Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS401
Course Name	Cryptography and Network Security
Desired Requisites:	Computer Networks

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand the transport layer and network layer security.	II	Understanding
CO2	apply the number theory concepts to different encryption and decryption techniques to solve problems related to confidentiality and authentication.	III	Applying
CO3	analyze the effectiveness of authentication and integrity processes of data across various applications	IV	Analyzing
CO4	evaluate Email, Web and System Security.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**INTRODUCTION** 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 MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures – Modular arithmetic-Euclid"s algorithm- Congruence and matrices	7
II	**SYMMETRIC KEY CRYPTOGRAPHY** 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, Random bit generation and 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.	7
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– Entity Authentication: Passwords, challenge-response algorithms, zero-knowledge Protocols, Authentication applications – Kerberos, X.509.	6
V	**Transport Layer Security and IP Security** Transport Layer Security, Secure Socket Layer(SSL), TLS, IP Security Overview, IP Security Architecture, Encapsulating security Payload.	7
VI	**Email, Web and System Security** Email Security: Pretty Good Privacy(PGP),S/MIME, Web Security, Secure Electronic Transaction, Intruders, Intrusion Detection, Firewalls, Honey Pots, Software Vulnerabilities, Malicious software	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
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS402
Course Name	High Performance Computing
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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 architectures.
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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	describe different parallel paradigms, inter connection networks, and tools for parallel programming.	II	Understanding
CO2	illustrate the design methodology and relevant parallel programming techniques to be used for parallelization of a given problem.	III	Applying
CO3	analyze a given problem for possibilities of parallel computations.	IV	Analyzing
CO4	evaluate different parallel algorithms using performance metrics.	IV	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction** What is parallel computing? The scope of parallel computing? Issues in parallel computing. Taxonomy of parallel architecture, Memory bound vs Compute bound problems, Dynamic interconnection networks, static interconnection networks, Routing mechanism for static network. Communication cost in static interconnection network.	8
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	**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, Thread programming C++11 Threads /OpenMP, MPI - two-sided communication, one side communication-based programming model aka PGAS (Partitioned Global	6

	Address Space) eg: OpenSHMEM/NVSHMEM	
IV	**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, parallel work efficiency, amdahl limiters, communication-computation overlap/pipelining.	8
V	**Parallel programming using accelerators** Introduction of CUDA/OpenCL, Chapel, etc. Basics of GPGPU, CUDA Programming model, CUDA memory type, CUDA and/or OpenCL for GPGPU hardware, case study.	6
VI	**Algorithms** Dense matrix algorithms, sorting, graph algorithms, prefix sum with decoupled lookback, parallel radix sort/batcher's sort	6

Textbooks	
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 "Introduction to PARALLEL PROGRAMMING", by Peter Pacheco.
References	
1	"Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill, 2004.
Useful Links	
1	Single-pass Parallel Prefix Scan with Decoupled Look-back https://research.nvidia.com/publication/single-pass-parallel-prefix-scan-decoupled-look-back
2	parallel radix sort/batcher's sort. https://developer.download.nvidia.com/video/gputechconf/gtc/2020/presentations/s21572-a- faster-radix-sort-implementation.pdf
3	High Performance Computing, Charles Severance, 1998. http://cnx.org/content/col11136/latest/
4	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

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

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

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS403
Course Name	Data Management, Protection and Governance
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	illustrate data management world and various types of data threats and approaches to ensure data center security.	II	Understanding
CO2	apply different standards for compliance and governance of data.	III	Applying
CO3	analyze various types of data threats and approaches to ensure data centre security.	IV	Analyzing
CO4	discriminate various concepts and technologies for enabling data storage and high availability	V	Evaluating
CO5	design data intensive enterprise applications and industry standard solutions in data management.	VI	Creating

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, thin provisioning, 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 , Preparing for DR – firedrill.	8

III	**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
IV	**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
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

Textbooks	
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://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
3	https://www.bmc.com/blogs/data-lifecycle-management/
4	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
CO1		3											2	
CO2	3												2	
CO3	3	2						2						2
CO4		3												1
CO5		3	3						2	2				

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

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS451
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	2Hrs/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

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	develop code for classical Encryption Techniques to solve the real life problems	III	Apply
CO2	analyze the network security system using open source tools	IV	Analyze
CO3	evaluate the securities of different security protocols	V	Evaluate
CO4	design and implement symmetric and asymmetric key encryption algorithms	VI	Create

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. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w
13. Exploring a Vulnerability Assessment Tool

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.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. 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 and related activities if any.				

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Course Information

Programme	B.Tech. (Computer Science and engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS452
Course Name	High Performance Computing Lab
Desired Requisites:	Data structures, Basic Programming knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	illustrate use of different parallel programming techniques	III	Applying
CO2	measure performance of parallel program using different metrics	III	Applying
CO3	apply and analyze different parallel strategies to a parallel program to improve its performance	VI	Analyzing
CO4	analyze the performance of a parallel program on different underling architectures	VI	Analyzing

List of Experiments / Lab Activities/Topics
List of Lab Activities: 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.

Textbooks	
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	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				1	1								1	1
CO2				2	2								2	1
CO3				2	2								2	1
CO4				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, and preferably to only one PO.

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. 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 and related activities if any.				

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS491
Course Name	Project-I
Desired Requisites:	Nil

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

Course Objectives

1	To understand Software Development Life Cycle and prepare project proposal based on real life use case
2	To utilize state of the art CASE tools especially for design, development and testing phases.
3	To experience project management techniques.
4	To acquaint the ability to map technical skills to real life applications from customers perspective.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand existing solutions and define scope of the project accordingly.	II	Understanding
CO2	apply project design and development methodology and appropriate team skills for project implementation.	III	Applying
CO3	identify use of modern engineering tools, software, and techniques utilized during project implementation.	IV	Analyzing
CO4	verify developed solution for different test cases and measure the performance of the system for various parameters.	V	Evaluating
CO5	build the project working model with real life use cases mainly to potential stakeholders.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

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.

Textbooks

1	NIL

References

1	NIL

Useful Links

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2	3		3	2		1		2	2	2			2	2
CO3					3								2	
CO4	2	2			2								2	
CO5			2			1		2	2	2			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, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. 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 and related activities if any.				

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., SemVII
Course Code	6CS453
Course Name	Techno-Socio Activity
Desired Requisites:	This is the audit course. No pre-requisite.

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

Course Objectives

1	To nurture technical knowledge mainly through various participations and competitions during their engineering study
2	To develop empathy by participating in social empowerment acts.
3	To propose a structured and rational solution to address the relevant skills.
4	To motivate students towards the desirous need of industry, economy and society.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	engage the programme for welfare of society and environment	III	Applying
CO2	appraise pragmatic skills for national and international competitions	IV	Analysing
CO3	develop professional and soft skills to participations.	IV	Analysing
CO4	analyse real world problem, create and showcase the best solution of techno-socio domains.	VI	Creating

List of Experiments / Lab Activities/Topic

List of Lab Activities:

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

1. Each student or group of students may participate in any social activity like "Swach Bharat Abhiyan",
2. "Blood Donation Camp", or any social activity announced by Govt. / Corporation / Panchayat.

Each student or group of students participating in technical events / competition.

3. Awards / recognition received in techno-socio activity
4. Completing the on line courses (on topics beyond syllabus) / certification of any companies / technologies (e.g. IBM / Oracle / CISCO etc.)
5. Developing any innovative gadget / solution / system and transfer in the interest of Nation / Society / Institute (WCE)
6. Published a papers in national / international conferences / journals
7. Coordinating the students clubs / services
8. Organizing techno-socio activity for the students / community in rural areas, backward areas.

Textbooks

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
CO1			1		3								2	
CO2									2		3			
CO3											1			
CO4											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, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	15
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	15
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	20
Week 1 indicates starting week of a semester. 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 and related activities if any.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS404
Course Name	Research Methodology
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Interaction	-	30	20	50	100
		Credits: 2			

Course Objectives

1	To develop a research orientation among the students and to acquaint them with fundamentals of research methods.
2	To develop understanding of the basic framework of research process and techniques
3	To identify various sources of information for literature review and data collection.
4	To develop an understanding of the ethical dimensions of conducting applied research.
5	To develop understanding about patent process.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understanding the limitations of specific research methods	II	Understanding
CO2	demonstrating the ability to choose appropriate research methods.	III	Applying
CO3	identify skills in qualitative and quantitative data analysis and presentation.	IV	Analyzing
CO4	classify critical thinking skills and improved writing skills.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Research Fundamentals** What is research, types of research, the process of research, Literature survey and review, Formulation of a research problem.	4
II	**Research Methods** Research design- Meaning, Need and Types, Research Design Process, Measurement and scaling techniques, Data Collection – concept, types and methods, Processing and analysis of data, Design of Experiment	5
III	**Analysis Techniques** Quantitative Techniques, sampling fundamentals, Testing of hypothesis using various tests like Multivariate analysis, Use of standard statistical software, Data processing, Preliminary data analysis and interpretation, Uni-variate and bi-variate analysis of data, testing of hypotheses.	5
IV	**Research Communication** Writing a conference paper, Journal Paper, Technical report, dissertation/thesis writing. Presentation techniques, software used for report writing such as WORD, Latex etc. Types of journal/conference papers	4

V	**Intellectual Property Rights** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	5
VI	**Patents and Patenting Procedures** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs	4

Textbooks	
1	C. R. Kothari, Research Methodology, New Age international
2	Deepak Chopra and Neena Sondhi, Research Methodology : Concepts and cases, Vikas Publishing House, New Delhi
References	
1	E. Philip and Derek Pugh, How to get a Ph. D. – a handbook for students and their supervisors, open university press
2	Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science & Engineering Students
Useful Links	
1	NPTEL Lectures

CO-PO Mapping

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

The strength of mapping is to be written as 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.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	15
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	15
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	20

Week 1 indicates starting week of a semester. 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 and related activities if any.

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2024-25						
Course Information						
Programme		B.Tech. (Computer Science and Engineering)				
Class, Semester		Final Year B. Tech., Sem VII				
Course Code		6CS411				
Course Name		PE4: Human Computer Interaction (HCI)				
Desired Requisites:		No				
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial		30	20	50	100	
		Credits: 03				

Course Objectives	
1	Introduction to concept related to Human Computer Interaction.
2	Understand the theoretical dimensions of human factors involved in the acceptance of computer interfaces.
3	Identify the impact of usable interfaces / interaction styles in the acceptance and performance utilization of information systems.
4	Resolve the various design issues using the state of the art technologies.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	understand the fundamentals of Human-Computer Interaction and Interaction design.	II	Understanding
CO2	apply human Capabilities and Core Cognitive aspects of interaction design.	III	Applying
CO3	analyse quantitative analysis, evaluation, and redesign through HCI concepts.	IV	Analysing
CO4	evaluate sample interfaces using different models of HCI.	V	Evaluating

Module	Module Contents	Hours
I	**Introduction :** The human , The computer ,The interaction , Paradigms , Usability of Interactive Systems , Guidelines, Principles, and Theories.	6
II	**Design Process :** Interaction design basics, HCI in the software process, Design rules, Implementation support , Evaluation techniques , Universal design , User support	7
III	**Models and Theories :** Cognitive models , Socio-organizational issues and stakeholder requirements , Communication and collaboration models , Task analysis , Dialog notations and design , Models of the system , Modelling rich interaction	6
IV	**Interaction Styles :** Direct Manipulation and Immersive Environments , Fluid Navigation , Expressive Human and Command Languages , Devices , Communication and Collaboration.	7
V	**Design Issues :** Advancing the User Experience ,The Timely User Experience , Documentation and User Support/Online help , Information Search , Data Visualization	7

VI	**Outside the Box:** Groupware, Ubiquitous computing and augmented realities, Hypertext, multimedia and the world wide web. Case Studies.	6

Textbooks	
1	"Human Computer Interaction" by Alan Dix, Janet Finlay, Third Edition, Pearson Education
2	"Designing the User Interface - Strategies for Effective Human Computer Interaction", by Ben Shneiderman Sixth Edition, Pearson Education.
References	
1	Usability Engineering: Scenario-Based Development of Human-Computer Interaction, by Rosson, M. and Carroll, J. (2002)
2	The Essentials of Interaction Design, by Cooper, et al., Wiley Publishing (2007)
3	Usability Engineering, by Nielsen, J. Morgan Kaufmann, San Francisco, 1993. ISBN 0-12-518406-9
4	The Resonant Interface: HCI Foundations for Interaction Design, by Heim, S., Addison-Wesley. (2007)
5	Usability engineering: scenario-based development of human-computer interaction, By Rosson, M.B & Carroll, J.M. , Morgan Kaufman.(2002)
Useful Links	
1	https://www.hcii.cmu.edu/research-areas/artificial-intelligence-ai
2	https://www.linkedin.com/advice/1/how-does-ai-impact-human-computer-interaction
3	https://www.interaction-design.org/literature/topics/human-computer-interaction

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6CS412
Course Name	Elective IV : Data Mining
Desired Requisites:	Database Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**apply** the data pre-processing and data mining algorithms to **solve** real world problems	II	Understanding
CO2	**analyze** a complex data mining problem and different data mining algorithms to **identify** solutions.	III	Applying
CO3	**measure** the performance of different data mining algorithms/tools, **evaluate** and **recommend** the optimal solution.	IV	Analyzing
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.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction** Data mining and its need, Different kinds of data that can be mined, Various patterns that can be mined, Technologies to be Used, Target applications, 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

Textbooks	
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.

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
CO1	2												2	
CO2		3												2
CO3				3									2	
CO4			3											2

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

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem
Course Code	6CS413
Course Name	Elective IV: Software Defined Network
Desired Requisites:	Computer Network and Data Communication

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		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,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand SDN and NFV, OpenFlow, challenges in SDN, and the recent development in SDN	II	Understanding
CO2	apply implementation of SDN through SDN Devices	III	Applying
CO3	analyse implementation of SDN through Open Flow Switches, SDN-Controllers and mininet.	IV	Analysing
CO4	evaluate the pros and cons of applying SDN, API approaches, Hypervisor overlays, and SDN Data Centre	V	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 SD	5

VI	**SDN Applications and Use Cases Data Centre Networks** SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System 3. **SDN'S FUTURE AND PERSPECTIVES:** SDN Open Source - SDN Futures	7

Textbooks	
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
3	

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	SDxCentral (https://www.sdxcentral.com/)
2	https://www.youtube.com/watch?v=dkUDUb9GtH0&list=PLpherdrLyny8YN4M24iRJBMCXkLcGbmhY&ab_channel=NickFeamster
3	

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	6OE471
Course Name	Open Elective III: Cyber Security
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Understand foundational concepts of cybersecurity.
2	Identify common cybersecurity threats and vulnerabilities.
3	Analyze strategies for mitigating cybersecurity risks.
4	Apply basic cybersecurity principles to real-world scenarios.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Define key terms and concepts in cybersecurity.	I	Remembering
CO2	Recognize common cyber threats and vulnerabilities.	II	Understanding
CO3	Evaluate cybersecurity strategies for risk mitigation.	III	Analyzing
CO4	Demonstrate the application of cybersecurity principles.	IV	Applying

Module	**Module Contents**	**Hours**
I	Introduction to Cybersecurity: Overview of Cybersecurity, Definition and Scope, Evolution of Cybersecurity, Foundational Concepts, Principles of Information Security, CIA Triad: Confidentiality, Integrity, Availability, Cybersecurity Threat Landscape, Types of Cyber Threats, Common Attack Vectors, Legal and Ethical Considerations, Cybersecurity Laws and Regulations, Ethical Issues in Cybersecurity	4
II	Cyber Threats and Attack Vectors: Malware and Viruses, Types of Malware, Detection and Prevention Techniques, Social Engineering Attacks, Phishing, Pretexting, Baiting, Mitigation Strategies, Network Attacks, DDoS Attacks, Man-in-the-Middle Attacks, Network Defense Mechanisms, Web Security Threats, Common Web Vulnerabilities, Best Practices for Web Security, IoT and Mobile Security, Challenges in IoT and Mobile Devices, Strategies for Securing IoT and Mobile Ecosystems,	6
III	Security Measures and Controls: Access Control Mechanisms, Authentication, Authorization, Accounting, Access Control Models, Firewalls and Intrusion Detection Systems, Types of Firewalls, IDS/IPS, Secure Software Development Practices, Secure Coding Principles, Tools for Secure Software Development, Endpoint Security, Endpoint Security Challenges, Endpoint Protection Solutions	8
IV	Cryptography and Data Protection: Fundamentals of Cryptography, Encryption Algorithms, Cryptographic Protocols, Cryptographic Applications, Public Key Infrastructure (PKI), Digital Signatures, Data Protection Mechanisms, Data Encryption, Data Masking and Tokenization	6

V	Network Security: Network Security Fundamentals, Network Vulnerabilities, Secure Communication Protocols, Wireless Security, Wi-Fi Security Mechanisms, Bluetooth Security, Virtual Private Networks (VPNs), VPN Types and Protocols, VPN Implementation and Management	6
VI	Security Policies and Compliance Security Policies Overview, Purpose and Scope of Security Policies, Components of Security Policies, Regulatory Compliance, Compliance Standards (e.g., GDPR, HIPAA), Compliance Implementation Strategies, Ethical Considerations, Responsible Disclosure, Privacy and Ethical Hacking	4

Textbooks	
1	"Cybersecurity Essentials" by William Stallings and Lawrie Brown.
2	"Principles of Computer Security" by Conklin, White, Williams, Davis, and Cothren.

References	
1	"Network Security Essentials" by William Stallings.
2	"Cryptography and Network Security" by William Stallings.

Useful Links	
1	National Institute of Standards and Technology (NIST) Cybersecurity Framework : https://www.nist.gov/cyberframework
2	OWASP (Open Web Application Security Project) Website : https://owasp.org/

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Open Elective III: **Information Retrieval**
Desired Requisites:	Basics of data, Information and presentations.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial		30	20	50	100
		Credits: 3			

Course Objectives	
1	To understand the basics of information retrieval.
2	To evaluate the performance of the IR system and understand user interfaces for searching.
3	To understand information sharing on the web.
4	To understand the various applications of information retrieval emphasizing recommendation systems, web Search.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand the fundamental concepts of Information retrieval.	II	Understanding
CO2	use of Tokenization, Tolerant Retrieval and concepts of Ranking algorithms in IR.	III	Applying
CO3	investigate the web information using appropriate techniques and trends in IR.	IV	Analysing
CO4	estimate the performance of information retrieval systems.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction to Information Retrieval** Exploring information retrieval systems, Short history, role of Information retrieval in Library, Important terms in IR, Types of IR models, Exact match and partial match retrieval, types of searches in IR, Challenges and opportunities in IR, IR terminologies, Indexing in IR, types of queries, example of Indexing, Inverted Index, Bitwise operations.	7
II	**Tokenization and Tolerant Retrieval** Basics of text processing, tokenizing, stemming, lemmatization, stop word removal, vector space model, concept of wild card queries in IR, introduction to NLTK	6
III	**Ranking Algorithms** Concept of ranking, Link Analysis, HITS algorithm, Google Panda Algorithm, BM25, Collaborative filtering, Knowledge graph, search engine results space (SERP), types of SERP, categories of web queries, surface web and deep web, Hidden web, dark web.	7

IV	**Evaluation and Visualization of Information Retrieval System** **Performance evaluation**: Precision and recall, MRR, F-Score, NDCG, user-oriented measures. **Visualization in Information System:** Starting points, Query Specification, document context, User relevance judgment, Interface support for search process.	6
V	**Web Searching:** Introduction to Web Search Engines, Exploring types of search engines, Crawler-based search engines, web mining, web search optimization, Comparison between web search engine and desktop search engines, SPAM **Introduction to Web Scraping**: Python for web Scraping, Request, HTML parsing, Beautiful Soup.	6
VI	**Trends in Information Retrieval** **XML Retrieval:** Basic XML concepts, Why to use XML, content and structure XML query language, Tag-based languages, XML parsing in python, Goals and challenges in XML retrieval, Text-Centric vs. Data-Centric XML retrieval. **Recommendation system (case study):** Collaborative Filtering and Content Based Recommendation of Documents and Products. Introduction to Semantic Web.	7

Textbooks	
1	Dr. Madhavi Vaidya, Yashovardhan Sowale, "Information Retrival"Wiley India Pvt. Ltd.
2	Ricardo Baeza-Yates, Berthier Riberio–Neto, Modern Information Retrieval, Pearson Education, ISBN: 81-297-0274-6.
3	Ryan Mitchell, Web Scraping with Python, O'reilly, second Edition, ISBN: 9781491985571.
3	Yates & Neto, "Modern Information Retrieval", Pearson Education, ISBN:81-297-0274-6
4	C.J. Rijsbergen, "Information Retrieval", (www.dcs.gla.ac.uk).,2ndISBN:978- 408709293.

References	
1	V. S. Subrahamanian, Satish K. Tripathi, Multimedia information System, Kulwer Academic Publisher. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, 2008.
2	Grigoris Antoniou and Frank van Harmelen, "A semantic Web Primer", Massachusetts.
3	Christopher D. Manning, Prabhakar Raghavan and Hinrich Schutzen, "Introduction to Information Retrieval", Cambridge University Press, Online book, ISBN:978-0-521- 86571-
4	Ricci F, Rokach L, Shapira B, Kantor P, Recommender Systems Handbook, Springer, ISBN:978-0-387-85819-7.
5	Norbert Fuhr, MouniaLalmas, Saadia Malik, Gabriella Kazai, Advances in XML Information Retrieval andEvaluation, Springer New York Publisher.

Useful Links	
1	https://web.stanford.edu/class/cs276/handouts/EvaluationNew-handout-1-per.pdf
2	https://www.coursera.org/learn/text-retrieval.

CO-PO Mapping

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

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

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	B.Tech. (All Branches)
Class, Semester	Fourth Year B. Tech., Sem VII
Course Code	6HS401
Course Name	Management Accounting/ Accounting and Finance for Engineers
Desired Requisites:	Mathematics course at Higher Secondary Junior College

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	Hrs/week	30	20	50	100
		Credits: 02			

Course Objectives

1	Introduce the basic concepts required to understand, classify, summarize, and interpret financial accounting
2	Acquire the knowledge of cost accounting tools used in a manufacturing organization.
3	Understand and analyse the tools and techniques of management accounting
4	Evaluate projects based on commercial viability

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Understand the concept of management accounting	Understanding
CO2	Solve the problems of financial statement and cost sheet	Applying
CO3	Apply the decision-making function using selected management accounting tools.	Applying
CO4	Evaluate the projects using BEP and CVP analysis	Evaluating

Module	**Module Contents**	**Hours**
I	**Financial Accounting:** Meaning, Concepts and conventions, accounting cycle	**5**
II	**Financial Accounting:** Preparation of financial statements- Trading, Profit and Loss Account, and Balance- Sheet (Trading firm - sole Proprietor)	**5**
III	**Cost Accounting:** Meaning and Significance of cost accounting, Elements of Cost- Material, Labour and Overheads,	**4**
IV	**Cost Accounting:** Classification of Cost, Preparation of Cost-Sheet	**4**
V	**Management Accounting** Significance of Management Accounting in decision-making. Tools and techniques of management accounting	**4**
VI	**Management Accounting** BEP and CVP analysis- Contribution, PV ratio, BEP, Margin of Safety, Angle of Incidence, decision-making based on CVP analysis	**4**

References

1	Dr. Jawahar Lal , "Accounting for Management", Himalaya Publishing House, 5th Edition, 2017.
2	I M Pandey "*Management Accounting",* Vikas Publishing House Pvt. Ltd., 3rd Edition 2018.
3	Gupta K Shashi , R.K. Gupta, Management Accounting -Principles and Practices*", Kalyani Publishers*., 14th Edition, 2017.
4	Peter Atrill and Eddie McLaney, "Management Accounting for decision makers", Pearson Education, 6th edition, 2009

Useful Links	
1	https://nptel.ac.in/courses/111105121
2	https://unacademy.com/content/cbse-class-11/study-material/accountancy/management-accounting/
3	https://www.shiksha.com/online-courses/articles/management-accounting-definition/
4	

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

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS431
Course Name	Elective V: Computer Forensics
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To understand the principles and methodologies of cyber forensics.
2	To develop practical skills in collecting, preserving, and analyzing digital evidence.
3	To apply forensic tools and techniques to investigate cybercrimes.
4	To comprehend the legal and ethical considerations in cyber forensics investigations.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the principles and methodologies of cyber forensics.	II	Understanding
CO2	Develop practical skills in collecting, preserving, and analyzing digital evidence.	III	Applying
CO3	Apply forensic tools and techniques to investigate cybercrimes.	IV	Applying
CO4	Comprehend the legal and ethical considerations in cyber forensics investigations.	V	Evaluating

Module	**Module Contents**	**Hours**

I	Introduction to Cyber Forensics :
	• Overview of Cyber Forensics
	  • Definition and scope of cyber forensics
	  • Importance in digital investigations
	• Cybercrime Landscape
	  • Types of cybercrimes
	  • Common attack vectors and threats
	• Fundamentals of Digital Forensics
	  • Key concepts and principles
	  • Goals and objectives of cyber forensics
		6

II	Digital Evidence Collection and Preservation:
	• Understanding Digital Evidence
	  • Types of digital evidence
	  • Characteristics and properties of digital evidence
	• Evidence Collection Procedures
	  • Legal considerations and best practices
	  • Chain of custody and documentation
	• Evidence Preservation Techniques
	  • Data imaging and duplication
	  • Hashing and integrity verification
		8

III	Forensic Tools and Techniques:
	• Introduction to Forensic Tools
	  • Types of forensic software and hardware
	  • Popular forensic toolkits and their capabilities
	• File System Analysis
	  • Recovering deleted files and partitions
	  • File carving techniques
	• Network Forensics
	  • Investigating network traffic
	  • Analyzing logs and packets
		10

IV	Network and Memory Forensics :
	• Network Forensics
	  • Protocols and network analysis tools
	  • Detecting and analyzing network-based attacks
	• Memory Forensics
	  • Understanding volatile data
	  • Memory acquisition and analysis techniques
		8

V	Mobile Device and Multimedia Forensics :
	• Mobile Device Forensics
	  • Forensic challenges with smartphones and tablets
	  • Acquisition and analysis of mobile data
	• Multimedia Forensics
	  • Analyzing digital images, audio, and video
	  • Authenticity and tampering detection techniques
		8

VI	Legal and Ethical Considerations in Cyber Forensics :
	• Laws and Regulations
	  • Overview of relevant cybercrime laws
	  • Jurisdictional issues and international cooperation
	• Ethical Guidelines
	  • Professional codes of conduct
	  • Ethics in handling digital evidence
		6

Textbooks	
1	"Computer Forensics: Investigating Network Intrusions and Cybercrime" by EC-Council Press.
2	"Digital Forensics for Dummies" by Linda Volonino and Reynaldo Anzaldua.
3	"File System Forensic Analysis" by Brian Carrier.
4	"Investigating the Cyber Breach: The Digital Forensics Guide for the Network Engineer" by Joseph Muniz and Aamir Lakhani.

References	
1	"Handbook of Digital Forensics and Investigation" by Eoghan Casey.

2	"The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics" by John Sammons.
Useful Links	
1	Digital Forensics Framework (DFF): https://en.wikipedia.org/wiki/Digital_Forensics_Framework
2	National Institute of Standards and Technology (NIST) Digital Forensics Website : https://www.digitalforensics.com/?utm_source=google&utm_medium=cpc&utm_campaign=DF-BRS-America&utm_content=602729920252&utm_term=digital%20forensics%20firm&utm_position=&utm_device=c&utm_placement=&utm_target=&utm_matchtype=p&gad_source=1&gclid=CjwKCAjwoPOwBhAeEiwAJuXRh_r2b3fheICpS0PqG9kG8WoBNMNWgcJdvnKiHHed1PwUxaeYyAMYcRoCFo8QAvD_BwE

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS432
Course Name	Elective V: Computer Vision
Desired Requisites:	Digital Image Processing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To impart knowledge of advanced techniques in computer vision.
2	To acquaint students with the concepts of image processing and computer vision
3	To allow students to compare various algorithms and select the one most appropriate for a particular application.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand basic concepts, terminology, theories, models and methods in the field of computer vision,	II	Understand
CO2	Apply computer vision techniques and algorithms to solve various problems	II I	Apply
CO3	Analyze different techniques in computer vision for segmentation, image analysis, feature extraction and representation, object tracking and motion detection.	IV	Analyze
CO4	Evaluate the performance of computer vision algorithms using suitable metrics and techniques	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Color Image Processing** Color Fundamentals, Color models, Gray level to color transformations, Basics of Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation	6
II	**Texture Analysis** Definition, Types of texture, Texels, Texture analysis – concept and categories, Approaches to texture analysis, Statistics, Texture descriptors - statistical - Auto-correlation, co-occurrence matrices and features, edge density and direction, local binary partition, Law's texture energy measures, Wavelets and texture analysis.	7
III	**Representation & Description** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal components for description, Relational Descriptors	6

IV	**Object Recognition & Restoration** **Object Recognition:** Object Detection Vs recognition, Patterns and Pattern Classes, Knowledge Representation, Statistical Pattern Recognition, Neural Nets, Syntactic Pattern Recognition,Optimization Techniques in Recognition. **Restoration:** Image Restoration Model, Noise Models,Restoration using spatial filtering, Reduction using frequency domain filtering.	8
V	**Moving Object Detection and Tracking** Introduction, Background Modeling, Connected Component Labeling, Shadow Detection, Single Object Tracking, Discrete Kalman Filtering, Particle-filter based tracking, Mean-shift tracking, Segmentation tracking via graph cuts	6
VI	**3D Vision** Introduction to 3D imaging ,applications. Case study based on the current trends in 3D imaging	6

Textbooks	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI

References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGrawHill
3	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd ed.

Useful Links	
1	NPTEL course: Link
2	NPTEL course: Link

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment canbe field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS433
Course Name	Elective V: Search Engine Design and Optimization
Desired Requisites:	Programming Laboratory – 3, Data Mining

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	describe working of search engines and SEO techniques	II	Understand
CO2	illustrate various SEO techniques and use SEO tools	III	Apply
CO3	analyze strengths and weaknesses of SEO techniques and use appropriate SEO technique as per real life scenario and analyze the performance of a website on a search engine using tools and analytical data	IV	Analyze
CO4	compare and contrast different SEO techniques	IV	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, AI tools for SEO** Keyword Research Tools, On-page SEO Tools, Link Building Tools,Technical SEO Tools, Rank Tracking Tools, Analytics Tools, and Local SEO Tools, AI Tools for SEO	6

Textbooks	
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
CO4		3	2		3								2	

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

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS434
Course Name	Elective VI: Systems Testing and Quality Assurance Techniques
Desired Requisites:	Software Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	03 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 03			

Course Objectives

1	Understand scalable processes for software life cycle for producing efficient high-quality enterprise software.
2	Acquaint a structured methodology for software lifecycle management encompassing development to maintenance support through eventual retirement phases.
3	Gain proficiency in leveraging existing resources for software development ensuring sustained software quality.
4	Familiarize with methods and tools for quality assurance and maintenance of software applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	articulate a robust set of scalable methods and procedures for software development, resulting in the efficient production of high-quality software for large systems.	II	Understand
CO2	demonstrate a structured software lifecycle management methodology into organizational practices, effectively guiding software projects through all stages from development to retirement.	III	Apply
CO3	practice effectively utilizing available resources for software development, resulting in a reduction of costs while maintaining consistent high-quality standards.	III	Apply
CO4	examine a comprehensive understanding of various methods and tools utilized for testing and maintaining software applications.	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction** **Software Testing:** Introduction, Meaning, what is Bug? Reasons for Bugs, Cost of Bugs, Software Tester Task. **Introduction to Software Development Models**: Software Testing: Testing axioms, Terms & Definitions **Testing Fundamentals**: Types, Black Box, White Box, Static & Dynamic Testing. Static Black Box Testing.	06
II	**Dynamic Black Box Testing:** Test to Pass & Test to Fail, Equivalence Partitioning, Data Testing, State Testing, Other Black Box Testing Techniques. **Static White Box Testing:** Formal Reviews, Peer Reviews, Coding Standards and Guidelines. Review Checklist **Dynamic White Box Testing:** Comparison with Debugging, Testing Pieces: Unit & Integration Testing Configuration Testing: Overview, Software and Hardware Devices. Deciding Hardware Configurations.	07

III	**Compatibility Testing:** Overview, Backward and Forward Compatibility. Testing Multiple versions. Data Sharing Compatibility **User Interface Testing:** Effective UI, Testing for Disabled. Data Coverage & Code Coverage	05
IV	**Documentation Testing:** Types of Documentation, Importance of Documentation Testing. **Security Testing:** Threat Modelling, Buffer Overrun, Safe String Functions, Computer Forensics **Web Site Testing:** Web Page Fundamentals, Black Box Testing: Text, Hyperlinks, graphics, Forms. Gray Box Testing & White Box Testing, Configuration and Compatibility Testing **System Testing:** Recovery Testing, Security Testing, Stress Testing, Performance Testing	08
V	**Planning Testing:** Goals, Test phases, Strategy, Resource Requirements, Schedule, Test Cases, Bug Reporting, Metrics. **Test Cases:** Test Case Planning, Design, Cases, Procedures, Organization and Tracking. **Bug Life Cycle and Tracking System.**	07
VI	**Testing, QA and QC:** Quality Management, Quality Planning Process, Quality Assurance Process, Quality Control process **Organisational Structures:** CMM Capability Maturity Model, ISO 9000.	06

Textbooks	
1	KshirasagarNaik and PriyadarshiTripathy, Software Testing and Quality Assurance: Theory and Practice, John Wiley & Sons, Inc.

References	
1	William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.
2	Louise Tamres, "Software Testing", Pearson Education Asia, 2002
3	Robert V. Binder, "Testing Object-Oriented Systems-Models, Patterns and Tools", Addison Wesley, 1999.
4	CemKaner, Jack Falk, Nguyen Quoc, "Testing Computer Software", Second Edition, Van Nostrand Reinhold, New York, 1993

Useful Links	
1	https://nptel.ac.in/courses/106105150
2	https://freevideolectures.com/course/4875/nptel-software-testing

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS435
Course Name	Elective VI: Augmented Reality Virtual Reality (ARVR)
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To gain the knowledge of historical and modern overviews and perspectives on virtual reality.
2	To learn the fundamentals of sensation, perception, and perceptual training.
3	To identify and examine state-of-the art AR and VR design problems and solutions from the industry and academia.
4	To have the scientific, technical, and engineering aspects of augmented and virtual reality systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the concepts, technologies, and applications of virtual and augmented reality (VR/AR).	II	Understanding
CO2	Apply the concepts of AR and VR to design solutions for interdisciplinary problems.	III	Applying
CO3	Compare and differentiate between AR/VR technologies in terms of their taxonomy, hardware components, software requirements, user interaction models, and application areas.	IV	Analyzing
CO4	Evaluate the key performance metrics of AR/VR systems while designing solutions.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction to Augmented-Virtual, Mixed and extended Reality, Taxonomy, technology and features of augmented reality, difference between AR, VR, MR and ER, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality.	6
II	**AR software development** AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit. **VR systems** VR as a discipline, Basic features of VR systems, Architecture of VR systems, VR hardware : VR input hardware: tracking systems, motion capture systems, data gloves, VR output hardware: visual displays.	7
III	**Virtual Reality Perception** Perception of Space and Time, Perceptual Stability, Attention, and Action, Perception: Design Guidelines, Adverse Health Effects, Motion Sickness, Eye Strain, Seizures, and Aftereffects, Hardware Challenges, Latency, Measuring Sickness, Reducing Adverse Effects, Adverse Health Effects: Design Guidelines	7

IV	**Virtual Reality Interaction** Content Creation, Concepts of Content Creation, Environmental Design, Affecting Behavior, Transitioning to VR Content Creation, Content Creation: Design Guidelines, Interaction, Human-Centered Interaction, VR Interaction Concepts, Input Devices, Interaction Patterns and Techniques, Interaction: Design Guidelines	7
V	**Virtual Reality Toolkit** Open Source Framework for the Community, Data and Machine Learning Visualization Design and Development in Spatial Computing, Character AI and Behaviors, The Virtual and Augmented Reality Health Technology Ecosystem	6
VI	**Applications** Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR	6

Textbooks	
1	The VR Book, Human Centered Design for Virtual Reality Jason Jerald ACM Books.
2	Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufm ann, 2013.
3	Creating Augmented and Virtual Realities Erin Pangilinan, Steve Lukas, Vasanth Mohan.
4	Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia" by Jonathan Linowes and Krystian Babilinski.

References	
1	John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.
2	Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, Delhi.
3	Augmented Reality: Principles and Practice" by Dieter Schmalstieg and Tobias Hollerer.

Useful Links	
1	http://msl.cs.uiuc.edu/vr/
2	https://developers.google.com/ar/develop
3	NPTEL

CO-PO Mapping

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

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

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Computer Science Engineering)
Class, Semester	Final Year B. Tech., Sem VIII
Course Code	6CS492
Course Name	Project Work II
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	12 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 6			

Course Objectives

1	To experience project management principles to become IT industry savvy
2	To utilize state of the art CASE tools especially for design, development and testing phases.
3	To acquaint the ability to map technical skills to real life applications from customers perspective.
4	To practice of specifying & using artifacts as per quality standards

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	summarize understanding of the problem and articulate it clearly.	II	Understanding
CO2	implement the proposed solution using appropriate tools and techniques.	III	Applying
CO3	identify use of modern engineering tools, software, and techniques utilized during project implementation.	IV	Analyzing
CO4	assess the performance of proposed solution for different measures.	V	Evaluating
CO5	build a solution for identified problem and prepare comprehensive project documentation including reports, technical papers, and design documents	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

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.

Textbooks

1	Nil

References

1	Nil

Useful Links

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2	3		3	2		1		2	2	2			2	2
CO3					3								2	
CO4	2	2			2								2	
CO5			2			1		2	2	2			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, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. 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 and related activities if any.