruce Schneier, Wiley.
2	"Cryptography and Network Security", Atul Kahate, Tata Mc Graw Hill.
3	
4	
Useful Links	
1	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3												3	2	
CO2	3	3			3								3	1	
CO3	3	3		2									3	2	
CO4	3	2											3	2	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	10	5	10	**25**
Analyze	10	5	10	**25**
Evaluate		10	10	**20**
Create	10	10	10	**30**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Project-1 and Seminar
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	6 Hrs/week				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To understand project identification process and carryout literature survey for real world problem
2	To use latest design, development tools and technologies.
3	To undergo project management techniques.
4	To acquire ability to map technical skills to real life applications through modeling.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	demonstrate the state-of-art technological trends through seminar.	Understanding
CO2	work in teams and participate in group activity of software development.	Applying
CO3	build and demonstrate the prototype / miniature model.	Creating

List of Experiments / Lab Activities

List of Experiments:

1. Project work is to be carried out in two semesters with group size of maximum three to four students
2. In first semester project group will select a project topic with consent from guide and approval from department and submit the brief document discussing the outline of the project with clear objectives.
3. Students should maintain a project log book containing weekly progress of the project.
4. At the end of the semester project group should complete the system design, Algorithm design and present with suitable model. (CFD, DFD & Data structure layout, SRS & UML diagram using project management tool)
5. Project report should be prepared using Latex and submitted in soft and hard form.

Text Books	
1	Nil
2	
3	
4	

References	
1	Nil
2	
3	
4	

Useful Links	
1	Nil

2	
3	
4	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	--	3	--	2	--	--	--	--	1	--	--	--	--	--	
CO2	--	--	3	--	--	--	--	--	--	1	--	--	--	--	
CO3	--	--	--	3	--	--	--	--	--	--	--	--	--	--	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	20	10		**30**
Apply	10	20	20	**50**
Analyze				
Evaluate				
Create			20	**20**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	High Performance Computing
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To be introduced with current trends in parallel computer architectures and programming models (i.e. languages and libraries) for shared memory, many core/multicore architecture.
2	To understand parallel program design methodology. Also to calculate speedup and efficiency of parallel algorithm.
3	To learn various parallel algorithms for matrices, graphs.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Describe different parallel paradigms, inter connection networks, and tools for parallel programming.	Understand
CO2	Demonstrate design methodology and performance measurement of parallel algorithms on various parallel platforms.	Apply
CO3	Analyze a given problem for possibilities of parallel computations	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction** What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network.	7
II	**Parallel programming models and paradigms** Introduction, parallel applications and development, code granularity and level of parallelism, parallel programming models and tools, methodical design of parallel algorithm, parallel program paradigm, programming skeleton and templates.	6
III	**Performance and scalability of parallel systems** Performance Metrics for parallel systems. The effect of Granularity and Data Mapping on Performance. The Scalability of parallel systems, Isoefficiency metric of scalability, sources of parallel overhead, Minimum execution time and minimum cost-optimal execution time.	6
IV	**parallel programming libraries** OpenMP, MPI, Thread basics ,Work Sharing constructs, Scheduling, Reduction, Mutual Exclusion Synchronization & Barriers, The MPI Programming Model, MPI Basics, Global Operations , Asynchronous Communication, Modularity, Other MPI Features, Performance Issues	6
V	**Parallel programming using accelerators** Introduction of CUDA/OpenCL, Chapel, etc. Basics of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or	7

	OpenCL for GPGPU hardware, case study.	
VI	**Algorithms** Dense matrix algorithms, sorting, graph algorithms.	7

Text Books	
1	"Introduction to Parallel Computing", (2nd ed.), by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar.
2	"High Performance Cluster Computing : Programming and Applications", Volume 2 By Buyya Rajkumar
3	"CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", by Shane cook

References	
1	"Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill, 2004.

Useful Links	
1	High Performance Computing, Charles Severance, 1998. http://cnx.org/content/col11136/latest/
2	MPI: The Complete Reference, Marc Snir, Steve Otto, Steven Huss-Lederman, David Walker, and Jack Dongarra, 1996. http://www.netlib.org/utk/papers/mpi-book/mpi-book.html
3	Designing and Building Parallel Programs, Ian Foster, 1995. http://www.mcs.anl.gov/~itf/dbpp/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2												1	1	
CO2		3											3	1	
CO3		2	2										2	1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember	10	5	5	20
2	Understand	10	10	5	25
3	Apply		5	25	30
4	Analyze			25	25
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Data Mining
Desired Requisites:	Database Engineering

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To gain the knowledge of theoretical background to several of the commonly used data mining techniques.
2	To analyze data, choose relevant models and algorithms for respective applications.
3	To evaluate the different data mining algorithms and tools
4	To develop research interest towards advances in data mining

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**apply** the data pre-processing and data mining algorithms to **solve** real world problems	Apply
CO2	**analyze** a complex data mining problem and different data mining algorithms to **identify** solutions.	Analyze
CO3	**measure** the performance of different data mining algorithms/tools, **evaluate** and **recommend** the optimal solution.	Evaluate
CO4	**Design** and **build** a data mining tool/solution to meet the given set of computing requirements in the context of the complex data mining problem.	Create

Module	Module Contents	Hours
I	**Introduction** Why and what is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining.	5
II	**About Data and its pre-processing** Data objects and attribute types, basic statistical description of data, Data visualization, Data pre-processing : Overview, data cleaning, data integration, data transformation and data discretization.	7
III	**Classification** Basic concepts, decision tree induction and rule based classification, Bayes Classification, Artificial Neural Network (ANN) based classification, Metrics for Evaluating Classifier Performance	8
IV	**Clustering** Basic concepts, measuring data similarity and dissimilarity, partitioning methods, Hierarchical Methods, Density-Based methods, Evaluation of Clustering	6
V	**Association Rule Mining** Basic concepts, Frequent itemset mining methods, interesting patterns and its evaluation methods, Pattern Exploration and Application.	6
VI	**Web Mining** Introduction, web content mining, web structure mining, web usage mining	7

Text Books

1	Jiawei Han , Micheline Kamber and Jian Pei , *"Data Mining - Concepts and Techniques"* , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1
2	Dunham, Margaret H , *"Data Mining: Introductory and Advanced Topics"*, 1st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2

References	
1	Sumathi, S., Sivanandam, S.N. , *"Introduction to Data Mining and its Applications"*, Springer , 2006 , ISBN 978-3-540-34351-6
2	P. Tan, M. Steinbach and V. Kumar, *"Introduction to Data Mining"*, 2nd Edition, Addison Wesley, 2019,
3	Related papers from various IEEE Transactions , Int. Journals / Conferences.
4	

Useful Links	
1	Data sets : https://archive.ics.uci.edu/ml/index.php
2	IEEE Transactions on Knowledge and Data Engineering : https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69
3	Tools - Tableau : https://www.tableau.com/developer/tools , SPSS : https://www.ibm.com/in-en/analytics/spss-statistics-software , Weka : https://www.cs.waikato.ac.nz/ml/weka/
4	Data Mining Resources : https://www.cs.purdue.edu/homes/ayg/CS590D/resources.html

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2												2		
CO2		3												2	
CO3				3									3		
CO4			3											3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	7	5	25	37
4	Analyze	6	5	13	24
5	Evaluate	3	5	10	18
6	Create	4	5	12	21
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	High Performance Computing Lab
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide basics of parallel architectures
2	To provide basics of parallel algorithm design and analysis
3	To provide basics of parallel programming platforms

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Comparison of different parallel architectures and performance evaluation	Understand
CO2	To measure performance of model using different metrics	Apply
CO3	To design a parallelization strategy for computing patterns on different hardware and using different parallel computing languages.	Create

List of Experiments / Lab Activities

List of Experiments:

A. Implementation of following tasks using OpenMP.

1. Implementation of sum of two lower triangular matrices.
2. Implementation of Matrix-Matrix Multiplication.
3. Implementation of dot product
4. Implementation of Prefix sum

B. Implementation of following tasks using MPI.

5. Implementation of Matrix-Vector Multiplication.
6. Implementation of Matrix-Matrix Multiplication.
7. Implementation of 2D Convolution
8. Implementation of dot product
9. Implementation of Prefix sum

C. Implementation of following tasks using CUDA.

10. Implementation of Matrix-matrix Multiplication using global memory.
11. Implementation of Matrix-Matrix Multiplication using shared memory.
12. Implementation of Histogram
13. Implementation of Odd even sort
14. Implementation of Prefix sum
15. Implement 2D Convolution using shared memory

D. Performance evaluation of following computations using open source libraries or OpenACC compare to sequential and explicit parallel implementation

16. Implementation of Matrix-Matrix multiplication using OpenACC MKL, and cuBLAS. Compare their performance with OpenMP based implementation from assignment no.2, 10 and 11.

Text Books	
1	Zbigniew J. Czech, Introduction to Parallel Computing, Cambridge University Press, 2016.
2	Kumar, V., Grama, A., Gupta, A., & Karypis, G. (1994). Introduction to parallel computing (Vol. 110). Redwood City, CA: Benjamin/Cummings.
3	Chandra, R., Dagum, L., Kohr, D., Menon, R., Maydan, D., & McDonald, J. (2001). Parallel programming in OpenMP. Morgan kaufmann.
4	Cheng, J., Grossman, M., & McKercher, T. (2014). Professional CUDA c programming. John Wiley & Sons.
References	
1	Michael Quinn, Parallel Computing: Theory and Practice, McGrawHill Publishers, July 2017.
2	Arch Robison, James Reinders, and Michael Macoul, Structured Parallel Programming: Patterns for Efficient Computation, Morgan Kaufman, Elsevier, 2012.
Useful Links	
1	-

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1				1	1								1	1	
CO2				2	2								2	1	
CO3				2	2								2	1	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember	15		5	**20**
Understand	15	5	5	**25**
Apply		15	15	**30**
Analyze		10	15	**25**
Evaluate				
Create				
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Data Mining Lab
Desired Requisites:	Database Engineering

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	The hands-on and practically implementation of the concepts/techniques studied in theory course.
2	Exposure to real life data sets for analysis and prediction.
3	Learning performance evaluation of data mining algorithms in a supervised and an unsupervised mode with different data mining tools.
4	Handling a mini data mining project for a given practical domain.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**interpret** the data mining process and **handle** important issues around data cleaning, pre-processing and integration.	Apply
CO2	**analyse** the real world problems using different data mining algorithms.	Analyze
CO3	**measure** the performance of different data mining algorithms / tools.	Evaluate
CO4	**design** and **build** the data mining system for solving any complex problem.	Create

List of Experiments / Lab Activities

List of Experiments:

1. For iris and breast cancer data set
   a) Calculate the mean, median, and standard deviation of conditional attributes.
   b) Draw histogram
   c) Draw the boxplots for pairs of attributes.
   d) Draw a scatter plot and a Quantile-Quantile (q-q) plot based on these two variables.

2. For iris and breast cancer data set, perform the
   a) Correlation analysis
   b) discretization using Binning and Histogram Analysis

3. Design and implementation of following classifiers :
   a. Regression classifier.
   b. Naïve Bayesian Classifier.
   c. k-NN classifier (Take k = 1,3,5,7)
   d. Three layer Artificial Neural Network (ANN) classifier (use back propagation)

4. Design and implementation of following clustering algorithms :
   a) Hierarchical clustering - AGNES & DIANA. Plot Dendrogram.
   b) k-Means
   c) k-Medoids (PAM)
   d) DBSCAN

5. Design and implementation of following Association Rule Mining algorithms :
   a) Basic Association Rule Mining Algorithm
   b) Apriori Algorithm

6. Design and implementation of following Web Mining algorithms :
   a) Implement the PageRank algorithm to calculate the rank of each page in the file. The output should be the 10 pages with the highest rank, together with their rank values.
   b) Implement the HITS algorithm to calculate the hub and the authority weight of each web page in the data set. The output should be the 10 most authoritative pages and 10 most hubby pages.

7. Hands on with the state of the art data analytics tools like Tableau , Weka , SPSS, Oracle Data Miner etc.

8. Mini-project : Group (2/3) of students should search any research journal / literature on data mining and select small problem statement. Design and build the data mining system for chosen problem. OR instructor may assign any problem statement for each group.

Instructions :

1. Use the standard data sets from UCI Machine Learning Repository
2. Follow the design, modelling and implementation/documentation methodology using standard CASE tools.
3. Use Python as Programming Language. For database programming / scripting use PL/SQL T-SQL, MySQL/Oracle 11g /IBM DB2 9.7 as backend database server.
4. Follow the submission guidelines.

Text Books	
1	Jiawei Han , Micheline Kamber and Jian Pei , *"Data Mining - Concepts and Techniques"* , Third Edition, Morgan Kaufmann, 2012, ISBN 978-0-12-381479-1
2	Dunham, Margaret H , *"Data Mining: Introductory and Advanced Topics"*, 1st Edition , PHI/Pearson, 2006 , ISBN 978-81-7758-785-2
References	
1	Sumathi, S., Sivanandam, S.N. , *"Introduction to Data Mining and its Applications"*, Springer , 2006 , ISBN 978-3-540-34351-6
2	P. Tan, M. Steinbach and V. Kumar, *"Introduction to Data Mining"*, 2nd Edition, Addison Wesley, 2019,
3	Related papers from various IEEE Transactions , Int. Journals / Conferences.
4	Open source tools for data analytics and machine learning.
Useful Links	
1	Data sets : https://archive.ics.uci.edu/ml/index.php
2	Tableau tool : https://www.tableau.com/developer/tools
3	SPSS tool : https://www.ibm.com/in-en/analytics/spss-statistics-software
4	Weka tool : https://www.cs.waikato.ac.nz/ml/weka/

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3												2		
CO2		3												2	
CO3					2								3		
CO4			3											3	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	5	5	7	**17**
Analyze	5	5	7	**17**
Evaluate	5	5	6	**16**
Create	15	15	20	**50**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science & Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Software Defined Network
Desired Requisites:	Computer Network and Data Communication

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To understand SDN/NFV motivation and benefits.
2	To describe how SDN/Openflow work.
3	To understand mininet and some programming languages.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	understand OpenFlow, challenges in SDN, and the recent development in SDN	Understanding
CO2	Analyse and apply implementation of SDN through Open Flow Switches, SDN-Controllers.	Analysing, Applying
CO3	Evaluate the pros and cons of applying SDN, API approaches, Hypervisor overlays, and SDN Data Centre	Evaluating

Module	**Module Contents**	**Hours**
I	**History and Evolution of Software Defined Networking (SDN)** Introduction, Traditional Vs. SDN network, Separation of Control Plane and Data Plane, IETF Forces, Active Networking. Control and Data Plane Separation: Concepts, Advantages and Disadvantages.	8
II	**OpenFlow Protocol and Network Virtualization** Introduction to OpenFlow Protocol, OpenFlow Versions, OpenFlow with multiple flow tables, Virtualization: Concepts, Applications of virtual networking, Existing Network Virtualization Framework (VMWare and others), Open Virtual Switch (OVS), OpenFlow flow entries on OVS, Monitoring tools: Mininet, OpenDaylight, etc., Mininet introduction, Network virtualization with mininet and Mininet topologies.	7
III	**Control Plane** Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall, Implementation using SDN Concepts.	6
IV	**Data Plane** Software-based and Hardware-based; Programmable Network Hardware. Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.	6
V	**Network Functions Virtualization (NFV) and Software Defined Networks** Network architecture, NFV Infrastructure, NFV Management and Orchestration (MANO), NFV and SDN	5

VI	**Data Centre Networks** Packet, Optical and Wireless Architectures, Network Topologies. Use Cases of SDNs: Data Centres, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.	7
Text Books		
1	SDN: Software Defined Networks, an Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.	
2	Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844	
References		
1	SDN and OpenFlow for Beginners by Vivek Tiwari, Sold by: Amazon Digital Services, Inc., ASIN: , 2013.	
2	Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014	
3	sdnhub.org	
Useful Links		
1	https://www.youtube.com/watch?v=dkUDUb9GtH0&list=PLpherdrLyny8YN4M24iRJBMCXkLcGbmhY&ab_channel=NickFeamster	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2			3							1			
CO2					3							2			
CO3												2			

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember	5		10	15
2	Understand	5	5	15	25
3	Apply	10	10	25	45
4	Analyze		5	10	15
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Advanced Machine Learning
Desired Requisites:	Introduction to Machine Learning

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	Introduces various mathematical concepts required for machine learning.
2	Understand GAN components, build basic GANs using PyTorch and advanced DCGANs using convolutional layers, control your GAN and build conditional GAN
3	Compare generative models, use FID method to assess GAN fidelity and diversity, learn to detect bias in GAN, and implement StyleGAN techniques
4	Use GANs for data augmentation and privacy preservation, survey GANs applications, and examine and build Pix2Pix and CycleGAN for image translation

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Explain advanced mathematical concept required for machine learning	Understand
CO2	Understand the intuition behind the fundamental components of GANs	Understand
CO3	Explore and implement multiple GAN architectures	Apply
CO4	Build conditional GANs capable of generating examples from determined categories	Create

Module	**Module Contents**	**Hours**
I	**Introduction** Mathematical Basics, Introduction to Machine Learning, Gradient Descent, Stochastic gradient descent: the workhorse of machine learning, Theory of SGD for convex objectives	8
II	**Backpropagation and hyperparameters** Backpropagation and automatic differentiation, Machine learning frameworks I: the user interface, Overfitting, Generalization error, Early stopping, Our first hyperparameters: step size/learning rate, minibatch size, Regularization, Application-specific forms of regularization, The condition number, Momentum and acceleration, Momentum for quadratic optimization, Momentum for convex optimization	6
III	**Intro to GANs** Learn about GANs and their applications, understand the intuition behind the basic components of GANs, and build your very own GAN using PyTorch.	6
IV	**Deep Convolutional GAN** Build a more sophisticated GAN using convolutional layers. Learn about useful activation functions, batch normalization, and transposed convolutions to tune your GAN architecture and apply them to build an advanced DCGAN specifically for processing images.	6

V	**Wasserstein GANs with Normalization** Reduce instances of GANs failure due to imbalances between the generator and discriminator by learning advanced techniques such as WGANs to mitigate unstable training and mode collapse with a W-Loss and an understanding of Lipschitz Continuity.	7
VI	**Conditional and Controllable GANs** Understand how to effectively control your GAN, modify the features in a generated image, and build conditional GANs capable of generating examples from determined categories.	7

Text Books	
1	Jacub langr, "GANs in Action: Deep learning with Generative Adversarial Networks" 1st Edition
2	Deep Learning, Goodfellow et al, MIT Press, 20172.
3	Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 20093.

References	
1	-

Useful Links	
1	https://nptel.ac.in/courses/106/106/106106198/
2	https://www.cs.cornell.edu/courses/cs6787/2019fa/
3	https://www.deeplearning.ai/program/generative-adversarial-networks-gans-specialization/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3														
CO2					3										
CO3			1		2										
CO4			1		2										

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10	10	10	30
3	Apply	10	5	25	40
4	Analyze				
5	Evaluate				
6	Create		5	25	30
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Intelligent Systems
Desired Requisites:	Exposure to concepts in discrete structures, probability/statistics and algorithmic analysis

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To introduce the concepts of Artificial Intelligence (AI) with emphasis on its use to solve real world problems.
2	To explain the challenges inherent in building "intelligent systems".
3	To explain core techniques and algorithms.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	discuss the basic concepts of Artificial Intelligence	Understanding
CO2	use basic knowledge representation, problem solving, and learning methods in AI	Applying
CO3	examine the applicability of algorithms in solving particular engineering problems to build intelligent systems.	Analyzing

Module	Module Contents	Hours
I	**Module 1 Introduction to Artificial Intelligence** Introduction, History, Application, Approaches, Introduction to Agents	4
II	**Module 2 Problem Solving** Problem solving by searching, Uninformed and informed search, Constraint satisfaction problems	8
III	**Module 3 Knowledge Representation and Logic** Propositional Logic, Inference rules, First Order Logic, Rule based systems, Semantic nets, Frames	8
IV	**Module 4 Planning** Introduction, Components of planning, Partial-order-planning, Graph plan, SATPLAN	6
V	**Module 5 Reasoning** Reasoning with uncertainty, Fuzzy reasoning, Bayes networks, Reasoning in semantic net	6
VI	**Module 6 Expert Systems and Machine Learning** Introduction, ES Architecture and Phases, ES Characteristics, Rule based ES, Rule Induction and Decision Trees; Natural Language Processing, Case studies: Philips – AI in clinics and hospitals, Schneider Electric – Improving agriculture and farming with AI, Google & TNO – AI for data analysis on traffic safety, Siemens – AI for industry, power grids and rail systems	7

Text Books	
1	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Prentice-Hall, 3rd edition, 2010
2	Elaine Rich and Kelvin Knight ,Nair , "Artificial Intelligence," McGraw Hill Publication, 3rd edition,1st July 2017

References	
1	Janakiraman et al., “Foundations of Artificial Intelligence and Expert Systems”, Macmilan India Ltd.
2	Townsend,“Introduction to Turbo prolog”

Useful Links	
1	https://www.youtube.com/watch?v=X_Qt0U66aH0&list=PLwdnzlV3ogoXaceHrrFVZCJKbm_laSHcH
2	https://www.youtube.com/watch?v=XCPZBD9lbVo&list=PLbMVogVj5nJQu5qwm-HmJgjmeGhsErvXD
3	Mod-01 Lec-01 Introduction - YouTube
4	Mod-01 Lec-02 Stages of NLP - YouTube

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2	2												2		
CO3		3													

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course

Bloom’s Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand	15	12	30	57
3	Apply	5	4	20	29
4	Analyze		4	10	14
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B. Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Data Management, Protection and Governance (By Veritas)
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	Get acquainted with the high-level phases of data life cycle management.
2	Acquire knowledge about the various aspects of data storage, data availability, data protection.
3	Gain exposure to various solutions/reference architectures for various use-cases
4	Understand the technical capabilities and business benefits of data protection.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Illustrate data management world and various types of data threats and approaches to ensure data center security	Understand
CO2	Apply different standards for compliance and governance of data	Apply
CO3	Analyze various types of data threats and approaches to ensure data center security	Analyze
CO4	Discriminate various concepts and technologies for enabling data storage and high availability	Evaluate
CO5	Design data intensive enterprise applications and industry standard solutions in data management	Create

Module	**Module Contents**	**Hours**
I	**Introduction to data life cycle management (DLM)** Goals of data life cycle management, Challenges involved- Volume of data source, Ubiquity of data locations, User demand for access, Stages of data life cycle – creation, storage, usage, archival, destruction, Risks involved without DLM, benefits, best practices	4
II	**Data storage and data availability** **Storage technology:** Hard Disk Device (HDD), Solid State Devices (SSD), memory devices, Data access - block, files, object, Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage, Storage virtualization technologies - RAID level, storage pooling, storage provisioning, Advance topics in storage virtualization – storage provisioning, thinprovisioning, Cloud storage – S3, glacier, storage tiering, High Availability-Introduction to high availability, clustering, failover, parallel access, Disaster Recovery -Need of disaster recovery, Building blocks - global cluster, wide-area-connector (WAC), heartbeat, Split-brain – problem and solutions o Preparing for DR – firedrill	8

III	**Introduction to data protection** Introduction-Need for data protection, basic of back-up/restore, Snapshots for data protection, copy-data management (cloning, DevOps), De-duplication, Replication, Long Term Retention – LTR, Archival, Design considerations-System recovery, Solution architecture, Backup v/s Archival, media considerations and management (tapes, disks, cloud), challenges with new edge technology (cloud, containers)	8
IV	**Data Threats and Data center security** Type of Threats-Denial of Service (DoS), man in the middle attacks, Unintentional data loss, Repudiation, Malicious attacks to steal data, Understanding, Identification and Threat modelling tools, Introduction to Ransomware, Security- Authorization and authentication - access control, Transport Layer Security (TLS), key management, security in cloud, Design and architecture considerations for security	7
V	**Data regulation, compliance and governance** Regulations requirements and Privacy Regulations-General Data Protection Regulation (GDPR), The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personal Identity Information), Information Governance- Auditing, Legal Hold, Data classification and tagging (Natural Language Processing)	5
VI	**Applications uninterrupted** Understand data management aspects of traditional and new edge applications, Reference architecture/best practices (pick 2-3 case studies from below topics)- Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra), Distributed applications (micro service architectures), Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes, Multi-Tiered applications, ETL workloads, Data analytics (AI/ML)	7

Text Books	
1	Robert Spalding, "*Storage Networks: The complete Reference*" Tata McGraw-Hill
2	Vic (J.R.) Winkler, "*Securing The Cloud: Cloud Computing Security Techniques and Tactics*" (Syngress/Elsevier) - 978-1-59749-592-9
3	TBD – online reference for each topic.
References	
1	*"Designing Data-Intensive Applications* " (O'Reilly, Martin Kleppmann)
2	TBD: provide more online material details and books (This can include some publicly available white-paper, solution guides etc.)
Useful Links	
1	https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
2	https://searchstorage.techtarget.com/definition/data-life-cycle-management
3	https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
4	https://www.bmc.com/blogs/data-lifecycle-management/
5	https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/

CO-PO Mapping															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3											2		
CO2	3												3		
CO3	3	2												3	
CO4		3												1	
CO5		3													
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks)					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10		10	20
3	Apply	5	10	15	30
4	Analyze	5	5	15	25
5	Evaluate		5	10	15
6	Create			10	10
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B. Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	OE-3 Cyber Security
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	Exhibit knowledge to secure corrupted systems, protect personal data, and secure computer networks in an Organization
2	Develop cyber security strategies and policies
3	Understand principles of web security and to guarantee a secure network by monitoring and analyzing the nature of attacks through cyber/computer forensics software/tools.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Understand the concepts of cyber security and data privacy in today's environment.	Understand
CO2	Perform fundamental incident response functions including detecting, responding, and recovering from security incidents.	Apply
CO3	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure	Analyze
CO5	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.	Evaluate
CO4	Design appropriate security technologies and policies to protect computers and digital information.	Create

Module	Module Contents	Hours
I	**Introduction to Cyber Space** Internet Architecture and the Protocol Layers- Basics of Internet, Layered architecture, OSI Reference Model, Protocol Data Unit(PDU), TCP/IP Model, IP addressing, Layers of security, Cyber Crime, Information Security, CIA Triad, Computer Ethics & Security Policies.	7
II	**Web Browsers and Email Security** Basics of Cryptography, Guidelines to choose Web Browsers, Security measures for using Web Browsers, Antivirus, Email Security, IDS, Firewall.	7
III	**Social Media and basic Windows Security** Guidelines for Social Media Security, Tips & best practices for Safer Social Media Networking, Best Security Practices for Windows Desktops & Laptops, Guidelines for generation of User Accounts & Passwords, Wi-Fi Security.	6
IV	**Smartphone Security** Introduction to Mobile Devices, Security Techniques for using Mobile Devices, Best Security Practices for Android Devices, Best Security Practices for IOS Devices.	6
V	**Online Banking, Credit Card & UPI Security, POS & ATM Security** Online Banking Security Techniques, Mobile Banking Security Techniques, Security for Debit & Credit Cards, UPI & e-Wallet Security Guidelines, Security for using Micro-ATMs & POS (Point of Sales).	7

VI	**Cyber Security Initiatives in India** Counter Cyber Security Initiatives in India, Cyber Security Incident Handling, Information Destroying and Recovery Tools- Recovering from Information Loss, Destroying Sensitive Information, CCleaner for Windows, How Cyber Criminal Works & Cyber Laws, IT ACT & how to prevent yourself from being a victim of Cyber Crime, Cybercrime: Examples and Mini-Cases.	7

Text Books	
1	Nina Godbole and Sunit Belpure, "*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives"*, Wiley
2	B. B. Gupta, D. P. Agrawal, Haoxiang Wang, *"Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives"*, CRC Press, ISBN 9780815371335, 2018
References	
1	"*Cyber Security Essentials*", James Graham, Richard Howard and Ryan Otson, CRC Press.
Useful Links	
1	https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview m2.ac.in
2	https://www.classcentral.com/course/swayam-introduction-to-cyber-security-14116
3	https://www.youtube.com/watch?v=AU3sdN-ZPCQ

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2		
CO2		3			2								3		
CO3	3	3											3	3	
CO4		2	3										3	1	
CO5				3									2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks)

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand	10	5	10	25
3	Apply	5	10	15	30
4	Analyze	5	5	15	25
5	Evaluate			10	10
6	Create			10	10
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Techno-Socio Outreach
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1Hr/week	**Credits: 1**			

Course Objectives

1	To identify real life social problems at local/global level
2	To propose possible solution using technical skills and analyse its impact for the betterment of the society and contribute for the nation building.
3	To encourage students to participate in technical and social activities

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	Identify and Analyze real world social problem.	Analyse
CO2	Demonstrate the solution individual or in group to techno-socio problem using technical skill towards society and nation building	Create

List of Experiments / Lab Activities

General guidelines:

Open to students. Student can undertake any techno-socio activity as listed below but not limited to it :

1. 50% weightage in each evaluation for technical aspects and 50% for societal importance
2. Each student or group of students may participate in any social activity like "Swach Bharat Abhiyan",
3. "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat. Each student or group of students participating in technical events / competition.
4. Awards / recognition received in techno-socio activity
5. Completing the on line courses (on topics beyond syllabus) / certification of any companies / technologies (e.g. IBM / Oracle / CISCO etc.)
6. Developing any innovative gadget / solution / system and transfer in the interest of Nation / Society / Institute (WCE)
7. Published a papers in national / international conferences / journals
8. Coordinating the students clubs / services
9. Organizing techno-socio activity for the students / community in rural areas, backward areas.

Text Books

1	Nil

References

1	The students may refer/undergo on line courses required to undertake any techno-socio activity.

Useful Links

1	Nil

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	--	--	--	--	--	3	3	2	2	--	--	--	2	--	--
CO2	--	--	--	--	--	3	3	2	3	--	--	--	3	--	--
CO3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Relative activity completion certification in SEM III & IV	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Relative activity completion certification in SEM V & VI	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Relative activity completion certification in SEM VII & VIII	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply				
Analyze	20	15	20	**55**
Evaluate				
Create	10	15	20	**45**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Computer Science and engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Project-2
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	16 Hrs/week				
Interaction	-	**Credits: 8**			

Course Objectives

1	To undergo project management techniques
2	To apply project design principles using latest tools and technologies
3	To develop analytical vision and skills to analyse, compare the outcome with other techniques
4	To write and publish deliverable technical artifacts for the project

Course Outcomes (CO) with Bloom's Taxonomy Level

CO1	work in teams and participate in group activity of software development	Apply
CO2	demonstrate different product development phases through appropriate selection of software tool for project implementation.	Evaluate
CO3	develop a software product	Create
CO4	analyse performance of developed product and Write/publish technical artifacts	Analyse

List of Experiments / Lab Activities

List of Experiments:

1. Preferably project work is to be continued from Project-I
2. Students should maintain a project log book containing weekly progress of the project
3. At the end of the semester project group should achieve all the proposed objectives of the problem statement.
4. The work should be completed in all aspects of design, implementation and testing.
5. Project report and technical artifacts should be prepared, submitted in soft and hard form along with all the code and datasets.
6. Group should demonstrate the work with various test cases and results obtained and explain future scope.
7. The group should participate in technical symposiums, paper presentations to demonstrate their work and findings in technical community.

Text Books

1	Nil
2	
3	
4	

References

1	Nil
2	
3	
4	

Useful Links	
1	
2	
3	
4	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	--	--	--	--	--	--	--	3	2	--	--	--	--	--	
CO2	--	--	--	--	3	--	--	--	2	3	--	--	--	--	
CO3	--	--	2	3	--	--	--	--	--	--	2	--	--	--	
CO4	--	--	--	--	2	--	--	--	2	--	--	--	--	--	
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High Each CO of the course must map to at least one PO.															

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	20	15	10	
Analyze			10	
Evaluate	10	10	10	
Create		05	10	
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Computer Forensic
Desired Requisites:	Cyber Security

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2	To understand how to examine digital evidence such as data acquisition, identification analysis.
3	To understand cyber related crimes and various investigative strategies
4	To understand various data storage methods, formats and computer forensic tools

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	apply the methods for data recovery, evidence collection and data seizure.	Apply
CO2	analyze a large amount of digital evidence and identify the most significant data.	Analyze
CO3	evaluate the different types of computer forensics technologies	Evaluate
CO4	apply a number of different computer forensic tools to a given scenario.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction** Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.	6
II	**Understanding Computing Investigations** Procedure for corporate High-Tech investigations, understanding data recovery workstation and software, conducting investigations.	6
III	**Methods of Storing Data** Understanding the binary number system & Conversions, Encoding and Decoding formats, Methods of storing data, Computer Memory, Development of hard disk, physical construction, CHS & LBA addressing, Understanding file system and file formats.	6
IV	**Storage Formats and Digital Evidence** Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.	7
V	**Cyber Crime and Incident Response** Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.	6

VI	**Computer Forensics Tools** Software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations-investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.	8

Text Books	
1	Warren G. Kruse II and Jay G. Heiser, "*Computer Forensics: Incident Response Essentials*", Addison Wesley
2	B Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "*Guide to Computer Forensics and Investigations"*, 2nd ed., Thomson Course Technology
References	
1	Vacca, J, "*Computer Forensics, Computer Crime Scene Investigation*", 2nd Ed, Charles River Media, ISBN: 1-58450-38
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2										2		
CO2	1	1	2										3		
CO3	3	3											2	3	
CO4	3	2			3								2	1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	10	10	20	40
4	Analyze	10	5	15	30
5	Evaluate		5	25	30
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Search Engine Design and Optimization
Desired Requisites:	Programming Laboratory – 3

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To inculcate understanding of detailed functions of search engines and different SEO techniques.
2	To illustrate working of different search engine designs and different SEO techniques.
3	To emphasize on optimizing design of search engines and use of SEO techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	describe working of search engines and SEO techniques	Understand
CO2	illustrate various SEO techniques	Apply
CO3	comprehend strengths and weaknesses of SEO techniques and use appropriate SEO technique as per real life scenario	Analyze

Module	Module Contents	Hours
I	**Search Engines and SEO Overview** SEO – What is it, History, Evolution and Importance, Types of SEO Techniques, How Search Engines Work, SERP, Google Search Engine Architecture and Algorithm, How Machine Learning in Search Works, Panda Update, Other advanced Search Engine algorithms	5
II	**Keyword Research and Analysis** What is keyword, Importance of Keyword, Keyword Phrases and Keyword Length, Keyword-Value Pyramid, where to start, Keyword Density, Finding Keywords, Keyword Selection Tips, Common Keyword Problems and Solutions, Keyword Analysis Tools	6
III	**On-page Optimization Techniques** The difference – On-page and Off-page optimization, On-page Optimization Techniques - The Page Title, Meta Descriptions & Meta Keywords, Headings, Bold Text, Domain Names & Suggestions, Canonical Tag, Meta Tags, Images and Alt Text, Internal Link Building, The Sitemap, Invisible Text, Server and Hosting Check, Robots Meta Tag, Doorway Pages, 301 Redirects, 404 Error, Duplicate content	9

IV	**Off-page Optimization Techniques** Local marketing of websites on the basis of locations, Social Media optimization techniques, Introduction of link building and its types, Directory submission, Blog and article submission, Forum posting, Forum signatures and commenting, Free classifieds, Classifieds posting, Press release submission, Video submission, Business listing submission, Guest blog, Detail knowledge on Link building and backlinks, Social bookmarking, Photo & Video Sharing, Infographics sharing, Document Sharing, Content Marketing and its importance, Question and answers, Web 2.0 submission, Importance of backlinks / Link building, Home page promoting tips and techniques, Strategies to build qualitative and relevant backlinks, Competitors backlink research and submission. Tracking the links, Submission to do follow websites, RSS Feed submissions.	7
V	**User Interface, Local and Social Media SEO** UX/UI, SEO and UX/UI, Best Practices. Local SEO and its importance, Local Searches, NAP, Directories, Top Local Search Signals, Reviews and Feedback. Introduction to Social Media SEO and their importance, Social Media Impact on SEO, Social Media and Local SEO.	6
VI	**SEO Tools, Reporting and Tracking** Keyword Research Tools, On-page SEO Tools, Link Building Tools, Technical SEO Tools, Rank Tracking Tools, Analytics Tools, and Local SEO Tools.	6

Text Books	
1	Jessie Stricchiola, Stephan Spencer, Eric Enge, “The Art of SEO - Mastering Search Engine Optimization”.
2	Moz, “Beginner's Guide to SEO”.

References	
1	Adam Clarke, “SEO 2021: Learn search engine optimization with smart internet marketing”

Useful Links	
1	https://analytics.google.com/analytics/academy/course/6

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	
CO1		1											1		
CO2	2	2	3										2		
CO3		3	2		3								2	1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks)					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	7	6	20	33
3	Apply	7	7	20	34
4	Analyze	6	7	20	33
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	
Course Name	Human Computer Interaction
Desired Requisites:	Nil

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To illustrate the concepts of Human Computer Interaction (HCI) with emphasis on its use with few case study example.
2	To explain the challenges inherent in developing "HCI systems"
3	To explain core techniques in HCI design

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Illustrate concepts of HCI and UI.	Apply
CO2	Analyse and design problem solving methods in HCI.	Analyze
CO3	Appraise applicability of HCI designs in solving engineering problems.	Evaluate
CO4	Build and demonstrate typical HCI and UI system.	Create

Module	Module Contents	Hours
I	**Introduction** Course objective and overview, Historical evolution of the field, The Human, The Computer, The Interaction.	7
II	**Design processes** Interaction Design basics, Concept of usability – definition and elaboration, HCI in the Software Process, Design Rules.	7
III	**Implementation and Evaluation** Implementation Support, Evaluation Techniques, Universal Design, Use Support.	6
IV	**Models** Cognitive Models, Socio – Organizational Issues and Stakeholders Requirements, Communication and Collaboration models.	6
V	**Theories** Task Analysis Dialog notations and Design Models of the system, Modeling Rich Interactions.	7
VI	**Case Study of Modern Systems** Group ware, Virtual Reality, Augmented Reality, Hypertext, Multimedia and World Wide web.	7

Text Books

1	Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition Pearson Education
2	B. Shneiderman, Designing the User Interface, Addison Wesley 2000 (Indian Reprint)
References	
1	Preece J, Rogers Y, Sharp H, Baniyon D, Holland S and Carey T, “Human Computer Interaction”, Addison-Wesley, 1994
2	
Useful Links	
1	https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_introduction
2	https://www.interaction-design.org/literature/topics/human-computer-interaction
3	https://nptel.ac.in/courses/106/103/106103115/
4	

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		2										2		
CO2	2	3	2										2		
CO3	2	2	3										2		
CO4	2		3										2		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course

Bloom’s Taxonomy Level		T1	T2	ESE	Total
1	Remember		5	5	10
2	Understand	5	5	10	20
3	Apply	5		10	15
4	Analyze	10	5	15	30
5	Evaluate		5	10	15
6	Create			10	10
Total		**20**	**20**	**60**	**100**