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Late Sau. Kantabai Bhavarlalji Jain College of Engineering

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)
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ESTD - 1928

Curriculum and Evaluation Scheme for Third Year B. Tech. in Artificial Intelligence & Data Science Engineering with Multidisciplinary Minor and Honor

To be implemented for 2024-28 Batch
(With Effect from Academic Year 2026-27)

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Vision of the Institute

Transform young aspirant learners towards creativity and professionalism for societal growth through quality technical education.

Mission of the Institute

1. To transfer the suitable technology, particularly for rural development.
2. To enhance diverse career opportunities among students for building a nation.
3. To acquire the environment of learning to bridge the gap between industry and academics.
4. To share values, ideas, and beliefs by encouraging faculty and students for the welfare of society.

Vision of theArtificial Intelligence & Data Science EngineeringEngineering Department

To nurture and excel in the domain of Artificial Intelligence and Data Science by providing exposure to develop intellectual professionals as well as ethical values to serve the greater cause of society.

Mission of the Artificial Intelligence & Data Science Engineering Engineering Department

To foster students with the latest technologies and thrust areas in the field of AI & DS.

- To inculcate values that will assist in developing professionals with social and ethical responsibilities.
- To collaborate with industry, academic, and research organizations to create competent IT professionals.

Program Outcomes (POs) for an engineering graduate:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

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PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes

1. **Professional Skills-**The ability to understand, analyze, and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying.

2. **Problem-Solving Skills-** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

3. **Successful Career and Entrepreneurship -** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur and a zest for higher studies.

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GENERAL COURSE STRUCTURE

A. Definition of Credit:

Table 1: Credit Definition

1 Hour Lecture (L) per week	1 Credit
1 Hour Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: (B.Tech. or Equivalent) in Tech. with Multidisciplinary Minor:

In the light of the fact that a typical NEP Compliant Model Four-year Undergraduate degree program in Technology has about 176 credits, the total number of credits proposed for the four-year B.Tech. in **Computer Engineering** with Multidisciplinary minor degree is kept as **172.**

Table 2: Range of Credits

Course Category		Credits As PER NEP Guidelines	Proposed Credits
Basic Science Course	BSC/ESC	14-18	15
Engineering Science Course		16-12	14
Programme Core Course (PCC)	Program Courses	44-56	47
Programme Elective Course (PEC)		20	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	14	17
Open Elective (OE) Other than a particular program		8	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	8	8
Ability Enhancement Course (AEC)	Humanities Social Science and Management (HSSM)	4	6
Entrepreneurship/Economics/ Management Courses		2	4
Indian Knowledge System (IKS)		2	2
Value Education Course (VEC)		4	5
Research Methodology(RM)	Experiential Learning Courses	4	4
Community Engagement Project (CEP)/ Field Project (FP)		2	2
Project		4	5
Internship/ OJT		12	12
Co-curricular Courses (CC)	Liberal Learning Courses	4	3
Total Credits		**160-176**	**172**

C. Semester wise Credit Distribution Structure for Four Year B. Tech in Computer Engineering with Multidisciplinary Minor:

Table3: Semester-wise Credit Distribution Structure

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Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	8	7	-	-	-	-	-	-	15
Engineering Science Course		7	7	-	-	-	-	-	-	14
Programme Core Course (PCC)	Program Courses	-	3	11	8	9	4	9	3	47
Programme Elective Course (PEC		-	-	-	-	6	5	6	3	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses	-	-	3	3	3	2	3	3	17
Open Elective (OE) Other than a particular program		-	-	-	3	2	3	-	-	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2	-	2	-	2	-	-	8
Ability Enhancement Course (AEC)	Humanities Social Science and Management (HSSM	1	-	1	2	2	-	-	-	6
Entrepreneurship/Economics/ Management Courses		-	-	2	2	-	-	-	-	4
Indian Knowledge System (IKS)		2	-	-	-	-	-	-	-	2
Value Education Course (VEC)		-	-	3	2	-	-	-	-	5
Research Methodology	Experiential Learnin Courses	-	-	-	-	-	4	-	-	4
Community Engagement Projec (CEP)/ Field Project (FP)		-	-	2	-	-	-	-	-	2
Project		-	-	-	-	-	2	3	-	5
Internship / OJT		-	-	-	-	-	-	-	12	12
Co-curricular Courses (CC)	Liberal Learning Courses	1	2	-	-	-	-	-	-	3
Total Credits (Major)		**21**	**21**	**22**	**22**	**22**	**22**	**21**	**21**	**172**

Students can opt for any of the following as per the rules and regulations given by the institute:

1. B. Tech with Multidisciplinary Minor = Total 172 Credits
2. **B. Tech with Multidisciplinary Minor and Honor = Total 190 Credits**

HONORS

- In addition to 172 credits of B. Tech Programmes (Bachelor of Technology) i.e. Major in which the student has taken admission, a student may opt for Honors in the same Tech. discipline/branch / Emerging Areas.
- A student is required to earn an additional 18 credits in the same Tech. discipline/ branch / Emerging Areas for Honors distributed over semesters III to VIII.
- The total number of credits required to complete the Honors in the same Tech. discipline/ Emerging Areas is 18 credits, in addition to 172 credits in Major.

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- Students will have to compulsorily choose Honors from the same Tech. discipline/branch.
- Honors Degree in the Bachelor of Engineering programme shall be awarded to students earning additional total credits of all six semesters from the second year to final year, i.e., 18 Credits, in addition to 172 credits or 130 credits respectively. The student admitted in the first year must earn 172 credits and 130 credits admitted in lateral entry (admitted after Diploma or B.Sc.) in the second year.
- Minor Courses can be completed through an online platform.

The student has to choose One Honor out of the Two Honor groups provided below

Honors offered by Artificial Intelligence & Data Science Engineering are as follows:

Table 4: Honors

Sr No	Name of Honors Offered by Department
A.	Cutting edge Game Development and Integrative system.
B.	Innovative cybersecurity and forensic Technology .

The detailed syllabus structure for the same is as follows:

Table 5A: Specialization Honors in Artificial Intelligence & Data Science Engineering

01	HOC	III	24-HOC-AD-2-01A	Human Computer Interaction	3	-	-	3	3
02	HOC	IV	24-HOC-AD-2-02A	Computer Vision	3	-	-	3	3
03	HOC	V	24-HOC-AD-3-03A	AI for Gaming	3	-	-	3	3
04	HOC	VI	24-HOC-AD-3-04A	Virtual and Augmented Reality	3	-	-	3	3
05	HOC	VII	24-HOC-AD-4-05A	Game Design and Development using Unity	3	-	-	3	3
06	HOC	VIII	24-HOC-AD-4-06A	Game Testing and Debugging	3	-	-	3	3
Total					**18**	-	-	**18**	**18**

Table 5B: Specialization Honors in Artificial Intelligence & Data Science Engineering

Sr. No	Category	SEM	Course Code	Course Name	Teaching Scheme				
					Hours				Credits
					L	T	P	Total Hours	
01	HOC	III	24-HOC-AD-2-01B	Cyber Security	3	-	-	3	3
02	HOC	IV	24-HOC-AD-2-02B	Digital Forensic	3	-	-	3	3
03	HOC	V	24-HOC-AD-3-03B	Cryptocurrency	3	-	-	3	3
04	HOC	VI	24-HOC-AD-3-04B	Ethical Hacking	3	-	-	3	3
05	HOC	VII	24-HOC-AD-4-05B	Physical Cyber World	3	-	-	3	3
06	HOC	VIII	24-HOC-AD-4-06B	IoT Security	3	-	-	3	3
Total					**18**	-	-	**18**	**18**

#Note for NPTEL/SYAYAM: Approved courses and platforms will be enlisted timely by authorities along with rules and regulations

Honors Syllabus for SEM V

Cutting edge Game Development and Integrative system

24-HOC-AD-3-03A AI Gaming

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 03	**Examination Scheme:** **SEE** : 100 Marks

Prerequisites Courses: 24-PCC-AD-2 -03 Computer Graphics And Animation

Companion Course:

Course Objectives:

- To **understand** the fundamental concepts of computer graphics, game design principles, and human–computer interaction required for developing interactive applications.
- To **apply** game engine tools for scene creation, object manipulation, event handling, animation, and user-interface (UI) design.
- To **develop** interactive 2D/3D game components using scripting, physics, lighting, and asset management techniques.
- To **evaluate** and deploy game applications by integrating audio, input devices, performance optimization, and publishing workflows.

Course Outcomes: After completion of the course, learners should be able to

CO. No	CO	BL
CO1	**Apply** heuristic search algorithms and optimization techniques (e.g., A*, Genetic Algorithms) to solve pathfinding and constraint satisfaction problems in gaming.	3
CO2	**Analyze** decision-making problems under uncertainty using Bayesian Networks and Markov Decision Processes (MDPs) to model adaptive game agents.	4
CO3	**Determine** equilibrium strategies in static and zero-sum games by computing Nash Equilibria and saddle points.	4
CO4	**Assess** the impact of information structures and commitment in dynamic games to judge the quality of strategic outcomes.	5
CO5	**Justify** the existence of stable solutions in infinite strategy spaces by applying advanced fixed-point theorems.	5
CO6	**Formulate** robust incentive mechanisms and signaling protocols that effectively manage incomplete information in competitive settings.	6

Course Contents

Unit I	Problem Solving and Search Strategies	6 Hr

Introduction to AI: Philosophy of AI, Definitions, and modeling problems as AI challenges,**Uninformed Search:** Modeling problems as search problems, algorithms for Uninformed Search,**Heuristic Search:** Domain relaxations and Heuristic Search techniques (e.g., A*). **Optimization:** Local Search methods and Genetic Algorithms for optimization in game environments.

#Exemplar/Case Studies : An NPC in a game must determine the most efficient path across a map by minimizing travel time,

preferring roads over mountains, and avoiding uncrossable rivers.		
***Mapping of Course Outcomes**	**CO1**	
Unit II	**Advanced Agents and Decision Making**	**6 Hr**
Adversarial Search: Techniques for game-playing agents, including Minimax and Alpha-Beta pruning,**Constraint Satisfaction:** Solving Constraint Satisfaction Problems (CSPs),**Uncertainty and Learning:** Handling uncertainty using Bayesian Networks,**Sequential Decision Making:** Introduction to Markov Decision Processes (MDPs) and Reinforcement Learning for adaptive agents.		
#Exemplar/Case Studies : In a racing simulator like *Gran Turismo*, AI drivers are trained using reinforcement learning to improve performance by learning from mistakes instead of following fixed paths.		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Static Games and Equilibrium**	**6 Hr**
Game Fundamentals: Definition of a game, static games, and basic notations,**Nash Equilibrium:** Concept of Nash equilibrium, examples, and analysis of Weakly and Strictly dominated strategies, **Zero-Sum Games:** Definition of Zero-sum games, Security strategies, Saddle point strategies, and the Von-Neumann min-max theorem.		
#Exemplar/Case Studies: In an FPS match, two players choose loadouts simultaneously in a zero-sum game where Sniper beats Mid-range, Mid-range beats Rusher, and Rusher beats Sniper, requiring a balanced strategy that cannot be easily exploited.		
Mapping of Course Outcomes	**CO3**	
Unit IV	**Dynamic Games and Information Structures**	**6 Hr**
Dynamic Game Theory: Definition and solution concepts for Dynamic games; Standard normal form and Threat equilibrium.,**Extensive Form:** Extensive Form Games, Single Act Games, and Informationally Inferior Games.**Information Knowledge:** Aumann model of incomplete information, Knowledge operator, Common knowledge, and the Structure theorem of common knowledge.		
#Exemplar/Case Studies: Title: In a poker game, Player B must decide to fold or call a large bet using incomplete information, inferring whether Player A has a strong hand or is bluffing.		
Mapping of Course Outcomes	**CO4**	
Unit V	**Strategic Analysis and Existence Theorems**	**6 Hr**
Mixed Strategies: Mixed and Behavioral strategies, Conditions for equivalence, and Kuhn's Theorem.,**Equilibrium Existence:** Computation of mixed saddle point strategies; Existence of Nash equilibrium via Kakutani fixed point theorem and Brower's fixed point theorem for infinite strategy spaces.,**Algorithm & Structure:** Nested and Ladder Nested Extensive games, and Equilibrium Algorithms.		
#Exemplar/Case Studies: In a penalty kick duel, both the striker and goalie must use mixed strategies—randomizing left and right choices—to remain unpredictable and avoid being exploited.		
Mapping of Course Outcomes	**CO5**	
Unit VI	**Advanced Game Theory and Mechanism Design**	**6 Hr**
Bayesian Games: Games of Incomplete Information, Bayesian Games, and Bayesian Nash Equilibrium, **Mechanism Design:** Basic concepts of mechanism design, Signaling, Screening, and Information design, **Communication & Contracts:** Pre-play communication, Correlated Equilibrium, Games with Contracts (Principal-Agent Models, Moral Hazard), and the Revelation Principle.		
#Exemplar/Case Studies: In an MMO, using a Vickrey (second-price) auction for legendary items encourages players to bid their truevalue, preventing sniping and dishonest bidding.		

***Mapping of Course Outcomes**	**CO6**
Learning Resources	
Text Books:	
● Artificial Intelligence: A Modern Approach, 4th EditionPearson Education, 2021ISBN: 978-0134610993 ● An Introduction to Game Theory ,Oxford University Press, 2004 ,ISBN: 978-0195128956	
Reference Books :	
● Drew Fudenberg and Jean Tirole Game Theory MIT Press, 1991 ISBN: 978-0262061414 ● Richard S. Sutton and Andrew G. Barto Reinforcement Learning: An Introduction, 2nd Edition MIT Press, 2018 ISBN: 978-0262039246	
Additional Resources: (Books, e-Resources) : ● Algorithmic Game Theory (Selected Chapters) Edited by Noam Nisan et al. Cambridge University.	
MOOC Courses links : **https://nptel.ac.in/courses/106102220**	

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Honors Syllabus for SEM V

Innovative cybersecurity and forensic Technology

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24-HOC-AD-3-03B: Cryptocurrency

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **SEE** : 100

Prerequisites Courses: Computer Networks, Web Technology, Data Science

Companion Course:

Course Objectives:

- To understand the fundamentals of cryptocurrency and blockchain technology
- To study cryptographic techniques used in decentralized systems
- To explore cryptocurrency mining, consensus mechanisms, and wallets
- To analyze smart contracts, DeFi, and Web3 ecosystems
- To understand security, regulatory, and ethical challenges
- To examine recent trends and future directions in the crypto industry

Course Outcomes:
After completion of the course, learners should be able to

CONo	CO	BL
CO1	Explain cryptocurrency and blockchain fundamentals	2
CO2	Apply cryptographic principles.	3
CO3	Analyze consensus mechanisms.	4
CO4	Develop smart contracts.	4
CO5	Evaluate security and regulations	2
CO6	Analyze future trends.	2

Course Contents

Unit I	**Introduction to Cryptocurrency & Blockchain**	**6 Hours**

Evolution of digital money, Centralized vs decentralized systems, Blockchain architecture: blocks, hash, Merkle tree, Public, private, and consortium blockchains, Cryptocurrency ecosystem overview

#Exemplar/Case Studies: Bitcoin vs traditional banking system

***Mapping of Course Outcomes**	**CO1**

Unit II	**Cryptography for Cryptocurrency**	**6 Hours**
Hash functions (SHA-256), Digital signatures, Public-key cryptography, Wallets: hot, cold, hardware wallets, Key management and security		
#Exemplar/Case Studies: How Bitcoin transactions are secured.		
***Mapping of Course Outcomes**	**CO2**	
Unit III	**Consensus Mechanisms & Mining**	**6 Hours**
Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Proof of Authority, Mining process and rewards, Energy efficiency and sustainability.		
#Exemplar/Case Studies: Ethereum PoW to PoS transition		
***Mapping of Course Outcomes**	**CO3**	
Unit IV	**Smart Contracts & Decentralized Applications (DApps)**	**6 Hours**
Smart contract concepts, Ethereum Virtual Machine (EVM), Solidity basics, DApps architecture, Oracles and interoperability		
#Exemplar/Case Studies	**Simple Ethereum smart contract demo**	
***Mapping of Course Outcomes**	**CO4**	
Unit V	**DeFi, NFTs & Web3 Applications**	**6 Hours**
Decentralized Finance (DeFi) ecosystem, Yield farming and liquidity pools, Non-Fungible Tokens (NFTs), DAO (Decentralized Autonomous Organizations), Web3 and decentralized identity.		
#Exemplar/Case Studies: NFT marketplace working model		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	**Security, Regulation & Recent Trends**	**6 Hours**
Cryptocurrency attacks and frauds, Smart contract vulnerabilities, Regulatory frameworks (India & Global), Central Bank Digital Currency (CBDC), AI + Blockchain integration, Future of cryptocurrency		
#Exemplar/Case Studies: Crypto scams and security breaches		
***Mapping of Course Outcomes**	**CO6**	
Learning Resources		
Text Books		
T1. Andreas M. Antonopoulos, *Mastering Bitcoin*		

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T2. Narayanan et al., *Bitcoin and Cryptocurrency Technologies*
Reference Books :
R1. Imran Bashir, *Mastering Blockchain* **R2.** Melanie Swan, *Blockchain: Blueprint for a New Economy*
Additional Resources: (Books, e-Resources) ● Whitepapers (Bitcoin, Ethereum) ● Research articles and technical blogs
MOOC Courses links : ● Coursera – Blockchain Specialization ● edX – Blockchain Fundamentals ● NPTEL – Blockchain and Cryptocurrency

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Honors Syllabus for SEM VI

Cutting edge Game Development and Integrative system

24-HOC-AD-3-04A : VIRTUAL AND AUGMENTED REALITY

Teaching Scheme:	**Credit:** 3	**Examination Scheme:**
Theory: 3 Hours/Week		**CIE** : 20 Marks **MSE :** 20 Marks **SEE** : 60 Marks

Prerequisites Courses:

Companion Course:

Course Objectives:

1. To **understand** the architecture and components of VR/AR systems to interpret how immersive environments function.
2. To **apply** various tracking, sensing, and rendering techniques to examine their role in VR/AR environments.
3. To **develop** insights into interaction methods and user experience (UX) elements to analyze their effectiveness in VR/AR applications.
4. To **evaluate** different VR/AR hardware and software platforms by comparing their capabilities and limitations.

Course Outcomes:
After completion of the course, learners should be able to

CO. No	CO	BL
CO1	**Explain** the fundamental concepts, components, and architecture of Virtual Reality and Augmented Reality systems.	2
CO2	**Describe** various tracking, sensing, and rendering techniques used in immersive VR/AR environments.	2
CO3	**Discuss** VR/AR interaction methods, user interface elements, and user experience considerations.	2
CO4	**Apply** suitable VR/AR tools, frameworks, and development platforms to create immersive applications.	3
CO5	**Develop** VR/AR prototypes by integrating tracking, rendering, and interaction techniques.	3
CO6	**Evaluate** different VR/AR systems and real-world applications to compare their performance, usability, and overall effectiveness.	4

Course Contents

Unit I	**Introduction to AR & VR**	**7 Hours**

Categorizing Realities: Virtual Reality (VR),Augmented Reality (AR),Mixed Reality (MR),**Features and Applications**:AR and VR, **VR Development:**Integration of VR Techniques**,**Content Objects and Scale,Gaze-Based Control & Handy Interactables,**AR Development**:Working with AR Techniques,Compatibility with Environment,System Architecture of AR,Application Areas of AR.		
#Exemplar/Case Studies: Case study of a single application using both VR and AR technologies		
***Mapping of Course Outcomes**	**CO1,CO2**	
Unit II	**Representing Virtual & Augmented Environments**	**7 Hours**
VR World Representation Visual Representation,Aural Representation,Haptic Representation **AR Hardware Essentials** AR Displays,Visual, Audio, Haptic, Other Sensory Displays,Visual Perception Requirements,Spatial Display Models,Processors – Architecture & Specifications,Tracking & Sensors,Calibration, Registration,Stationary Tracking Systems,Mobile Sensors,Optical Tracking,Sensor Fusion		
#Exemplar/Case Studies: AR-Based Sports Training & Performance Analysis.		
***Mapping of Course Outcomes**	**CO3**	
Unit III	**Geometry, Vision & Computer Vision for AR/VR**	**7 Hours**
Geometry of Virtual Worlds Geometric Models,Changing Position & Orientation,Axis-Angle Representations,Viewing Transformations,Chaining Transformations,**Human Vision for VR** Human Eye,Eye Movements,Implications for VR **Computer Vision for AR** Marker-based Tracking,Multiple-Camera Infrared Tracking,Natural Feature Detection,SLAM (Simultaneous Localization and Mapping),Outdoor Tracking		
#Exemplar/Case Studies: Use of OpenCV for AR App Development		
***Mapping of Course Outcomes**	**CO2**	
Unit IV	**Rendering, Perception & AR Tracking Techniques**	**7 Hours**
Visual Perception in VR/AR Perception of Depth,Perception of Motion,Perception of Color,Combining Sources of Information **Rendering Techniques** Ray Tracing,Shading Models,Rasterization,Correcting Optical Distortions,Improving Latency & Frame Rates **AR Tracking Approaches** Marker-Based Tracking:Marker Types: Template, 2D Barcode, Imperceptible,Camera Pose & Identification Markerless Tracking:Localization-Based Augmentation,Visual Tracking,Feature-Based Tracking,Hybrid Tracking,Initialization & Recovery		
#Exemplar/Case Studies:IKEA Place – Real-Time AR Furniture Placement		
***Mapping of Course Outcomes**	**CO1, CO5**	
Unit V	**Motion, Tracking & AR/VR Devices**	**7 Hours**
Motion in VR Motion in Real vs Virtual Worlds,Velocities & Accelerations,Vestibular System,Physics in the VirtualWorld,Mismatched Motion & Vection **Tracking Technologies** 2D & 3D Orientation,Position & Orientation Tracking,Tracking Attached Bodies **AR Devices & Components** AR Components:Scene Generator,Tracking Systems,Monitoring Systems,Display Systems,Game Scene		

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AR Devices:Optical See-Through HMD,Virtual Retinal Systems,Monitor-Based Systems,Projection Displays,Video See-Through Systems.		
#Exemplar/Case Studies: Pokémon GO – Hybrid Tracking AR Game		
***Mapping of Course Outcomes**	**CO5, CO6**	
Unit VI	**Interaction, Audio & Mixed Reality**	**7 Hours**
Interaction in VR/AR Motor Programs & Remapping,Locomotion,Object Manipulation,Social Interaction, **Audio in VR/AR** Physics of Sound,Physiology of Human Hearing,Auditory Perception,Auditory Rendering, **Mixed Reality (MR)** What is Mixed Reality?,Applications of MR,Input & Output in MR,Computer Vision in MR,SLAM Variants in MR,DTAM (Dense Tracking & Mapping),PTAM (Parallel Tracking & Mapping),SVO (Semi-Direct Visual Odometry)		
#Exemplar/Case Studies: Google Tilt Brush – Immersive VR Art Creation(Artists can create 3D art in virtual space using motion controllers.)		
***Mapping of Course Outcomes**	**CO3**	
Learning Resources		
Text Books T1: Steven M. LaValle, Cambridge University Press, 2016. T2: Interface, Application and Design – William R. Sherman and Alan B. Craig, Morgan Kaufmann Publishers.		
Reference Books : R1: Foundations of Effective Design – Alan B. Craig, William R. Sherman, and Jeffrey D. Will, Morgan Kaufmann. R2: Theory and Practice – Doug A. Bowman, Ernst Kruijff, Joseph J. LaViola Jr., and Ivan Poupyrev, Addison Wesley. R3: Merging Real and Virtual Worlds – Oliver Bimber and Ramesh Raskar, A K Peters/CRC Press.		
Additional Resources: (Books, e-Resources)		
MOOC Courses links : ● NPTEL Course On"Foundation for Virtual and Augmented Reality Systems" https://onlinecourses.nptel.ac.in/noc26_cs03/preview?utm_source**:** ● NPTEL Course OnThis course focuses mainly on **VR fundamentals**, including human perception, graphics, rendering, and system design.https://onlinecourses.nptel.ac.in/noc25_cs87/preview?utm_source		

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SNJB's Late Sau. K. B. Jain College of Engineering, Chandwad
(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)
Curriculum and Evaluation Scheme for Third Year B. Tech. in Artificial Intelligence and Data Science Engineering with Multidisciplinary Minor and Honor
To be implemented for 2024-28 Batch
(With Effect from Academic Year 2026-27)

Honors Syllabus for SEM VI

Innovative cybersecurity and forensic Technology

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24-HOC-AD-3-04B: Ethical Hacking

Teaching Scheme: Theory: 3 Hours/Week	**Credit:** 3	**Examination Scheme:** **SEE** : 100 Marks

Prerequisites Courses: 24-PCC-AD-2-06: Computer Networks, 24-HOC-AD-2-01B : Cyber Security , 24-HOC-AD-2-02B :Digital Forensic

Companion Course: 24-PEC-AD-3-03A:Ethical Hacking

Course Objectives:

- **Understand** fundamentals of Ethical Hacking and penetration testing, including the CIA triad, hacking methodologies, and core network security concepts.
- **Apply** techniques for reconnaissance, scanning, and vulnerability assessment to identify potential security weaknesses.
- **Analyze** web application security threats and wireless security mechanisms to evaluate associated risks.
- **Learn** cryptography and system security mechanisms to design and implement appropriate security countermeasures.
- **Explore** advanced exploits, including privilege escalation and the security challenges in mobile and cloud environments.

Course Outcomes:
After completion of the course, learners should be able to

CONo	CO	BL
CO1	**Understand** the fundamentals of ethical hacking, including the CIA triad, hacking methodologies, and key network layer security concepts.	2
CO2	**Apply** footprinting, scanning, and social engineering techniques to perform vulnerability assessment and reconnaissance	3
CO3	**Analyze** web applications to identify common vulnerabilities as outlined in the OWASP Top 10.	4
CO4	**Apply** appropriate mitigation strategies and security principles to defend against prevalent web application attacks.	3
CO5	**Analyze** privilege escalation techniques and security misconfigurations in Windows, Linux, and cloud environments.	4
CO6	**Evaluate** security protocols and identify threats in wireless networks, including methods to secure endpoints and IoT devices.	4

Course Contents

Unit I	Introduction to Ethical Hacking	**6 Hours**

Basic Concepts of Networking ,TCP/IP Protocol Stack ,IP addressing and routing ,TCP and UDP ,IP subnetting.		
#Exemplar/Case Studies: The MOVEit Transfer Hack (2023) - A Supply Chain Catastrophe**.**		
***Mapping of Course Outcomes**	**CO1**	
Unit II	Routing protocols	**6 Hours**
IP version 6, Routing examples,Software Installation and Network Setup,Information Gathering,Port Scanning Using NMAP, Other Features of NMAP.		
#Exemplar/Case Studies: The Storm-0558 Microsoft Exchange Server Intrusion 2023.		
***Mapping of Course Outcomes**	**CO2**	
Unit III	Basic concepts of cryptography	**7 Hours**
Private-key cryptography ,Public-key cryptography ,Cryptographic hash functions , Digital signature and certificate, Applications		
#Exemplar/Case Studies:The Weakest Link: How Stolen Private Keys Compromised a Global Supply Chain.		
***Mapping of Course Outcomes**	**CO4**	
Unit IV	Steganography	**6 Hours**
Biometrics,Network Based Attacks ,DNS and Email Security,Social engineering attack,Denial of service attack.		
#Exemplar/Case Studies: The Human Firewall Bypass: How Social Engineering Crippled MGM Resorts 2023		
***Mapping of Course Outcomes**	**CO6**	
Unit V	Elements of Hardware Security	**7 Hours**
Side Channel Attacks ,Physical Unclonable Function,Hardware Trojan,Metasploit framework, Attack demonstrations using metasploit,Webserver vulnerability and attacks,sql injection error based from web application,sqlmap.		
#Exemplar/Case Studies: The Hardware-Software Kill Chain: A Case Study in Spectre Vulnerabilities and Web Application Exploitation.		
***Mapping of Course Outcomes**	**CO5**	
Unit VI	Cross Site Scripting	**6 Hours**
The NMAP tool: a relook,Network analysis using wireshark,Summarization of the course.		
#Exemplar/Case Studies: The Magecart Menace: A Cross-Site Scripting Case Study in Digital Payment Skimming 2023.		
***Mapping of Course Outcomes**	**CO3**	

Learning Resources
Text Books
T1. Hacking: The Art of Exploitation by Jon Erickson **T2.** Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
Reference Books :
R1. Google Hacking -An Ethical Guide by-Fadia Aniket. **R2.**Nwtwork Intrusion alert -An Ethical Hacking guide to intrusion detection by-Fadia Aniket.
Additional Resources: (Books, e-Resources) Ethical Hacking-A Hands on Introduction to Breaking in By - Daniel G Graham.
MOOC Courses links : ● https://nptel.ac.in/courses/106105217