



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE
www.sathyabama.ac.in

SCHOOL OF COMPUTING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Minutes of Meeting

Date: 22.4.2022

Time: 10.00 AM

Venue: Board Room

Agenda:

- Newly added courses for the following courses for B.E. CSE :
 - Cyber Physical Systems- SCSA1701
 - Artificial Intelligence- SCSA1702
 - Cyber Physical Systems Lab- SCSA2701
- Updating the course contents for the following courses for B.E. CSE :
 - SCSA1619 Design Thinking and Innovations

Minutes

- In order to improve students' problem-solving, analytical, and spatial thinking abilities, the Design Thinking and Innovations theory course will be converted into a practical course.
- The design and technique used for the capstone project work comply to the design standards set out by ASTM, ISO, ESA, IEEE, and other organizations.

All the external members appreciated the updates made in the above course.

Convener: Dr. T.Sasikala, Dean School of Computing

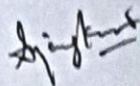
External Members:

Academic Expert

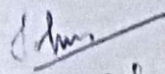
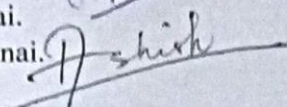
- Dr.T.G.Sambanthan, Professor & Head, Department of Computer Science & Engineering NITTTR, Chennai.
- Dr. Riyaz Ahamed, Senior lecturer, School of Computer Science and Engineering, Taylor's University, Malaysia.

Industry Experts

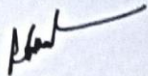
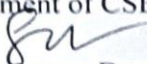
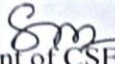
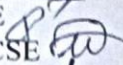
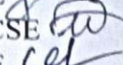
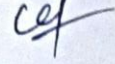
- Dr.V.Sankaran, Program Manager, Engineering and R&D Services, HCL Technologies

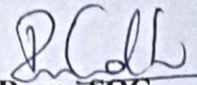
- Mr. Ajay Kumar, CTO, Cognibot Robotics, Chennai. 

Alumni

- Mr. Johnson S, Project Test Manager, TCS , Chennai. 
- Mr. Ashish Chopra, Senior BDE, Freshworks, Chennai. 

Internal Members:

- Dr.L. Lakshmanan, HoD, Department of CSE 
- Dr.S.Vigneswari, HoD of CSE 
- Dr. Ulagamuthalvi, Associate Professor, Department of CSE 
- Dr. S. Murugan, Professor, Department of CSE 
- Dr. Prem Jacob, Associate Professor, Department of CSE 
- Dr. Usha Nandini, Associate Professor, Department of CSE 
- Dr. Ramya Franklin, Asst. Professor, Department of CSE 


Dean - SOC

SCSA1319	DESIGN THINKING AND INNOVATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the idea of Human-centered design and design thinking.
- To understand the concept of empathy and its technique.
- To understand observation phase and insight concepts in design thinking.
- To leverage the use of prototype in design thinking
- To design business models using the design thinking innovations.

UNIT 1 HUMAN-CENTERED DESIGN 9 Hrs.

Introduction to Human-centered Design – Applications of Human-centered Design – Design Process – Mindsets of Human-centered designer – Principles and process of Design Thinking – Planning a Design Thinking Project

UNIT 2 INTERVIEWING & EMPATHY-BUILDING TECHNIQUES 9 Hrs.

Introduction to Empathy – Practicing Empathy – Empathy vs. Sympathy – Methods for Empathetic design – Tips for Interviews – Empathy Interviews – Understanding and defining the problem

UNIT 3 MAKING SENSE OF OBSERVATIONS & INSIGHTS 9 Hrs.

Observation Phase – Tips for observing – Insights definition – Problems with Insights – Case study: Insight problems in the history of aviation – Creativity process, principles and techniques – Evaluation of ideas

UNIT 4 DEVELOPING AND TESTING PROTOTYPES 9 Hrs.

Role of Prototype in design thinking – Types of prototyping – Guidelines for prototyping – Lean Startup Method for Prototype Development – Visualization and presentation techniques – Testing prototypes: Feedbacks and Maximize learning

UNIT 5 DEFINING & TESTING BUSINESS MODELS & BUSINESS CASES 9 Hrs.

Business Model Definition – Design thinking to design business model – Innovation in Business Model – Pursuing innovation in business – Business model innovations cases – Kano Model – Desirability Testing.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand and apply human-centered design process and planning of design thinking project

CO2: Use empathetic design in the interview process

CO3: Identify need for observations and insights problems and come up with creative ideas in design thinking

CO4: Understand, build and test the prototypes

CO5: Use design thinking concepts to build successful business models.

CO6: Implement innovation techniques in business models.

TEXT /REFERENCE BOOKS

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West (2018).
2. Design Kit by IDEO.org. "The field guide to human centered design." (2015), ISBN: 978-0-9914063-1-9.
3. <https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy>
4. <https://www.interaction-design.org/literature/article/stage-4-in-the-design-thinking-process-prototype>
5. <https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning>
6. <https://uxplanet.org/what-are-insights-aa1f2d1b3b9c>
7. <https://labs.sogeti.com/using-design-thinking-to-design-business-models/>
8. <https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/>

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

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SCSBDPROJ	DESIGN THINKING AND INNOVATIONS	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To apply knowledge in Real time problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to Engineering /Non Engineering problems.

Activity 1

Design thinking introduction

- Phases of design thinking- a study approach.
- Group Discussion on Ideation- Users perspective.
- Formation of team – Thinking skills- Brain storming.

Activity 2

Problem identification (phase I)

- Selecting user requirements.
- Survey on various user's applications.
- Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.

Activity 3

Problem identification (Phase II)

- Study of an application and its importance to end user.
- Various models of an applications.
- Finalize the identified problem.

Activity 4

Design ideation and various stages

- Sketch design diagram.
- Architecture or full diagrammatic study.

Activity 5

Review and upgradation

- Review of the ideation (one to one interaction).
- Feedback.
- Upgradation plan.

Activity 6

Implementation (Phase I)

- Build the prototype using available resources.
- Record Module diagrams.

Activity 7

Implementation(Phase II)

- Display and review of the prototype.
- Record its functionality and its Usage-Technical manual.

Activity 8

Testing

- To test the product design with real time environment.
- Record Process-user manual.

Activity 9

IPR-Activity I

- To study various IPR activities.
- To prepare for IPR Process.
- To file an IPR.

Activity 10

Start-ups Formation

- To exhibit the product to public: feedback approach.
- To prepare full documentation.
- Start-ups registration/apply patent/publish paper/submit model/prototype/Apply for seed/submit as research proposal.

COURSE OUTCOMES

On completion of the course, the students will be able to

CO1 - Solve real world problems by applying knowledge across domains.

CO2 - Develop various design products, processes or technologies for sustainable and socially relevant applications.

CO3 - Demonstrate knowledge of resource utilization/budgets to Implement appropriate methodologies.

CO4 - Execute tasks by application of engineering standards/ requirements/ design criteria, within timelines.

CO5 - Conduct extended investigation that results in the translation of idea to product / production of a research thesis/ developing a proof of concept.

CO6 - Communicate well organized technical and scientific findings effectively in written and oral forms, following ethical and professional norms.

TEXT / REFERENCE BOOKS

1. Mueller-Roterberg, Christian. "Handbook of Design Thinking." Hochschule Ruhr West (2018).
2. Design Kit by IDEO.org. "The field guide to human centered design." (2015), ISBN: 978-0-9914063-1-9.
3. <https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy>.
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5. <https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning>.
6. <https://uxplanet.org/what-are-insights-aa1f2d1b3b9c>.
7. <https://labs.sogeti.com/using-design-thinking-to-design-business-models/>.
8. <https://www.northeastern.edu/graduate/blog/implementing-business-model-innovation/>.

COURSE ASSESSMENT METHODS

Direct Methods	Design innovation Reviews Report Submission IPR Registration
Indirect Methods	Course Exit Survey

Assessment Method	Rubrics	Marks allotted	Assessment Type
Review 1	1	30	CAE
Internal Guide	2	10	CAE
IPR Process and Registration	5	10	ESE
Total – Internal		50	
Final Review	3	30	ESE
Report Submission	4	20	ESE
Total –External		50	



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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Minutes of Meeting

Date: 8.12.2022

Time: 9.30 AM

Venue: Board Room

Agenda:

- Updating the course contents for the following courses for B.E. CSE
 - SCSA1204 Python Programming
 - SCSA3019 Augmented and Virtual Reality
- Revision of course contents of Physics and Chemistry courses.
- Inclusion of Parallel and Distributing Computing course in the curriculum.
- Inclusion of guidelines and rubrics for project Phase 1 and Phase 2

Minutes

- Based on the staff and student feedback the course contents of Python programming and Augmented & Virtual Reality courses were modified and new course are included.
- The course contents of Engineering Physics and Engineering Chemistry courses were revised as per the requirement of Basic Sciences component stated by the ABET team.
- Parallel and Distributed Computing course will be included as a core course in the B.E Computer Science and Engineering curriculum from the academic year 2023-24.
- The updates made in the above courses were well-received by all of the external members.

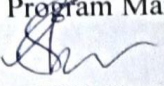
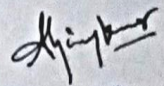
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External Members:

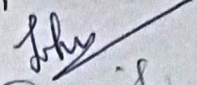
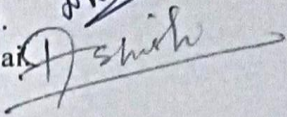
Academic Expert

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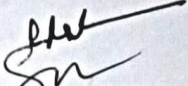
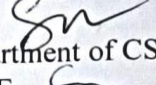
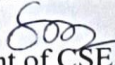
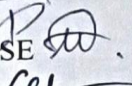
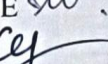
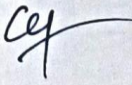
Industry Experts

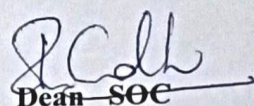
- Dr.V.Sankaran, Program Manager, Engineering and R&D Services, HCL Technologies 
- Mr. Ajay Kumar, CTO, Cognibot Robotics, Chennai. 

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- Dr. Ramya Franklin, Asst. Professor, Department of CSE 


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Revision 2022-2023-Even

SCSA1211 (Old)	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To build and package Python modules for reusability.
- To understand how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To design and program Python applications.

UNIT 1 INTRODUCTION

9Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Data Types - Built-in function - Conditional statements - Iterative statements- Input/output functions - Compound Data Types - Nested compound statements
– Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES

9Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement- Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT 3 GUI PROGRAMMING

9 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK

9Hrs.

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server – Email – URLAccess.

UNIT 5 CASE STUDY

9Hrs.

Web Programming using Python Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.

COURSE OUTCOMES

- CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
CO2: Do the decision making and write functions in Python.
CO3: Explain how to design GUI Applications in Python and evaluate different database operations.
CO4: Design and develop Client Server network applications using Python.
CO5: Ability to design real life situational problems and think creatively about solutions of them.
CO6: Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT /REFERENCE BOOKS

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.
2. Python Notes for Professionals by Stack Overflow Documentation (<https://books.goalkicker.com/PythonBook/>)
3. Dr. Charles R. Severance, "Python for Everybody- Exploring Data Using Python 3", 2016.
4. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Bookshelf, 2nd Edition, 2014.
6. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks



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SCSA1211 (Revised)	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To build and package Python modules for reusability.
- To understand how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To design and program Python applications.

UNIT 1 INTRODUCTION

9 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Data Types - Built-in function – Conditional statements - Iterative statements- Input/output functions - Compound Data Types - Nested compound statements

UNIT 2 OBJECT ORIENTED CONCEPTS

9 Hrs.

Class – Objects – Constructors –Getters and Setters- Polymorphism – Encapsulation -Inheritance -Data Abstraction- Method Overloading-Method overriding-Data Hiding-Import Class

UNIT 3 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES

9 Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT 4 GUI PROGRAMMING

9 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, list box, message, radio button, text, spin box.

UNIT 5 DATABASE AND NETWORK

9 Hrs.

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socket module - Client – Server –Email – URL Access.

Max. 45 Hrs.

COURSE OUTCOMES

On Completion of course student will able to

- CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python.
CO2: Do the decision making and write functions in Python.
CO3: Explain how to design GUI Applications in Python and evaluate different database operations.
CO4: Design and develop Client Server network applications using Python.
CO5: Ability to design real life situational problems and think creatively about solutions of them.
CO6: Apply the best features of mathematics, engineering and natural sciences to program real life problems.

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- 1 Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.
- 2 Python Notes for Professionals by Stack Overflow Documentation (<https://books.goalkicker.com/PythonBook/>)
- 3 Dr. Charles R. Severance, "Python for Everybody- Exploring Data Using Python 3", 2016
- 4 Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Pragmatic Bookshelf, 2nd Edition, 2014
- 5 Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCSA3019	AUGMENTED AND VIRTUAL REALITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To make students know the basic concept and framework of virtual reality.
- To teach students the principles and multidisciplinary features of virtual reality.
- To teach students the technology for multimodal user interaction and perception in VR, in particular the visual, auditory and haptic interface and behavior.
- To teach students the technology for managing large scale VR environment in real time.
- To provide students with an introduction to the VR system framework and development tools.

UNIT 1 INTRODUCTION OF VIRTUAL REALITY

9 Hrs.

Fundamental Concept and Components of Virtual Reality- Primary Features and Present Development on Virtual Reality - 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.

UNIT 2 I/O INTERFACE AND TECHNIQUES IN VR

9 Hrs.

Multiple Modals of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual / Auditory / Haptic Devices. Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp.

UNIT 3 VISUAL COMPUTATION IN VIRTUAL REALITY

9 Hrs.

Fundamentals of Computer Graphics-Software and Hardware Technology on Stereoscopic Display-Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering -Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtoolsetc

UNIT 4 INTRODUCTION OF AUGMENTED REALITY

9 Hrs.

System Structure of Augmented Reality-Key Technology in AR-- AR software development - AR software. Camera parameters and camera calibration. Marker-based augmented reality. Pattern recognition. AR Toolkit

UNIT 5 APPLICATION OF VR IN DIGITAL ENTERTAINMENT

9 Hrs.

VR Technology in Film & TV Production.VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.3D user interfaces - Why 3D user interfaces. Major user tasks in VE. Interaction techniques for selection, manipulation and navigation.3DUI evaluation.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to CO1 - Design and implement the VR system.

CO2 - Implement the Augmented Reality software.

CO3 - Analyze and design the framework in VR using various software development tools in VR. CO4 - Design the multi modal user interface.

CO5 - Describe the principles and features of VR and AR.

CO6 - Recognize the technologies used to manage the large scale VR environment in real time.

TEXT / REFERENCE BOOKS

- 1 Sherman, William R. and Alan B. Craig. Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
- 2 Fei GAO. Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
- 3 Guangran LIU. Virtual Reality Technology, Tsinghua Press, Jan. 2011.
- 4 Burdea, G. C. and P. Coffet. Virtual Reality Technology, 2nd Edition. Wiley-IEEE Press, 2003/2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

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SCSA3092	AUGMENTED AND VIRTUAL REALITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Learn the fundamentals of virtual and augmented reality.
- Identify the contrasts between AR/VR concepts and technologies.
- Recognize the core principles of Virtual Reality, such as presence and immersion.
- Examine the usability of AR/VR applications and their utilization of AR/VR features.
- Using the UNITY platform for business, design and prototype effective AR/VR apps.

UNIT 1 INTRODUCTION TO AUGMENTED REALITY AND VIRTUAL REALITY

9 Hrs.

A Brief History of Augmented Reality - Displays - Definition and Scope (Multimodal Displays, Spatial Display Model, and Visual Displays) - AR: Strong vs. Weak - AR Applications - AR Challenges. Scope and Definition - Types of VR - VR Characteristics - Basic VR Environments - VR Environment Limitations - Virtual Reality Hardware Requirements: Immersion vs. Presence.

UNIT 2 INTERACTION FOR AR/VR ENVIRONMENTS DESIGN

9 Hrs.

Identifying user needs is the first step in the interaction design process. - AR/VR design and analysis - Typical AR/VR Graphical Metaphors - Affordances in AR/VR - Human Data Processing - Design for Perception and cognition - User experience(UX) guidelines for AR/VR - UX obstacles for AR/VR - AR/VR prototypes - AR/VR prototype evaluation.

UNIT 3 INTRODUCTION TO UNITY

9 Hrs.

Overview of Unity: Windows, Interface, Navigation, Terminology, Game Objects, Hierarchy, Parenting Objects - Asset Store, Importing Plug-ins - Terrain Creation, Materials, Colors, and Transparency - Introduction to Monobehaviors: Awake, Start, and Update

UNIT 4 INTRODUCTION TO VUFORIA AND PHYSICS IN UNITY

9 Hrs.

Overview of Vuforia: Interface, Navigation, Terminology, Image Targeting, Custom Images - Introductory to Scripting: Definitions, Creating Objects, Accessing Components, Debugging, Lists, Loops - Overview of Physics in Unity

UNIT 5 EXPANDING ON SCRIPTING AND INTERACTIONS

9 Hrs.

Creating Trigger Events - Manipulating Components in Scripts - Programming Interactions between Objects and Tracked Images - Designing a simple User Interface in AR - Navigating World Space for Objects and User - Introduction to colliders and their use: OnCollisionEnter, OnCollisionExit, OnCollisionStay, OnTrigger vs OnCollision - Rigidbodies and how Colliders report to them – Case Study to building a real time application using AR and VR.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1: Describe the principles and features of VR and AR.
- CO2: Understand the design of AR and VR software.
- CO3 : Design the multi model user interface using UNITY
- CO4: Understand the Vuforia and Scripting Physics
- CO5: Able to create real time application using AR and VR

TEXT / REFERENCE BOOKS

1. Sherman, William R. and Alan B. Craig. Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
2. Fei GAO. Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
3. Guangran LIU. Virtual Reality Technology, Tsinghua Press, Jan. 2011.
4. Burdea, G. C. and P. Coffet. Virtual Reality Technology, 2nd Edition. Wiley-IEEE Press, 2003/2006.
5. Schmalstieg, D., & Hollerer, T. (2016). Augmented reality: principles and practice. Addison-Wesley Professional

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

Added Content

SCSA1701	CYBER PHYSICAL SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

UNIT 1 INTRODUCTION TO INDUSTRY 4.0 & CYBER PHYSICAL SYSTEM

9 Hrs.

Industry 4.0 - Globalization and Emerging Issues, The Fourth Revolution - Smart and Connected Business Perspective, Basics of Industrial IoT - Industrial Processes - Industrial Sensing & Actuation, Industrial Internet Systems - Basic principles of design and validation of CPS - Cyber-Physical Systems (CPS) in the real world- Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT 2 EMBEDDED SYSTEMS MODELING AND DESIGN AND CPS

9 Hrs.

Platform components - Embedded Systems definition, specification, and languages. Concepts, requirements, examples. Embedded system models at different abstraction levels. Test benches, design under test, Intellectual Property components. Discrete event simulation, semantics, algorithms. Design, analysis techniques for decentralized computer architectures, communication, and hardware-software systems. -Cyber Physical System Hardware Platform - Processors, Sensors, Actuators - Network - WirelessHart, CAN, Automotive Ethernet – Software stack -Real-Time Operating system (RTOS) -Scheduling Real Time control tasks.

UNIT 3 SENSORS, ACTUATORS AND SENSOR NETWORKS

9 Hrs.

Sensors, Actuators and Sensor Networks & Real-Time and Distributed Systems - Fundamental principles and applications of sensors, actuators. Smart sensors and micro sensor/micro actuator array devices. Introduction to signal processing and sensor/actuator networks, deployment and architecture, wireless communication, multiple access control layer, data gathering, routing and querying, collaborating signal processing - Time dependent systems, clock synchronization, real-time communication protocols, specification of requirements, task scheduling. Validation of timelines, real-time configuration management. Middleware architecture for distributed real-time and secure services.

UNIT 4 SECURITY OF CYBER PHYSICAL SYSTEMS

9 Hrs.

Security of Cyber Physical Systems -Embedded and CPS security - attacks and countermeasures, authentication, identification, confidentiality, data integrity, authorization, access control, malware attacks and counter-measures, security protocols. Privacy issues - vehicular devices and smart metering. Applications of public key and symmetric cryptography, - digital certificates, credentials. Security and vulnerability of cyber-physical infrastructure networks - Mobile and wireless network security, Robust wireless infrastructure - Cloud computing and data security, Event Awareness and System Monitoring for Cyber Physical Infrastructure.

UNIT 5 CYBER-PHYSICAL SYSTEMS CASE STUDIES AND PROJECTS

9 Hrs.

Cyber-Physical Systems Case Studies and Projects - Automotive: SW controllers for Antilock braking system, Adaptive Cruise Control, Lane Departure Warning, Suspension Control - Healthcare: Artificial Pancreas/Infusion Pump/Pacemaker - Green Buildings: automated lighting, AC control - power distribution grid - robotics - civil infrastructure – avionics – Transportation.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.
- CO2:** Identify the limitations of some computational models.
- CO3:** Apply the theoretical knowledge the design of compilers.
- CO4:** Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.
- CO5:** Categorize the essential modelling formalisms of Cyber-Physical Systems (CPS)
- CO6:** Ability to understand cyber modelling system.

TEXT / REFERENCE BOOKS

1. "Industry 4.0: The Industrial Internet of Things", Alasdair Gilchrist (Apress)
2. "Industrial Internet of Things: Cyber manufacturingS ystems" Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
3. Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A Cyber-Physical Systems Approach, Second Edition, <http://LeeSeshia.org>, ISBN 978-1-312-42740-2, 2015.
4. Rajeev Alur. Principles of Cyber-Physical Systems. MIT Press. 2015.
5. K. J. Astrom and R. M. Murray. Feedback Systems: An Introduction for Scientists and Engineers. Prince- ton University Press, 2009. http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page.
6. Sajal Das, Krishna Kant, and Nan Zhang, Securing Cyber-Physical Critical Infrastructure – Foundations & Challenges, Morgan Kaufmann, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 10 Questions of 2 marks each-No choice

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SCSA1702	ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of intelligent agents
- To learn the different search strategies in AI.
- To understand the knowledge in solving AI problems.
- To learn the concepts of learning and communication in AI.
- To know about the various applications of AI.

UNIT 1 INTRODUCTION AND PROBLEM SOLVING

9 Hrs.

Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information.

UNIT 2 INFORMED SEARCH AND GAME PLAYING

9 Hrs.

Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance.

UNIT 3 KNOWLEDGE AND REASONING

9 Hrs.

Knowledge based agent – The Wumpus world environment – Propositional logic – Inference rules – First-order logic – Syntax and semantics – Situation calculus – Building a knowledge base – Electronic circuit domain – Ontological Engineering – Forward and backward chaining – Resolution – Truth maintenance system-Mental Events and Mental Objects.

UNIT 4 ACTING LOGICALLY

9 Hrs.

Planning – Representation of planning – Partial order planning –Planning and acting in real world – Acting under uncertainty – Bayes's rules – Semantics of Belief networks – Inference in Belief networks – Making simple decisions – Making complex decisions.

UNIT 5 APPLICATIONS

9 Hrs.

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** An ability to identify, analyze the search algorithm for the AI problems.
- CO2:** Represent a problem using first order logic.
- CO3:** Provide the knowledge based agent to solve the problem.
- CO4:** Understand the Informed search strategies.
- CO5:** Apply the baye's rule to solve the problem for societal concern.
- CO6:** Design user centric applications that use AI concepts

TEXT / REFERENCE BOOKS

1. Stuart J.Russel, Peter Norvig, "Artificial Intelligence A Modern Approach ", 3rdEdition, Pearson Education, 2009.
2. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
3. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

PART A : 10 Questions of 2 marks each-No choice

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

Exam Duration : 3 Hrs.

20 Marks

80 Marks

SCSA2701	CYBER PHYSICAL SYSTEMS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To introduce basics of cyber-physical system and Industrial revolution 4.0 concepts
- To develop an exposition of the challenges in implementing a cyber-physical system
- To analyze the functional behaviour of CPS based on standard modeling formalisms.
- To design CPS requirements based on operating system and hardware architecture constraints.
- To understand the concepts involved in Cyber Physical Systems Security

LIST OF EXPERIMENTS

1. Study about embedded components such as sensors and actuators
2. Study about Industrial Revolution and Cyber physical system opportunities and challenges
3. Create a program that blinks the LED on the development board using MBED software.
4. Pick one-one from the available sensors and actuators and find or create code that will display the sensed data on the PC
5. Create a program that displays data from the sensor in regular intervals in a compact format.
6. To Design Basic weather station using embedded components using Lab view software.
7. Login to devicehub.net and create a project then create a virtual device. Add the corresponding sensor and actuator to the virtual device.
8. Study the MQTT protocol. Examine the components of the protocol.
9. Create a connection from an MQTT capable device/software with an MQTT broker then send and receive data using it.
10. To configuring the gateways and exchange the data to local database using Dream factory
11. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots
12. To configuring the gateways and upload the data to cloud server using Dream factory or Ubidots

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** An ability to expose the student to real world problems in CPS and Industrial revolution 4.0 best practices.
- CO2:** Identify the limitations of some computational models.
- CO3:** Apply the theoretical knowledge the design of compilers.
- CO4:** Student can Analyze and verify the correctness of CPS implementations against system requirements and timing constraints.
- CO5:** Categorize the essential modeling formalisms of Cyber-Physical Systems (CPS)
- CO6:** Implement the real time use case and problem statements

SCSA3008	DISTRIBUTED DATABASE AND INFORMATION SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the role of databases and database management systems in managing organizational data and information.
- To understand the techniques used for data fragmentation, replication and allocation during the distributed database design process.
- To discuss the issues involved in resource management and process.
- To Perceive the building blocks and design of information systems
- To acquire knowledge of information systems on Business operations

UNIT 1 INTRODUCTORY CONCEPTS AND DESIGN OF (DDBMS)

9 Hrs.

Data Fragmentation - Replication and allocation techniques for DDBMS - Methods for designing and implementing DDBMS - designing a distributed relational database - Architectures for DDBMS - Cluster federated - parallel databases and client server architecture - Overview of query processing.

UNIT 2 DISTRIBUTED SECURITY & DISTRIBUTED DATABASE APPLICATION TECHNOLOGIES

9 Hrs.

Overview of security techniques - Cryptographic algorithms - Digital signatures - Distributed Concurrency Control - Serializability theory - Taxonomy of concurrency control mechanisms - Distributed deadlocks – Distributed Database Recovery - Distributed Data Security - Web data management - Database Interoperability.

UNIT 3 ADVANCED IN DISTRIBUTED SYSTEMS

9Hrs.

Authentication in distributed systems - Protocols based on symmetric cryptosystems - Protocols based on asymmetric cryptosystems - Password-based authentication - Unstructured overlays - Chord distributed hash table - Content addressable networks (CAN) - Tapestry - Some other challenges in P2P system design - Tradeoffs between table storage and route lengths - Graph structures of complex networks - Internet graphs - Generalized random graph networks.

UNIT 4 FUNDAMENTALAS OF INFORMATION SYSTEMS

9 Hrs.

Defining information – Classification of information – Presentation of information systems – Basics of Information systems – Functions of information systems – Components of Information systems- Limitations of Information systems – Information System Design.

UNIT 5 ENTERPRISE COLLOBRATION SYSTEMS

9 Hrs.

Groupware – Types of groupware – Enterprise Communication tools – Enterprise Conferencing tools – Collaborative work management tools – Information System for Business operations – transaction processing systems – functional Information Systems – Decision Support systems – Executive Information systems – Online Analytical processing.

Max.45 Hours

COURSE OUTCOMES

On completion of the course the student will be able to

Identify the introductory distributed database concepts and its structures.

CO1: Produce the transaction management and query processing techniques in DDBMS..

CO2: To develop in-depth understanding of relational databases and skills to optimize database performance in practice.

CO3: Critiques on each type of databases.

CO4: Analyse, Design and present the information systems.

CO5: Designing of decision support system and tools for Business operations.

TEXT /REFERENCE BOOKS

1. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education Asia, 2012.
2. Ajay D. Kshemkalyani, MukeshSinghal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2008.
3. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 2006.
4. Ralph Stair and George Reynolds. , "Principles of Information Systems" Course Technology, Inc.,2006

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 Questions of 2 marks each-No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks