Shri Shankaracharya Technical Campus, Bhilai

(An Autonomous Institute Affiliated to CSVTU Bhilai)

SYLLABUS

B. Tech. Seventh Semester- Computer Science & Engineering

(GAMING TECHNOLOGY)

SYLLABUS

B.TECH. (COMPUTER SCIENCE AND ENGINEERING- GAMING TECHNOLOGY)

SEVENTH SEMESTER

		11-07-2023	1.00	Applicable for AY 2023-24 Onwards
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Sl. No.	Board of Studies (BOS)	Courses (Subject)	Subject Code	Course Code	Period per Week			Scheme of Examination Theory/Lab			Total Marks	Credit
					L	T	P	ESE	CT	TA		
1	Computer Science & Engineering	Cryptography and Network Security	**CS114701**	PCC	2	1	-	100	20	30	150	3
2	Computer Science & Engineering	Game Engine Architecture	**CS114702**	PCC	2	1	-	100	20	30	150	3
3	Computer Science & Engineering	Augmented Reality and Virtual Reality	**CS114703**	PCC	3	-	-	100	20	30	150	3
4	Computer Science & Engineering	Professional Elective- III AI in Gaming	**CS114721**	PEC	3	-	-	100	20	30	150	3
5	Computer Science & Engineering	Open Elective-IIAdv Statistical Method	**CS100741**	OEC	3	-	-	100	20	30	150	3
6	Computer Science & Engineering	UX-UI Lab	**CS114791**	LC	-	-	2	25	-	25	50	1
7	Computer Science & Engineering	Augmented Reality and Virtual Reality Lab	**CS114792**	LC	-	-	2	25	-	25	50	1
8	Computer Science & Engineering	Capstone Project Phase I	**CS102793**	PROJ	-	-	4	50	-	50	100	2
9	Computer Science & Engineering	Internship assessment/Industrial training (Report and Seminar)	**CS102794**	MC	-	-	2	-	-	25	25	1
10	Computer Science & Engineering	Universal Human Values and Professional Ethics	**CS102795**	NC	-	-	-	-	-	25	25	-
Toatl					**13**	**2**	**10**	**600**	**100**	**200**	**1000**	**20**

L : Lecture, T: Tutorial, P : Practical, ESE : End Semester Exam CT : Class test TA: Teacher's assessment
PCC :Program Core Courses, PEC: Professional Elective Courses, OEC : Open Elective Courses, LC : Laboratory Courses PROJ : Project WorkMC: Mandatory Courses, NC : Non Credit

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Table-I: Professional Elective – III [7th Sem]

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code
1	Computer Science and Engg.	Internet and Web Technology	CS102721
2	Computer Science and Engg.	Natural Language Processing	CS110722
3	Computer Science and Engg.	Object Oriented Database Management System	CS111723
4	Computer Science and Engg.	Industrial IOT	CS115724
5	Computer Science and Engg.	AI in Gaming	CS114725

Table-II: Open Elective – II [7th Sem]

Sl. No.	Board of Studies (BOS)	Courses (Subject)	Course Code
1	Computer Science and Engg.	Advance Statistical Methods	CS100741
2	Computer Science and Engg.	Enterprise Resource Planning	CS100742

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Subject Code CS114701	Cryptography & Network Security	L = 2	T = 1	P = 0	Credits = 3
Evaluation Scheme	**ESE**	**CT**	**TA**	**Total**	**ESE Duration**
	100	**20**	**30**	**150**	**3 Hours**

Course Objectives	Course Outcomes
The objective of the course to: **1.** To understand the principles and practices of cryptography and network security **2.** To understand the practical applications that have been implemented and are in use to provide network Security	**Students will be able to:** **CO1** Understand the Conventional encryption algorithms for confidentiality and their design principles **CO2** Understand the Public key encryption algorithms and their design principles **CO3** Understand the Use of message authentication codes, hash functions, digital signature and public key certificates **CO4** Understand the Network security tools and applications **CO5** Understand the System-level security issues like threat of and countermeasures for intruders and viruses, and the use of firewalls and trusted systems.

UNIT 1 Overview: Security trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. **Symmetric (Private Key) Ciphers:Classical Encryption Techniques:** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. **Block Ciphers and the Data Encryption Standard:** Block Cipher Principles, The Data Encryption Standard (DES), The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles.	**CO 1** **7 Hrs**
UNIT 2Symmetric Ciphers (continued): **Basic Concepts in Number Theory and Finite Fields:** Groups, Rings, and Fields, Modular Arithmetic, the Euclidian algorithm, Finite Fields of the Form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2n). **Advanced Encryption Standard:** The Origins AES, Evaluation criteria for AES, the AES Cipher. **Stream cipher:** Stream ciphers and RC4. **Confidentiality using symmetric encryption:** Placement of encryption function, traffic confidentiality,	**CO2** **8 Hrs**

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key distribution.	
UNIT 3 Asymmetric (Public Key) Ciphers: Introduction to Number Theory: Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms. **Public-Key Cryptography and RSA:** Principles of Public-Key Cryptosystems. **Key Management-Other Public-Key Cryptosystems:** Key management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.	**CO3** **7 Hrs**
UNIT 4 Asymmetric Ciphers (continued): Message Authentication and Hash functions: Message authentication requirements, authentication functions, Message authentication codes, Hash functions, Security of Hash functions and MAC, SHA, HMAC, CMAC. **Digital Signatures and Authentication protocols**: Digital signature, Authentication protocols, Digital signature standards.	**CO4** **7 Hrs**
UNIT 5 Network Security applications: Authentication applications: Kerberos, X.509 Authentication services, public key infrastructure. **Electronic mail security**: PGP, S/MIME. Overview of IP Security. **Web Security**: Web security considerations, SSL and TLS, Secure electronic transaction. **System Security:** Intruders, Intrusion detection, password management, viruses and related threats, virus counter measures, Firewall design principles, and trusted systems.	**CO5** **7 Hrs**

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Text Books:

S. No.	Title	Author(s)	Publisher
1	Cryptography and Network Security, Principles and Practices	William Stallings	Pearson Education,Prentice Hall, 4th Edition.
2	Cryptography and Network Security	AtulKahate	McGraw Hill Education (India) Private Limited; Thirdedition.

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Applied Cryptography: Protocols & Algorithms	Schneier& Bruce,	MGH International
2	Cryptography and Security	Dr T R Padmanabhan N Harini	Wiley India Pvt Ltd, 2011

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Subject Code CS114702	Game Engine Architecture	L = 2	T = 1	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of this course is to provide students with a comprehensive understanding of game engine architecture and the core components involved in game development. By the end of the course, students should have a strong foundation in graphics rendering, physics simulation, audio processing, scripting, and gameplay systems. They will gain practical knowledge of various techniques and design patterns used in game engines, allowing them to develop their own games or contribute to game development projects.	Upon completion of this course, students should be able to: **CO1:**Understand the role and importance of game engines in game development. **CO2:**Identify and explain the core components of a game engine. **CO3:** Implement a game loop and event-driven architecture. **CO4:**Apply graphics APIs such as OpenGL, DirectX, and Vulkan to render 3D graphics and implement shaders. **CO5:** Optimize mesh rendering and apply lighting and shadowing techniques.

Unit 1: Introduction to Game Engine Architecture, Overview of game engines and their role in game development, Core components of a game engine, Game loop and event-driven architecture. Game engine design patterns	**CO 1** **7 Hrs**
Unit 2: Graphics Rendering, Graphics API overview (OpenGL, DirectX, Vulkan)**,** Rendering pipeline and shaders,Mesh rendering and optimization techniques, Lighting and shadowing techniques, Post-processing effects	**CO2** **8 Hrs**

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Unit 3: Physics Simulation, Overview of physics simulation in games, Rigid body dynamics and collision detection, Integration methods and numerical stability, Constraints and joints, Character physics and ragdoll simulation	**CO3** **7 Hrs**
Unit 4: Audio Processing, Introduction to audio in games, Digital audio representation and formats, Playback and mixing techniques, Spatial audio and 3D sound, Audio synthesis and procedural audio	**CO4** **7 Hrs**
Unit 5: Scripting and Gameplay Systems, Scripting languages and integration in game engines, Entity-component system architecture, Input handling and user interaction, AI and behavior systems, Networking and multiplayer support.	**CO5** **7 Hrs**

Text Books:

S.No.	Title	Author(s)	Publisher
1	Game Engine Architecture	Jason Gregory	
2	Real-Time Rendering	Tomas Akenine-Möller, Eric Haines, and Naty Hoffman	
3	Physics for Game Developers	David M. Bourg	

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Game Engine Black Book	Wolfenstein 3D" by Fabien Sanglard	
2	Introduction to 3D Game Programming with DirectX 12	Frank D. Luna	
3	Game Programming Patterns	Robert Nystrom	
4	Game Coding Complete	Mike McShaffry	

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Subject Code CS114703	Augmented Reality and Virtual Reality	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	20	30	150	3 Hours

Course Objectives	Course Outcomes
Theobjectiveofthiscourseistoprovideafoundationtothefastgrowingfieldof ARandmakethestudentsawareofthevariousARdevices.	**Afterundergoingthecourse,studentswill beableto:** **CO1** DescribehowARsystemsworkandlist theapplicationsofAR. **CO2** Understandandanalysethehardwarer equirementofAR. **CO3** UsecomputervisionconceptsforARa nddescribeARtechniques. **CO4** Analyzeandunderstandtheworkingof variousstateoftheartARdevices. **CO5** Acquireknowledgeofmixedreality.

Unit-1Introduction ,Definition, History and the Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to theSpectrum Between Real and Virtual Worlds, applications of augmented reality. Concepts Related to AugmentedReality,IngredientsofanAugmentedRealityExperience.

Unit-2 Augmented reality hardware and display hardware display and haptic, Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, SpatialDisplay Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications. Tracking& Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary TrackingSystems,MobileSensors,Optical Tracking,SensorFusion.

UNIT-III:ComputerVisionforAugmented Reality&A.R.Software:ComputerVisionforAugmentedReality, Tracking, Multiple-Camera, InfraredTracking, NaturalFeatureTrackingbyDetection,Simultaneous LocalizationAndMapping,Outdoor ,TrackingAugmentedRealitySoftware-Introduction, Major Software ComponentsApplication. ForAugmentedRealitySystems,SoftwareusedtoCreateContentfortheAugmentedReality.

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Unit-4 AR techniques, Maker base and markerless tracking: Marker-based approach-
Introductionto marker tracking types of marker, marker camera pose, representation of matrix multiplication Marker types- Template markers, 2D barcode markers, imperceptible markers.Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking,featurebasedtracking,hybridtracking,andinitializationandrecovery.

UNIT-V: AR Devices & Components: AR Components – Scene Generator, Tracking system, monitoring system,display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems,Projection displays, Video see-through systems. Introduction to mixed reality, Applications of mixed reality, InputandOutputinMixedreality,ComputerVisionandMixedReality,simultaneouslocalizationandmapping(SLAM).

Text Books:

S.No.	Title	Author(s)	Publisher
1	ARGameDevelopment,1stEdition,ApressPublications,2018,ISBN978-1484236178	bySchmalstieg/Hollerer,9332578494	PearsonEducationIndia;Firstedition(12 October2016),ISBN-10:
2	Augmented Reality: Principles and Practice	Dieter Schmalstieg and Tobias Hollerer	
3	Virtual Reality: Concepts and Technologies	Philippe Fuchs and Franco Tecchia	
4	Theory and applications of marker-based augmented reality.	SanniSiltanen	Julkaisija–UtgivarePublisher. 2012.ISBN 978-951-38-7449-0.

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile"	Tony Parisi	
2	Augmented Reality for Developers: Build Exciting AR Applications with Unity, ARCore, ARKit, and Vuforia	Jonathan Linowes	
3	DesigningforMixedReality,.	KharisO'Connell	PublishedbyO'ReillyMedia,Inc., 2016,ISBN:9781491962381

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Subject Code CS114791	UX/UI Lab	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	--	25	50	3 Hours

Course Objectives	Course Outcomes
The objective of this lab course is to provide students with hands-on experience in designing user-centered and visually appealing user interfaces (UI) and user experiences (UX) for gaming applications. The course aims to introduce students to various UX design principles, usability testing techniques, and UI development tools, enabling them to create immersive and engaging gaming interfaces. Through practical exercises and projects, students will develop skills in prototyping, UI implementation, and collaboration, preparing them for real-world challenges in the gaming industry.	**Students should be able to:** **CO1** Understand the importance of user-centered design in gaming applications. **CO2** Apply UX design principles to create intuitive and seamless gaming experiences. **CO3** Conduct usability testing to identify and address usability issues in gaming interfaces. **CO4** Design visually appealing and consistent UI elements for gaming applications. **CO5** Use industry-standard UI development tools to implement gaming interfaces and **CO6** Collaborate effectively in a team to design and prototype gaming UI/UX.

List of Experiments 12 Hrs

Experiment 1: Introduction to UX and UI Design

- Understand the fundamentals of UX and UI in gaming.
- Familiarize with design principles and user-centered design concepts.

Experiment 2: User Research and Persona Creation

- Conduct user research to identify target audience and user preferences.
- Create user personas to inform design decisions.

Experiment 3: Wireframing and Prototyping

- Create wireframes for gaming interfaces.
- Develop interactive prototypes using industry-standard tools.

Experiment 4: Information Architecture and Navigation Design

- Design information architecture for a gaming application.
- Implement intuitive navigation and user flows.

Experiment 5: Usability Testing

- Plan and conduct usability tests for gaming interfaces.
- Analyze usability test results and propose improvements.

Experiment 6: Visual Design Principles for Gaming UI

- Explore visual design principles and aesthetics in gaming.
- Create mood boards and style guides for gaming interfaces.

Experiment 7: Color Theory and Typography in Gaming

- Apply color theory principles to gaming UI.
- Choose appropriate typography for gaming applications.

Experiment 8: UI Development Tools and Implementation (Part 1)

- Introduction to popular UI development tools (e.g., Unity UI, Unreal UMG).
- Implement basic UI elements for a gaming project.

Experiment 9: UI Development Tools and Implementation (Part 2)

- Implement advanced UI elements, animations, and transitions.
- Integrate UI with game mechanics and logic.

Experiment 10: Accessibility in Gaming UI

- Design inclusive interfaces for users with diverse abilities.
- Test and ensure accessibility compliance.

Experiment 11: Responsive UI Design for Gaming

- Design UI for different platforms (PC, console, mobile).
- Adapt UI to various screen resolutions and aspect ratios.

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Text Books:

S.No.	Title	Author(s)	Publisher
1	The Design of Everyday Things	by Donald A. Norman	
2	Game Design Workshop: A Playcentric Approach to Creating Innovative Games	by Tracy Fullerton	
3	Game Usability: Advancing the Player Experience	by Katherine Isbister and Noah Schaffer	
	A Project Guide to UX Design: For User Experience Designers in the Field or in the Making	by Russ Unger and Carolyn Chandler	

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Universal Principles of Design	by William Lidwell, Kritina Holden, and Jill Butler	

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Subject Code CS114792	Augmented Reality and Virtual Reality Lab	L = 0	T = 0	P = 2	Credits = 1
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	25	--	25	50	3 Hours

Course Objectives	Course Outcomes
Course objective is to provide students with practical experience in developing applications and experiences using augmented reality (AR) and virtual reality (VR) technologies. The lab aims to equip students with the necessary skills and knowledge to create immersive and interactive AR and VR applications, games, and simulations. By the end of the lab, students should be proficient in AR and VR development techniques and have a solid understanding of the potential applications of these technologies in the gaming industry.	**Upon completion of the Augmented Reality and Virtual Reality Lab, students should be able to:** **CO1** Demonstrate a comprehensive understanding of augmented reality and virtual reality technologies, their underlying principles, and their applications in the gaming industry. **CO2**: Apply AR marker-based tracking techniques to develop AR applications that can place virtual objects in the real world. **CO3**: Design and develop virtual reality applications that provide immersive experiences, including navigation, object interaction, and scene transitions. **CO4**: Implement AR image recognition systems to overlay relevant virtual content on specific real-world images or markers. **CO5**: Apply physics simulation concepts in virtual reality environments to create realistic interactions and dynamics.

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List of Experiments 12 Hrs

1. AR Marker-Based Object Placement: Design an augmented reality application that allows users to place virtual objects in the real world using marker-based tracking.
2. VR 360-Degree Video Player: Develop a virtual reality application that can play 360-degree videos, allowing users to experience immersive video content.
3. AR Image Recognition: Implement an augmented reality application that recognizes specific images and displays relevant 3D models or information on top of them.
4. VR Interactive Environment: Create a virtual reality environment where users can interact with virtual objects and navigate through different scenes using motion controllers.
5. AR Indoor Navigation: Develop an augmented reality navigation system that provides indoor directions and guidance using markerless tracking or SLAM (Simultaneous Localization and Mapping) techniques.
6. VR Physics Simulation: Build a virtual reality application that simulates real-world physics interactions, such as object collisions, gravity, and rigid body dynamics.
7. AR Interactive Book: Create an augmented reality book or educational application that brings static content to life through interactive 3D models, animations, and multimedia elements.
8. VR Game Development: Design and develop a virtual reality game using a game engine, incorporating immersive gameplay mechanics and VR-specific interactions.
9. AR Remote Assistance: Implement an augmented reality application that enables remote assistance, allowing users to share their live view and receive guidance or instructions from an expert.
10. VR Training Simulation: Build a virtual reality training simulation for a specific scenario or industry, such as flight simulation, medical training, or hazardous environment training, incorporating realistic interactions and scenarios.

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Text Books:

S.No.	Title	Author(s)	Publisher
1	Virtual Reality and Augmented Reality: Myths and Realities	Mel Slater and Maria V. Sanchez-Vives.	
2	Augmented Reality: Principles and Practice	Dieter Schmalstieg and Tobias Hollerer	
3	Virtual Reality: Concepts and Technologies	Philippe Fuchs and Franco Tecchia	

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile"	Tony Parisi	
2	Augmented Reality for Developers: Build Exciting AR Applications with Unity, ARCore, ARKit, and Vuforia	Jonathan Linowes	

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Subject Code	Capstone Project Phase I	L=0	T=0	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	50	0	50	100	3 Hours

Guideline for Allocation of project:

1. Information regarding broad area must be made available to the students well in advance (may be during previoussemester).
2. Information must cover following parameters. I. Broad area: Subject or expertise/application area. II. Required skills: Knowledge of subject(s), software, tools & other characteristics. III. Type of project: Hardware, software, design, survey, study based etc. IV. Guide available: Name of Guide (S) from Department & Institute. V. Other related information depending upon specific branch & institute.
3. It is also recommended to give proper counseling to pick up suitable project.
4. Students must get chance to select projects as per their choice or decided mutually between students anddepartment faculty (HoD) concern.
5. One project group must contain maximum four students, however students can do project individually but it shouldbe approved by department.
6. Compiled list of projects must be submitted to the University within 25 days of start of semester.
7. Compiled list may contain following parameters.

Monitoring of project:

1. It is recommended to give projects as per the specializations of existing faculty of the department instead of outsideperson/agency.
2. Project must be allocated, developed and monitored by department / institution itself, but not by outside agencies.
3. Regular review by guide is recommended to ensure development & contribution of students. Internal

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Evaluation & Submission of project:

1. Evaluation of project would be as per the examination scheme of the University, which is based on internal as well as external evaluation.
2. Internal assessment requires submission of project report for getting approved by the concern authority. However printing and binding would be as per the conventional format.
3. Evaluation will be based on live demonstration / presentation and Viva.
4. Final submission of project is expected as, Submission of a copy to the University,• One copy to the Institution central library,• One copy to the department.•

External Evaluation:

External assessment of project would be like conduction of practical exams of University, and must be executed asper the norms of practical exams.

NOTE: Completion of Project outside the department/Institution should not be encouraged

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Professional Elective-III

Subject Code CS102701	Internet and Web Technology	L = 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
1. Describe the important features of the Web and Web browser software 2. Evaluate e-mail software and Web-based e-mail services 3. Use FTP and other services to transfer and store data 4. Demonstrate the use of real-time chat and briefly describe the history of the wireless Internet 5. Create HTML documents and enhance them with browser extensions	**Students will be able to:** **CO1** Understand, analyze and apply the role of languages like HTML, DHTML, CSS, XML, Javascript, and web applications **CO2** Analyze a web page and identify its elements and attributes. **CO3** Create XML documents and XML Schema. **CO4** Learn about various security issues. **CO5** Will be able to plan and host websites.

UNIT-I INTRODUCTION TO INTERNET: Introduction, Evolution of Internet, Internet Applications, Internet Protocol -TCP/IP, UDP, HTTP, Secure Http(Shttp) Internet Addressing – Addressing Scheme – Ipv4 & IPv6, Network Byte Order, Domain Name Server and IP Addresses, Mapping . Internet Service Providers, Types Of Connectivity Such As Dial-Up Leaded Vsat Etc. Web Technologies: ThreeTier Web Based Architecture; Jsp, Asp, J2ee, .Net Systems	**CO1** **8Hrs**

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UNIT-II HTML CSS AND SCRIPTING: HTML - Introduction, Sgml, Dtd(Document Type Definition, Basic Html Elements, Tags and usages, HTML Standards , Issues in HTML Dhtml: Introduction Cascading Style Sheets: Syntax ,Class Selector, Id Selector Dom (Document ObjectModel) &DSO (Data Source Object) Approaches To Dynamic Pages: Cgi, Java Applets, Plug Ins, Active X, Java Script –Java Script Object Model, Variables-Constant – Expressions, ConditionsRelational Operators- Data Types – FlowControl – Functions & Objects-events and event handlers – Data type Conversion & Equality – Accessing HTML form elements	**CO2** **8Hrs**
UNIT-III XML: What is XML – Basic Standards, Schema Standards, Linking & Presentation Standards, Standards thatbuild on XML, Generating XML data, Writing a simple XML File, Creating a Document type definition, Documents&Data ,DefiningAttributes & Entities in the DTD ,Defining Parameter Entities & conditional Sections, Resolving a namingconflict, UsingNamespaces, Designing an XML data structure, Normalizing Data, NormalizingDTDS	**CO3** **8 Hrs**
UNIT-IV INTERNET SECURITY & FIREWALLS: Security Threats From Mobile Codes, Types Of Viruses, ClientServer Security Threats, Data & Message Security, Various electronic payment systems, Introduction to EDI, Challenges–Response System, Encrypted Documents And Emails,Firewalls: Hardened Firewall Hosts, Ip- Packet Screening, ProxyApplication Gateways, Aaa (Authentication, AuthorizationAnd Accounting).	**CO4** **8Hrs**
UNIT-V WEBSITE PLANNING & HOSTING: Introduction, Web Page Lay-Outing, Where To Host Site, MaintenanceOf Site, Registration Of Site On Search Engines And Indexes, Introduction To File Transfer Protocol, Public DomainSoftware, Types Of Ftp Servers (Including Anonymous),Ftp Clients Common Command. Telnet Protocol, Server Domain,Telnet Client, Terminal Emulation. Usenet And Internet Relay Chat.	**CO5** **8 Hrs**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Internet & Intranet Engineering	Daniel Minoli	TMH
2	Internet for Every One	Alexis Leon and Mathews Leon	Tech World

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Using HTML 4, XML and JAVA	Eric Ladd, Jim O'Donnel	Prentice Hall of India -1999
2	Beginning Java Script	Paul Wilton	SPD Publications
3	Frontiers of Electronics of Commerce	Ravi kalakota& Andrew B. Whinston	Addison Wesley

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(GAMING TECHNOLOGY)

Subject Code CS110722	Natural Language Processing	L = 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: **1.** To understand the concepts of morphology, syntax, semantics and pragmatics of the language. **2.** To recognize the significance of pragmatics for natural language understanding. **3.** To describe the simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation. **4.** To describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.	**Students will be able to:** **CO1** Understand language and the tools that are available to efficiently study and analyze large collections of text. **CO2** Analyze and discuss the effects of electronic communication on our language. **CO3** Learn natural language processing with manual and automated approaches. **CO4** Learn computational frameworks for natural language processing.

UNIT 1 Introduction:A computational framework for natural language, description of English or an Indian language inthe frame work, lexicon, algorithms and data structures for implementation of the framework, Finitestate automata, the different analysis levels used for NLP (morphological, syntactic, semantic,pragmatic, Recursive and augmented transition networks. Applications like machine translations.	**CO1** **7 Hrs**
UNIT 2 WordLevel& Syntactic Analysis:Word Level Analysis: Regular Expressions, Finite-	**CO2** **8 Hrs**

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State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine readable dictionaries and lexical databases, RTN, ATN.	
UNIT 3 SemanticAnalysis:Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.	**CO3** **7 Hrs**
UNIT 4 Natural Language Generation:Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.	**CO4** **7 Hrs**
UNIT 5 Information Retrieval & Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.	**CO5** **7 Hrs**

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Text Books:

S. No.	Title	Author(s)	Publisher
1	Natural Language Understanding	James Allen	Pearson Education, 2002
2	NLP: A Paninian Perspective	AksharBharati, VineetChaitanya, and Rajeev Sangal	Prentice Hall, 2016
3	Meaning and Grammar	G. Chirchia and S. McConnell Ginet	MIT Press, 1990

Reference Books:

S. No.	Title	Author(s)	Publisher
1	An Introduction to NLP, CL&SR	Daniel Jurafsky and James H. Martin	Pearson Education, 2006.
2	Natural language processing in Prolog	Gazdar, &Mellish	Addison-Wesley

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Natural Language Processing	Prof. PawanGoyal	IIT Kharagpur
2	Natural Language Processing	Prof. Pushpak Bhattacharya	IIT Bombay

Web Reference:https://www.coursera.org/specializations/natural-language-processing

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Subject Code CS111723	Object Oriented DBMS (OODBMS)	L = 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: 1. This course discusses the requirements for advanced database features in database applications. 2. Introduce Parallel and Distributed databases. 3. Understand the enhanced data models for advanced applications. 4. Examines the concepts of various emerging database technologies.	**Students will be able to:** **CO1**. Able to understand the needs and concepts of object-oriented database, spatial database, web database, data warehousing and data mining. **CO2**. Able to analyze, design and evaluate the construct of various advanced databases such as object-oriented, object-relational, semi-structured, unstructured and distributed databases. **CO3**. Be able to implement practical solutions to GIS database problems using OO/OR database, spatial database, data warehousing and data mining approaches. **CO4.** Be able to understand the architecture and design of client server, parallel and distributed database. **CO5.** Be able to understand the concept of web and structured data like XML.

UNIT 1: : The extended Entity- Relationship Model and Object model: The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes,				**CO 1**

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Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.	**7Hrs**
UNIT 2: Object oriented databases: Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS.	**CO 2** **8 Hrs**
UNIT 3: Object relational and extended relational databases: Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS	**CO 3** **7 Hrs**
UNIT 4: Parallel and distributed database and Client server architecture: Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture.	**CO 4** **7 Hrs**
UNIT 5: Databases on the web and semi structured data: Web interfaces to the Web, Overview of XML; Structure of XML data, Document schema, Querying XML data; Storage of XML data, XML applications; The semi structured data model, Implementation issues, Indexes for text data. Enhanced Data Models for Advanced Applications: Active database concepts. Temporal database concepts. Spatial databases, Concepts and architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.	**CO 5** **7 Hrs**

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Text Books:

S.No.	Title	Author(s)	Publisher
1	Object Oriented Interfaces and Databases	Rajesh Narang	Prentice Hall of India
2	Database Management Systems, Raghu Ramakrishnan	Johannes Gehrke	McGraw-Hil

Reference Books:

S.No.	Title	Author(s)	Publisher
1	Fundamentals of Database Systems	Elmasri and Navathe	Pearson Education
2	Database System Concepts	Korth, Silberchatz, Sudarshan	McGraw-Hill

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(GAMING TECHNOLOGY)

Subject Code CS114724	**AI in Gaming**	**L = 3**	**T = 0**	**P = 0**	**Credits = 3**
Examination Scheme	**ESE**	**CT**	**TA**	**Total**	**ESE Duration**
	100	**20**	**30**	**150**	**3 Hours**

Course Objectives	**Course Outcomes**
The students should be able to understand and use AI techniques for generating efficient, intelligent behaviour in games. Additional attention is to be given to AI algorithms for improving game play experience.	**After completion of course, students would be able to:** **CO1** Understand identify tasks that can be tackled using AI techniques. **CO2** Apply appropriate AI technique for the problem under investigation. **CO3** Create efficient and robust AI algorithms for game tasks. **CO4** Apply learning mechanisms to gaming problems. **CO5** Apply AI algorithms for improving game play experience.

Unit 1: Introduction

Introduction to Game AI, kind of AI used in game development, model of game AI, AI engine structure.

Unit 2: Movement Algorithms and Steering Behavior

kinematic movement algorithms, problems related to the steering behaviour of objects and Solutions. Coordinated Movement and Motor Control This unit discusses the concepts related to coordinated movements and motor control.

Unit 3: Pathfinding

Basic Path finding Algorithms in game development, Path finding for complex solutions

Unit 4:

Decision-Making and Uncertainty decision trees and state machines for game development, models for implementing knowledge uncertainty, such as fuzzy logic and Markov systems.

Unit 5:

Introduction to Learning Mechanisms Board game theory and discusses the implementation of some key algorithms, such as minimax and negamax, Random Number Generation and Minimaxing, algorithms for implementing action prediction, decision learning and reinforcement learning.

Text Books:

S.No.	Title	Author(s)	Publisher
1	Artificial Intelligence and Games,	Georgios N. Yannakakis and Julian Togelius,	Springer International Publishing, 2018.
2	Artificial Intelligence for Games,	Ian Millington and John Funge,	CRC Press; 2nd edition, 2009.

Reference Books:

S. No.	Title	Author(s)	Publisher
1	https://www.athabascau.ca/syllabi/comp/comp452.php		
2	https://www.udemy.com/course/artificial-intelligence-for-simple-games/		

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(GAMING TECHNOLOGY)

Subject Code CS115725	Industrial IOT	L = 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: 1. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application. 2. Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students	**Students will be able to:** **CO1**Analyze and discuss the effects of electronic communication on our language. **CO2** Ability to identify, formulate and solve engineering problems by using Industrial IoT. **CO3**Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability. **CO4**Analyze and discuss next generation sensors and AR,VR concepts. **CO5** Understand industrial applications and analyse the case studies of IIOT.

UNIT 1: Introduction to Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions,	**CO 1** **7 Hrs**

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Support System for Industry 4.0, Smart Factorie	
UNIT 2: Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	**CO2** **8 Hrs**
UNIT 3:IIoT Data Monitoring & Control: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology	**CO3** **7 Hrs**
UNIT 4: Cyber Physical Systems: Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis	**CO4** **7 Hrs**
UNIT 5: Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management **Case Studies of IIoT Systems:** IIoT application development with Embedded PC based development boards, Development of mini Project on new version of Operating systems and Edge development board	**CO5** **7 Hrs**

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Text Books:

S. No.	Title	Author(s)	Publisher
1	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Publications: Apress
2	The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics	Bartodziej, Christoph Jan Springer	Publication in the field of economic science.

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Embedded System: Architecture, Programming and Design	Rajkamal	TMH3
2	Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems	Dr.OvidiuVermesan, Dr. Peter Friess	River Publishers

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Open Elective-II

Subject Code CS100741	Advanced Statistical Method	L = 3	T = 0	P = 0	Credits = 3
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours

Course Objectives	Course Outcomes
The objective of the course to: 1. Ability to summarize and present data numerically and visually. 2. Knowledge of which statistical methods to use in which situations 3. Ability to think critically about data-based claims and quantitative arguments 4. Ability to learn new statistical analysis techniques on your own	**Students will be able to:** **CO1** Apply statistical methods and hypothesis testing to business problems **CO2** Learn the details and complexities of Analysis of Variance (ANOVA) **CO3** Learn some of the details and complexities of Multiple Regression (MR) **CO4** Communicate statistical ideas to a diverse audience. **CO5** Formulate a statistical solution to real-data research problems

UNIT 1 Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement). Sampling distribution of sample mean, stratified random sampling.	**CO1** **7 Hrs**
UNIT 2 Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Multiple regression& multiple correlation. Analysis of variance (one way,	**CO2** **7 Hrs**

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two ways with as well as without interaction).	
UNIT 3 Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation. **Sufficient Statistic:** Concept & examples, complete sufficiency, their application in estimation. **Test of hypothesis:** Concept & formulation. Type 1 and Type II errors, Neyman Pearson lemma, Procedures of testing.	**CO3** **8 Hrs**
UNIT 4 Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test. Kolmogorov-Smirnov test. Spearmans and Kendall's test Tolerance region**.**	**CO4** **7 Hrs**
UNIT 5 Basics of Time Series Analysis & Forecasting: Stationary. ARIMA Models: Identification, Estimation and Forecasting.	**CO5** **7 Hrs**

Text Books:

S. No.	Title	Author(s)	Publisher
1	Probability and Statistics for Engineers (Fourth Edition)	LR. Miller, J.E. Freund and R.Johnson	Prentice Hall India Learning PrivateLimited
2	Fundamentals of Statistics (vol. 1 & vol. II)	A. Goon. M. Gupta and B. Dasgupta.	World Press

Reference Books:

S. No.	Title	Author(s)	Publisher
1	Discovering Statistics Using R.	Field, A., Miles, J., & Field, Z. (2012).	Thousand Oaks, CA: Sage

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Subject Code CS100742	Enterprise Resource Planning	L = 3	T = 0	P = 0	Credits = 3
Examination Scheme	ESE	CT	TA	Total	ESE Duration
	100	20	30	150	3 Hours
	Minimum number of class tests to be conducted=02			Minimum Assignments=02	

Course Objectives	Course Outcomes
• To know the basics of ERP and business modules of ERP. • To understand the key implementation issues of ERP. • To be aware of some popular products in the area of ERP. • To appreciate the current and future trends in ERP	**CO1** To know the basics of ERP **CO2** To understand the key implementation issues of ERP **CO3** To know the business modules of ERP **CO4** To be aware of some popular products in the area of ERP **CO5** To appreciate the current and future trends in ERP

Unit-I Introduction: Overview of enterprise systems ñ Evolution - Risks and benefits – Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems. Introduction to SAP

Unit- II ERP Solutions and Functional Modules: Overview of ERP software solutions- Small, medium and large enterprise vendor solutions, BPR and best business practices - Business process Management, Functional modules.

Unit-III ERP Implementation: Planning Evaluation and selection of ERP systems - Implementation life cycle -

ERP implementation, Methodology and Frame work- Training ñ Data Migration – People Organization in implementation-Consultants, Vendors and Employees.

Unit-IV Post Implementation: Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Emerging Trends on ERP: Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics - Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

Unit V ERP and Related Technologies. ERP and Related Technologies. Business Process Reengineering (BPR). Management Information System (MIS). Executive Information System. Decision support System (DSS). Supply Chain Management (SCM) Other Related Technologies of SCM E-Procurement; E-Logistics; Internet Auctions; E-markets; Electronic Business Process Optimization; Business Objects in SCM; E commerce

Text Books:

S. No.	Title	Author(s)	Publisher
1	ERP demystified	Alexis Leon	Tata McGraw-Hill,2008
2	Essentials of Business Process and Information System	Sinha P. Magal and Jeffery Word	Wiley India,2012

Reference Books:

S. No.	Title	Author(s)	Publisher
1	ERP and Supply Chain Management	Christian N. Madu	CHI4
2	Implementing SAP ERP Sales & Distribution	Glynn C. Williams	McGraw-Hill