



(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagamal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

**B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATION – 2020
AUTONOMOUS SYLLABUS
CHOICE BASED CREDIT SYSTEM
VII TO VIII SEMESTER CURRICULUM AND SYLLABI**

VISION:

To make the Department of Computer Science and Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total Quality Education".

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

- PEO 1:** Apply the basic engineering skills and domain knowledge for developing effective computing solutions to address various social issues.
- PEO 2:** Able to have successful career in technical / managerial roles in multi-disciplinary environment.
- PEO 3:** To confront the evolving technical challenges and problems in the areas of computing.

PROGRAM OUTCOMES:

After going through the four years of study, the Artificial Intelligence and Data Science graduates will have the ability to

POs	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 : **Professional Skills:** To apply learned skills to build optimized solutions pertaining to Data Processing, Artificial Intelligence and Machine Learning.

PSO2 : **Problem - Solving Skills:** To analyze data using domain knowledge to get insights and develop appropriate solutions.

SEMESTER VII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	AD1701	Data Visualization	PC	3	3	0	0	3
2	AD1702	Natural Language Processing	PC	3	3	0	0	3
3	CS1636	Full Stack Development#	PC	4	2	0	2	3
4	PE5	Professional Elective – V	PE	3	3	0	0	3
5	PE6	Professional Elective – VI	PE	3	3	0	0	3
6	OE2	Open Elective – II*	OE	3	3	0	0	3
		Online Course**						
PRACTICALS								
7	AD1711	Data Visualization Laboratory	PC	4	0	0	4	2
8	AD1712	Natural Language Processing Laboratory	PC	4	0	0	4	2
9	AD1721	Capstone Project	EEC	4	0	0	4	2
TOTAL				31	17	0	14	24

SEMESTER VIII

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Online Course – II**	OL	0	0	0	0	3
PRACTICALS								
2	AD1821	Project Work	EEC	16	0	0	16	8
TOTAL				16	0	0	16	11

* Course from the Curriculum of other UG programmes.

Theory cum Laboratory Course

** Students shall complete online course in this semester. Credits earned will be added in consolidated mark statement.

PROFESSIONAL ELECTIVES (PEs)**PROFESSIONAL ELECTIVE V (SEMESTER VII)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CS1635	Augmented Reality and Virtual Reality	PE	3	3	0	0	3
2	AD1731	Business Intelligence	PE	3	3	0	0	3
3	CS1632	Game Design and Development#	PE	4	2	0	2	3
4	CS1734	Principles of Cyber Security	PE	3	3	0	0	3
5	CS1732	Software Project Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE VI (SEMESTER VII)

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	CS1733	2D & 3D Techniques for Graphics Modeling and Simulation	PE	3	3	0	0	3
2	AD1732	Application of Robotics	PE	3	3	0	0	3
3	AD1733	Enterprise Application Development#	PE	4	2	0	2	3
4	AD1734	Statistical Tools for Data Science Engineers#	PE	4	2	0	2	3
5	CS1736	Risk Modeling and Assessment	PE	3	3	0	0	3
6	AD1735	Virtualization and Cloud Computing#	PE	4	2	0	2	3

OPEN ELECTIVE – II**OPEN ELECTIVE II (SEMESTER VII - Offered to EEE, ECE, EIE, Mech, MTR)**

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	OAD171	Artificial Intelligence and Machine Learning	OE	3	0	0	3

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Explain the core skills and components involved in visualization design
- Understand the methodologies used to visualize large data sets
- Gain knowledge about the different processes involved in data visualization
- Get used with interactive data visualization
- Explore different security aspects involved in data visualization

UNIT I INTRODUCTION 9

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT II VISUALIZING DATA PROCESS 9

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT III VISUALIZATION TECHNIQUES 9

Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point Data -Visualization of Line Data - Visualization of Area Data - Other Issues in Geospatial Data Visualization Multivariate Data: Point-Based Techniques - LineBased Techniques - Region-Based Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics and Networks- Displaying Arbitrary Graphs/Networks.

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the fundamentals of natural language processing
- Understand the use of CFG and PCFG in NLP
- Understand the role of semantics of sentences and pragmatics
- Apply the NLP techniques to IR applications

UNIT I INTRODUCTION 9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV SEMANTICS AND PRAGMATICS 10

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation,

WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 8

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC). Applications - Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the fundamentals of Natural Language Processing.
- CO2:** Illustrate the algorithms used in word level analysis in NLP.
- CO3:** Describe the use of CFG and PCFG syntactic analysis of NLP.
- CO4:** Explain the role of semantics of sentences and pragmatics in NLP.
- CO5:** Compare and contrast the use of different statistical approaches for different types of NLP applications.

TEXT BOOKS

1. Daniel Jurafsky & James H Martin, 2014, *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech*, Pearson Publication.
2. Steven Bird, Ewan Klein & Edward Loper, 2009, *Natural Language Processing with Python*, 1st ed, O'Reilly Media.

REFERENCE BOOKS

1. Breck Baldwin, 2015, *Language Processing with Java and LingPipe Cookbook*, Atlantic Publisher.
2. Richard M Reese, 2015, *Natural Language Processing with Java*, O'Reilly Media.

3. Nitin Indurkha & Fred J Damerau, 2010, *Handbook of Natural Language Processing*, 2nd ed, Chapman and Hall/CRC Press.
4. Tanveer Siddiqui & Tiwary, US, 2008, *Natural Language Processing and Information Retrieval*, Oxford University Press, 2008.

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to

- Familiarize with the front-end design of web pages using HTML5, CSS3 and Bootstrap4.
- Implement interactive web application design using JavaScript and jQuery.
- Build simple web applications using AngularJS framework.
- Understand the basic concepts of Node.js & Express.js Framework.
- Familiarize with the different back-end design using MySQL, MongoDB.

UNIT I INTRODUCTION TO FRONT END DESIGN 6

Introduction to full stack development – Front-end web UI frameworks fundamentals – Basics of HTML5 & CSS3 – Responsive web design - Overview of Bootstrap4 – Containers – Grid system – Bootstrap4 CSS – Bootstrap4 Layout components – Themes – simple web application design.

UNIT II JAVASCRIPT AND JQUERY 6

An Introduction to JavaScript – JavaScript Objects – DOM model – functions - Event handling – jQuery overview – Selectors - Events – jQuery traversing– jQuery Effects - jQuery HTML- jQuery and AJAX

UNIT III ANGULARJS FRAMEWORK 6

Overview of JavaScript frameworks: MEAN stack frameworks - Introduction to Angular JS - Binding and Expression – Directives – Controllers – Filters – Modules – Services – Scopes – Tables & forms – AngularJS DOM – Animations – Simple application

UNIT IV EXPRESS.JS AND NODE.JS FRAMEWORK 6

Introduction to Node.js – Node.js Architecture - NPM(Node Packaging Manager) - Installing NPM module - Creating and locating modules - Creating a simple HTTP server - Overview of Express.js framework – Simple Express application – Routing – MVC in Express – middleware – templates – Error handling – Debugging – using process managers.

UNIT V **MYSQL, MONGODB WITH NODEJS**
FRAMEWORK

6

Introduction to MySQL with Node.js– Basic DDL & DML Operations, NoSQL Database -Basic CRUD Operations – Indexing –Aggregation -Data Modelling concepts - Connecting MongoDB using Mongoose

THEORY: 30 PERIODS

LIST OF EXPERIMENTS:

1. Build responsive website to display information about your department details using HTML5, CSS3, Bootstrap4. Use Bootstrap4 features like grids, jumbotron, carousel, etc.
2. Implement simple random quote generator using JavaScript. When the user clicks on New Quote button, it will generate new quote and display it to the user randomly. There is a collection of pre-defined quotes collected and store in constant. Whenever the new quote is displayed to the user, background colour should also be changed.
3. Create password strength checker application using jQuery.
4. Design simple scientific calculator using AngularJS framework
5. Develop to-do-list application using AngularJS.
6. Develop a BMI calculator application using node.js framework.
7. Build simple server application using node.js.
8. Build simple library management system using node.js and MySQL/MongoDB.

PRACTICAL: 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 8 GB RAM)	30
2.	Printer	1
3.	Node.js, MongoDB, Angular Framework, React Framework, MySQL	Open source

TOTAL: 60 PERIODS

OUTCOMES

- CO1:** Develop the responsive web pages using front-end UI tools like HTML5, CSS3 and Bootstrap4.
- CO2:** Create dynamic web pages using JavaScript and jQuery.
- CO3:** Make use of AngularJS framework for developing simple web applications.
- CO4:** Construct web applications using node.js framework.
- CO5:** Make use of backend tools to build the real time web applications.

TEXT BOOKS

1. Brad Dayley & Brendan Dayley, 2018, *Node.js, MongoDB and Angular Web Development*, 2nd ed, Pearson Education.
2. Deitel, Deitel & Nieto, 2011, *Internet and World Wide Web - How to Program*, 5th ed, Prentice Hall.

REFERENCE BOOKS

1. Chris Northwood, *The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer*, Apress publisher.
2. Adam Bretz & Colin J Ihrig, *Full Stack JavaScript Development with MEAN*, Sitepoint publisher.
3. Vasan Subramanian, *Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node*, Apress publisher.

AD1711

DATA VISUALIZATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Design and create data visualizations
- Analyze existing visualizations based on data visualization theory and principles
- Identify opportunities for application of data visualization in various domains
- Develop interactive visualizations for the Web applications

LIST OF EXPERIMENTS

1. Build Common Chart Types in Data Views
2. Visualization of Biological data
3. Visualization of E-Commerce Transaction Data
4. Map Visualization
5. Data Visualization through Video
6. Dashboard Starters for Cloud-based Data
7. Build a dashboard using grafana
8. Exploratory Data Analysis
9. Interactive Data Visualization for the web

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 8 GB RAM)	30
2.	Printer	1
3.	D3 - Javascript visualisation library, Open Processing - classroom platform for teaching P5, Matplotlib, Tableau Desktop, HubSpot, Chartio, Databox, Grafana	Open source

OUTCOMES

CO1: Create meaningful Data Visualizations

CO2: Apply data transformations such as aggregation and filtering for visualization.

CO3: Make use of the visualization tools to depict area plots and regression plots

CO4: Experiment with exploratory data analysis

CO5: Apply JavaScript with D3.js to develop interactive visualizations for the Web.

AD1712

**NATURAL LANGUAGE PROCESSING
LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Implement word analysis and word generation
- Implement morphology by the use of Add-Delete table
- Apply add-one smoothing in N-grams
- Implement syntactic and semantic elements in Natural Language Processing
- Implement word similarity and word disambiguation.

LIST OF EXPERIMENTS

1. Implementation of Word Analysis
2. Implementation of Word Generation
3. Implementation of Morphology
4. Demonstration of N-grams
5. Demonstration of part-of- speech tagging.
6. Demonstration of Lexical analyzer
7. Demonstration of Semantic analyzer.
8. Implementation of Sentiment Analysis.
9. Implementation of word similarity.
10. Implementation of simple problems related to word disambiguation.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 4 GB RAM)	30
2.	Printer	1
3.	Server (Intel Core i3, 4 GB RAM) (High Speed Processor)	1

OUTCOMES

- CO1:** Create word forms from root and suffix information.
- CO2:** Make use of Add-Delete table in Morphology.
- CO3:** Construct sparse N-gram table.
- CO4:** Implement rule based system for syntax of a language.
- CO5:** Implement thesaurus method in word similarity and word disambiguation.

AD1821

PROJECT WORK

L	T	P	C
0	0	16	8

OBJECTIVES:

To enable the students to

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same
- Train the students in preparing project reports and to face reviews and viva voce examination

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department..

TOTAL: 240 PERIODS

OUTCOMES

- CO1:** Identify challenging engineering problems/Societal needs to propose project-based solutions
- CO2:** Build critical-thinking and analytical decision-making capabilities to find solution by formulating proper methodology
- CO3:** Analyze various algorithmic strategies using technological tools to provide software solutions
- CO4:** Develop solutions to identified problems
- CO5:** Complete an independent project, resulting in at least a publication in reputed journals or conference proceedings

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts and framework of virtual reality
- Be familiar with the relevance of virtual reality concept, virtual reality methodology, and virtual reality environment
- Design virtual reality on the web and mobile to demonstrate engineering applications
- Understand augmented reality methodology
- Demonstrate the basic functionalities of augmented reality

UNIT I INTRODUCTION 9

The three I’s of virtual reality-commercial Virtual Reality technology and the five classic components of a Virtual Reality system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces-Output Devices: Graphics displays-sound displays & haptic feedback.

UNIT II VIRTUAL REALITY DEVELOPMENT PROCESS AND CONTENT CREATION CONSIDERATIONS 9

Geometric modelling - kinematics modelling- physical modelling - behaviour modelling - model Management, Methodology and terminology-user performance studies- Virtual Reality health and safety issues-Usability of virtual reality system-cyber sickness -side effects of exposures to virtual reality environment.

UNIT III VIRTUAL REALITY ON THE WEB & MOBILE 9

JS-pros and cons-building blocks (WebVR, WebGL, Three.js, device orientation events)- frameworks (A-frame, React VR)-Google Virtual Reality for Android-Scripts, mobile device configuration, building to android-cameras and interaction-teleporting-

spatial audio - Assessing human parameters-device development and drivers - Design Haptics.

UNIT IV INTRODUCTION TO AUGMENTED REALITY 9

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

UNIT V AUGMENTED REALITY DEVELOPEMENT PROCESS 9

Connecting Context and Content in AR System, Various types of contents. Associating content to context, Content Rendering in AR, POSE estimation, Obtaining RST (Rotation Scaling Translation) matrix, rendering 2D content - Images and Video, rendering 3D content - 3D models -AR Application Areas- Case study – Unity 3D and Vuforia – Deploying AR on mobiles.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the basic concepts and framework of virtual reality.
- CO2:** Interpret the relevance of concept, methodology and environment of virtual reality.
- CO3:** Develop web and mobile applications using virtual reality.
- CO4:** Summarize augmented reality methodology.
- CO5:** Explain the functionality of augmented reality development process.

TEXT BOOKS

1. Burdea C & Philippe Coiffet, 2008, *Virtual Reality Technology*, 2nd ed, Gregory, John Wiley & Sons, Inc..
2. Alan B Craig, 2013, *Understanding Augmented Reality, Concepts and Applications*, Morgan Kaufmann.

REFERENCE BOOKS

1. Dieter Schmalstieg & Tobias Hollerer, 2016, *Augmented Reality: Principles and Practice (Usability)*, Pearson Education (US), Addison-Wesley Educational Publishers Inc, United States.
2. Jason Jerald, 2015, *The VR Book: Human-Centred Design for Virtual Reality*, Association for Computing Machinery and Morgan & Claypool, New York, USA.
3. Steve Aukstakalnis, 2016, *Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)*, 1st ed, Addison-Wesley Professional.
4. Tony Parisi, 2015, *Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile*, 1st ed, O'Reilly Media.
5. Tony Parisi, 2014, *Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages*, 1st ed, O'Reilly Media.
6. Jos Dirksen, 2015, *Learning Three.js: The JavaScript 3D Library for WebGL*, 2nd ed, Packt Publishing.
7. Dieter Schmalstieg & Tobias Hollerer, 2016, *Augmented Reality: Principles & Practice*.
8. Cawood, 2008, *Augmented Reality: A Practical Guide*.

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the fundamentals of Business Intelligence
- Learn various tools used in BI
- Familiarize with various BI models
- Work with different modelling techniques based on requirement
- Familiarize the recent trends in BI

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE 9

Understand the need for Decision support system and Analytics – Evolution of Computerized Decision support to Analytics - Framework for Business Intelligence – Overview of Analytics – Analytics applied in real world – Introduction to Big Data Analytics – Overview of Analytics Eco System.

UNIT II DESCRIPTIVE ANALYTICS 9

Nature of Data – Data Pre-processing – Statistical Modelling for Business Analytics – Regression Modelling for Inferential Statistics – Business Reporting – Data Visualization – Emergence of Visual Analytics – Information Dashboard – Business Intelligence and Data Warehousing – Business Performance Measurement – Six sigma as a Performance Measurement System.

UNIT III PREDICTIVE ANALYTICS 11

Data Mining Methods – Case Study to estimate the true accuracy of Classification Models – Data Mining Software Tools – Privacy Issues – Text Analytics and Text Mining overview - NLP – Case Study on Text Mining applications – Case Study on Sentiment Analysis – Case Study on Web Mining – Case study on social analytics.

UNIT IV PRESCRIPTIVE ANALYTICS 9

Model-based Decision Making – Mathematical Models for Decision support – Decision Modelling with spread sheets - Decision Analysis – Simulation: Types – Visual Interactive simulation – Case Study on application of Stream Analytics.

UNIT V FUTURE TRENDS**7**

Analysis of Sensor Data – Cloud computing and Business Analytics – Location based Analytics for Organizations – Issues of Legal/Privacy/Ethics - Overview of Impact of Analytics in Organization – Data Scientist as a Profession.

TOTAL: 45 PERIODS**OUTCOMES**

- CO1:** Explain the fundamentals of Business intelligence.
- CO2:** Illustrate various tools used in Business Intelligence
- CO3:** Summarize various Business Intelligence models.
- CO4:** Apply various modeling techniques to real time situations.
- CO5:** Explain the future trends of Business Analytics.

TEXT BOOK

1. Ramesh Sharda, Dursun Delon & Efraim Turban, 2018, *Business Intelligence, Analytics and Data Science – A Managerial Perspective*, 4th ed, Pearson.

REFERENCE BOOKS

1. Efraim Turban, Ramesh Sharda & Dursun Delon, 2013, *Decision Support and Business Intelligence Systems*, 9th ed, Pearson.
2. Larissa T Moss & Atre S, 2003, *Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making*, Addison Wesley.
3. Carlo Vercellis, 2009, *Business Intelligence: Data Mining and Optimization for Decision Making*, Wiley Publications.
4. David Loshin Morgan & Kaufman, 2012, *Business Intelligence: The Savvy Manager's Guide*", 2nd ed.

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to

- Understand the fundamental concepts of game design and development
- Expose concept of 2D and 3D Computer Graphics principles and algorithms for game design
- Familiarize with the processes, mechanics, issues in game design
- Understand the architecture of game engines
- Develop and implement simple games using standard APIs

UNIT I INTRODUCTION 6

Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

UNIT II GRAPHICS FOR GAME PROGRAMMING 6

Coordinate Systems – Ray Tracing, Modeling in Game Production – Vertex Processing, Rasterization – Fragment Processing and Output Merging – Illumination and Shaders, Parametric Curves and Surfaces.

UNIT III GAME DESIGN PRINCIPLES 6

Character Development – Story Telling – Narration – Game Balancing – Core mechanics – Principles of level design – Genres of Games – Collision Detection – Game Logic – Game AI, Path Finding – Case study : Tetris.

UNIT IV GAMING ENGINE DESIGN 6

Renderers – Software Rendering – Hardware Rendering and Controller Based Animation – Spatial Sorting – Level of Detail – Collision Detection – Standard Objects and Physics – Case study: The Sims

UNIT V GAME DEVELOPMENT

6

Developing 2D and 3D Interactive Games Using OpenGL – DirectX – Isometric and Tile Based Games – Puzzle Games – Single Player Games – Multi -Player Games – Case study: Mine craft.

TOTAL: 30 PERIODS

OUTCOMES

- CO1:** Explain the essential elements of Game Design and Game Play.
- CO2:** Demonstrate the concepts of Graphics for Game Design and Development.
- CO3:** Illustrate the importance of Game Design Principles and process.
- CO4:** Demonstrate the essential components of game engine for designing and developing games.
- CO5:** Develop interactive 2D/3D Games.

LIST OF EXPERIMENTS

1. Design sprites with necessary animations for a 2D sidescroller game .
2. Add related physics components for a 2D sidescroller game.
3. Develop the game design documents for a 2D sidescroller game.
4. Develop simple 2D puzzle game.
5. Develop simple 3D interactive game.

PRACTICAL : 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i5/i7, 500 GB, 8 GB RAM)	30
2.	Printer	1
3.	Software: Unity game engine	30

TOTAL: 60 PERIODS

TEXT BOOKS

1. David H Eberly, 2010, *3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics*, 2nd ed, Morgan Kaufmann.
2. Jung Hyun Han, 2011, *3D Graphics for Game Programming*, 1st ed, Chapman and Hall/CRC.

REFERENCE BOOKS

1. Jonathan S Harbour, 2009, *Beginning Game Programming, Course Technology*, 3rd ed, PTR.
2. Ernest Adams & Andrew Rollings, 2014, *Fundamentals of Game Design*, 3rd Edition, Pearson Education.
3. Scott Rogers, 2010, *Level Up: The Guide to Great Video Game Design*, 1st ed, Wiley.
4. Jim Thompson, Barna by Berbank-Green & Nic Cusworth, 2008, *Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer*, 1st ed, Wiley.

CS1734

PRINCIPLES OF CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basics of cyber security
- Know the security aspects in OS and networks
- Familiarize with security countermeasures
- Understand the privacy aspects in cyber space
- Familiarize with various cyber laws in force

UNIT I INTRODUCTION TO CYBER SECURITY 9

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authenticate Access Control and Cryptography - Web User Side - Browser Attacks - Web Attack Targeting Users - Obtaining User or Website Data - Email Attacks.

UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS 9

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service.

UNIT III DEFENCES: SECURITY COUNTERMEASURES 9

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity -SQL Injection Attacks – case study of data breaches.

UNIT IV PRIVACY IN CYBERSPACE 9

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V MANAGEMENT AND INCIDENTS 9

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the fundamentals of cyber security
- CO2:** Discuss the various security aspects in OS and networks
- CO3:** Summarize various security measures to safeguard resources
- CO4:** Describe the privacy aspects in cyber space
- CO5:** Explain the cyber laws in force

TEXT BOOKS

1. Charles P Pfleeger, Shari Lawrence Pfleeger & Jonathan Margulies, 2018, *Security in Computing*, 5th edition, Pearson Education.
2. George K Kostopoulous, 2017, *Cyber Space and Cyber Security*, 2nd edition, CRC Press.

REFERENCE BOOKS

1. Martti Lehto & Pekka Neittaanmäki, 2015, *Cyber Security: Analytics, Technology and Automation edited*, Springer International Publishing Switzerland.
2. Nelson Philips & Enfinger Steuart, 2009, *Computer Forensics and Investigations*, Cengage Learning, New Delhi.

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Familiarize with Software Project Management concepts
- Identify the appropriate techniques for the intended project life cycle and estimate the effort
- Understand the objectives of activity planning and risk management
- Explore the concepts of project management and control
- Provide the basic ideas of staffing in software projects

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II A Parametric Productivity Model – Staffing Pattern.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking –

Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behaviour – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain Project Management principles while developing software
- CO2:** Apply the appropriate techniques for software effort estimation
- CO3:** Illustrate the activities in a project and manage risks
- CO4:** Summarize project management and control
- CO5:** Demonstrate staff selection process and the issues related to people management

TEXT BOOK

1. Bob Hughes, Mike Cotterell & Rajib Mall, 2017, *Software Project Management*, 6th edition, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Robert K Wysocki, 2011, *Effective Software Project Management*, 8th edition, Wiley Publication.
2. Walker Royce, 1998, *Software Project Management*, 6th edition, Addison-Wesley
3. Gopaldaswamy Ramesh, 2013, *Managing Global Software Projects*, McGraw Hill Education (India), 14th Reprint

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts of graphics modelling and animation.
- Familiarize with different 2D modelling techniques.
- Be exposed to the techniques for modelling 3D objects.
- Learn about different 3D texturing and rendering techniques.
- Gain knowledge about the simulation techniques used for 3D object modelling.

UNIT I INTRODUCTION TO MODELLING, ANIMATION AND MAX 10
INTERFACE

Introduction to computer based animation - basic types of animation: real time, non-real-time- definition of modelling - creation of 3d objects - exploring the max interface, controlling & configuring the viewports - customizing the max interface & setting preferences - working with files - importing & exporting, selecting objects - setting object properties - duplicating objects - creating & editing standard primitive and extended primitives objects - transforming objects – pivoting – aligning.

UNIT II 2D MODELLING 10

Understanding 2D Splines& shape - Extrude & Bevel 2D object to 3D - Understanding Loft & terrain - Modelling simple objects with splines - Understanding morph, scatter, conform connect compound objects- blob mesh – Boolean Proboolean and procutter compound object

UNIT III 3D MODELLING AND ANIMATION 9

Modelling with Polygons - using the graphite - working with XRefs - Building simple scenes - Building complex scenes with XRefs using assets tracking - deforming surfaces - mesh modifiers - modelling with patches and NURBS - Creating Keyframes - auto keyframes - move & scale keyframe on the timeline - simple controllers, animation modifiers – complex controllers - Camera effects: function curves in the track view - motion mixer - configuring & aiming cameras - camera

motion blur – camera depth of field - camera tracking - using basic lights & lighting techniques - working with advanced lighting - light tracing – radiosity.

UNIT IV 3D TEXTURING AND RENDERING 9

Using material editor and the material explorer - creating and applying standard materials - adding material details with maps - creating compound materials and material modifiers - unwrapping UVs & mapping texture - using atmospheric and render effects - Rendering with V-Ray - V-ray light setup - V-ray rendering settings – HDRI Illumination - Fine-tuning shadows.

UNIT V 3D SIMULATION 7

Bind to Space Warp object - Gravity, wind, displace force object – deflectors - FFD space warp, wave, ripple, bomb - Creating particle system through parray - understanding particle flow user interface – working principle of particle flow – hair and fur modifier - cloth and garment maker modifiers.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the basic concepts of modelling and animation.
- CO2:** Illustrate 2D graphics modelling techniques.
- CO3:** Discuss different 3D modelling and animation techniques.
- CO4:** Explain various texturing and rendering methods used for 3D graphics modelling.
- CO5:** Illustrate the usage of 3D simulation techniques in 3D graphics modelling.

TEXT BOOKS

1. Michael E Mortenson, 2010, *3D Modelling, Animation, and Rendering*, Create space publishers.
2. Boardman Ted, 2014, *3dsmax 7 Fundamentals*, Pearson Education.

REFERENCE BOOKS

1. Boris Kulagin, *3ds Max 8 from Modelling to Animation*, Bpb publishers.
2. Michael G, *3D Modelling and Animation*, Igi Publishers.
3. Lance Flavell, *Beginning Blender: Open Source 3D Modelling, Animation, and Game Design*, Apress publishers.

AD1732

APPLICATION OF ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Study the various parts of robots and fields of robotics.
- Study the Localization and Map Representation of robots.
- Learn about localization, planning and navigation.
- Learn about different applications of field robot.
- Study the humanoid Robots in applications.

UNIT I INTRODUCTION 9

History of service robotics – Present status and future trends – Need for service robots – applications - examples and Specifications of service and field Robots. Non-conventional Industrial robots.

UNIT II LOCALIZATION 9

Introduction-Challenges of Localization - Map Representation - Probabilistic Map based Localization - Monte Carlo Localization - Globally Unique Localization - Positioning Beacon Systems - Route based localization.

UNIT III PLANNING AND NAVIGATION 9

Introduction-Path planning overview - Road map path planning -Cell decomposition path planning - Potential field path planning - Obstacle avoidance - Case studies: tiered robot architectures.

UNIT IV FIELD ROBOT APPLICATIONS 9

Ariel robots -Collision avoidance - Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

UNIT V HUMANOIDS APPLICATIONS 9

Wheeled and legged, Legged locomotion and balance, Arm movement, Gaze and auditory orientation control, Facial expression, Hands and manipulation, Sound and speech generation, Motion capture/Learning from demonstration, Human activity recognition using vision, touch, sound, Vision, Tactile Sensing, Models of

emotion and motivation. Performance, Interaction, Safety and robustness, Applications, Case studies.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the basic concepts of working of robot.
- CO2:** Summarize the Localization and Map Representation of the robot.
- CO3:** Demonstrate the knowledge for planning and navigation of a robot.
- CO4:** Summarize the use of field robots in various applications.
- CO5:** Summarize the use of humanoid Robots in various applications.

TEXT BOOKS

1. Mittal, RK, Nagrath, IJ, 2005, *Robotics and Control*, 4th Reprint, Tata McGraw Hill, New Delhi.
2. John J Craig, 2009, *Introduction to Robotics Mechanics and Control*, 3rd ed, Pearson Education.
3. Groover, MP, Weiss, M, Nageland, RN & Odrej, NG, 1996, *Industrial Robotics*, McGraw Hill.

REFERENCE BOOKS

1. Ashitava Ghoshal, 2010, *Robotics-Fundamental Concepts and Analysis*, Oxford University Press, Sixth impression.
2. Klafter, RD, Chimielewski, TA & Negin, M, 1994, *Robotic Engineering—An Integrated Approach*, Prentice Hall of India, New Delhi.
3. Ghosh, BK, 1998, *Control in Robotics and Automation: Sensor Based Integration*, Allied Publishers, Chennai.

AD1733 ENTERPRISE APPLICATION DEVELOPMENT

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to

- Understand the architectures of Distributed systems, to compare technologies associated with J2EE and DOTNET.
- Implement lightweight enterprise-ready applications.
- Familiarize the capability in python programming and grow true web applications utilizing Django

UNIT I CLIENT SERVER ARCHITECTURE 6

2-tier model - 3-tier model - n-tier model -J2EE architecture - DOTNET architecture - MVC architecture.

UNIT II SPRING 6

Web services – Consuming a restful web service – Java desktop application / JSP, building REST service with spring – Spring security architecture- Securing web applications.

UNIT III STRUTS 6

Struts – Introduction – MVC framework – STRUTS architecture – Business service – Parameter passing – Action class and configuration files – struts.xml tags.

UNIT IV HIBERNATE 6

HIBERNATE ORM – Persistence – Relational Database – The object relational impedance mismatch – Using native Hibernated APTs and hbm.xml – Using the java persistence API's.

UNIT V DJANGO 6

Introduction - Django model layer – View layer - Template layer – Forms — Django security – Django web application tools.

TOTAL: 30 PERIODS

OUTCOMES

- CO1:** Develop a consistent application across all delivery projects in an organization.

- CO2:** Explain the concepts of reduction in costs and effort for the delivery projects.
- CO3:** Demonstrate the business strategy, vision and target operating model.
- CO4:** Explain the concepts of flexibility to include new ideas in the future.
- CO5:** Develop quality Enterprise Application by means of integration of various developed.

LIST OF EXPERIMENTS

1. Create a program to connect with database and manipulate the records in the database using ADO.NET
2. Develop a car showroom inventory web application with 2-tier architecture
3. Develop a real estate web application with n-tier architecture
4. Develop a simple Spring MVC application that take user input and checks the input using standard validation annotations
5. Design a student identity management web application using struts
6. framework. The application should be able to provide an identity such as student id, access to department assets with department id, access to lab assets with lab id.
7. Create a simple online bookstore using Django as a back end
8. Creating a Java Application using Hibernate technology.
- 9.. Example for Basic Hibernate CRUD operations.
10. Example for Spring Dependency Injection and Types
11. Example for Simple spring JDBC program

PRACTICAL : 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 8 GB RAM)	30
2.	Printer	1
3.	Software: .NET, Java Spring, Django, Hibernate, JDBC	30

TOTAL: 60 PERIODS

TEXT BOOKS

1. Inderjeet Singh, Beth Stearns, Mark Johnson & the Enterprise Team, 2011 (Reprint) *Designing Enterprise Applications with the J2EETM Platform*, 2nd ed, Addison Wesley.
2. Martin Fowler, 2010, *Patterns of Enterprise Application Architecture*, 1st ed, (Addison Wesley Signature Series).

REFERENCE BOOKS

1. John Kanalakis, 2003, *Developing .NET Enterprise Applications*, 1st ed, Apress.
2. Yakov Fain, 2010, *Enterprise Development with Flex*, 1st ed, O'Reilly Series.
3. Jansch, VO, 2008, *PHP/Architect's Guide to Enterprise PHP Development*, Musketeers.me, LLC, 2008
4. Steven Holzner, 2007, *PHP: The Complete Reference*, 1ST ED, McGraw Hill Education.

AD1734

**STATISTICAL TOOLS FOR DATA SCIENCE
ENGINEERS**

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to

- Provide students with a framework that will help them choose the appropriate descriptive statistics in various data analysis situations.
- Analyze distributions and relationships of real-time data.
- Apply estimation and testing methods to make inference and modeling techniques for decision making using various techniques including multivariate analysis.

UNIT I BASIC STATISTICAL TOOLS FOR ANALYSIS 6

Summary Statistics, Correlation and Regression, Concept of R^2 and Adjusted R^2 and Partial and Multiple Correlation, Fitting of simple and Multiple Linear regression, Explanation and Assumptions of Regression Diagnostics.

UNIT II STATISTICAL INFERENCE 6

Basic Concepts, Normal Distribution-Area properties, Steps in tests of significance – large sample tests - Z tests for Means and Proportions, Small sample tests – t-test for Means, F test for Equality of Variances, Chi-square test for independence of Attributes.

UNIT III FORECASTING METHODS 6

Introduction: Concept of Linear and Non Liner Forecasting model, Concepts of Trend, Exponential Smoothing, Linear and Compound Growth model, Fitting of Logistic curve and their Applications, Moving Averages, Forecasting accuracy tests.

UNIT IV MODELING METHODS 6

Probability models for time series: Concepts of AR, ARMA and ARIMA models.

UNIT V DESIGN OF EXPERIMENTS 6

Analysis of variance – one and two way classifications – Principle of design of experiments, CRD – RBD – LSD, Concepts of 2^2 and 2^3 factorial experiments.

TOTAL: 30 PERIODS

OUTCOMES

- CO1:** Explain the value of statistics as a discipline and its relevance for Engineering.
- CO2:** Perform large sample test and small sample test of Hypothesis as well as calculate confidence interval for a population parameter for real time data.
- CO3:** Experiment with various forecasting methods.
- CO4:** Apply various techniques of time series models, including the regression with ARMA models.
- CO5:** Interpret the outcomes of estimation and hypothesis tests in the context of a problem.

LIST OF EXPERIMENTS

1. Computing Summary Statistics using real time data
2. Plotting and visualizing data using Tabulation and Graphical Representations.
3. Applying simple linear and multiple linear regression models to real dataset; computing and interpreting the coefficient of determination for scale data.
4. Testing of hypothesis for large sample tests for real-time problems.
5. Testing of hypothesis for Small Sample tests for F-test
6. Testing of hypothesis for Small Sample tests for Chi-square test
7. Applying Time series analysis -Trends. Growth, Logistic, Exponential models
8. Applying Time series model AR, ARMA and ARIMA
9. Performing ANOVA (one-way and two-way), CRD, RBD and LSD for real dataset.
10. Performing 2^2 factorial experiments with real time Applications.

PRACTICAL : 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 8 GB RAM)	30
2.	Printer	1

3.	Software R-4.0.5 or latest version (free, open source)	
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TOTAL: 60 PERIODS

TEXT BOOKS

1. Douglas C Montgomery George C Runger, 2016, *Applied Statistics and Probability for Engineers*, 6th ed, John Wiley & Sons.
2. Robert H Shumway, David S Stoffer, 2017, *Time Series Analysis and Its Applications with R Examples*, Springer publications.

REFERENCE BOOKS

1. Trevor Hastie & Robert Tibshirani, 2017, *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, 2nd ed, Springer Series in Statistics.
2. Susan Milton & Jesse Arnold, 2017, *Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences*, Mc.Grawhill education.

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the fundamentals of risk modeling and assessment
- Identify the risks through hierarchical holographic modeling and its derivatives
- Understand the objectives of risk modeling, assessment and management.
- Explore the concepts of multi objective risk impact analysis
- Learn the principles and guidelines of project risk management.

UNIT I FUNDAMENTALS OF RISK MODELING AND 9
ASSESSMENT

Introduction- Systems Engineering - Risk Assessment and Management, The Role of Modeling in the Definition and Quantification of the Risk Function: -Introduction - The Risk Assessment and Management Process: Historical Perspectives- Information, Intelligence, and Models- The Building Blocks of Mathematical Models - On the Complex Definition of Risk, Vulnerability, and Resilience: a Systems Based Approach - On the Definition of Vulnerabilities in Measuring Risks to Systems-On the Definition of Resilience in Measuring Risk to Systems-On the Complex Quantification of Risk to Systems

UNIT II IDENTIFYING RISK AND RISK FILTERING 9

Identifying Risk through Hierarchical Holographic Modeling and its Derivatives: Hierarchical Aspects -Hierarchical Overlapping Coordination -HHM - HHM and the Theory of Scenario Structuring - Adaptive Multiplayer HHM Game - Water Resources System -Sustainable Development- HHM in a System Acquisition Project -Software Acquisition - Hardening the Water Supply Infrastructure- Risk Assessment and Management for Support of Operations other than War Automated Highway System – Food Poisoning Scenarios Risk Filtering, Ranking, and Management: Introduction - Past Efforts in Risk Filtering and Ranking - RFRM: A Methodological Framework - Case Study: An OOTW 220.

UNIT III ADVANCES IN RISK MODELING, ASSESSMENT AND 9
MANAGEMENT - I

Risk of Extreme Events and the Fallacy of the Expected Value: Introduction - Risk of Extreme Events- The Fallacy of the Expected Value -The PMRM -General Formulation of the PMRM -Summary of the PMRM- Illustrative Example-Analysis of Dam Failure and Extreme Flood through the PMRM – Example Problems - Multiobjective Decision Tree Analysis: Introduction -Methodological Approach- Differences between SODT and MODT- Example Problems.

UNIT IV ADVANCES IN RISK MODELING, ASSESSMENT AND 9
MANAGEMENT - II

Multiobjective Risk Impact Analysis Method: Introduction - Impact Analysis- The Multiobjective, Multistage Impact Analysis Method: An Overview - Combining the PMRM and the MMIAM - Relating Multiobjective Decision Trees to the MRIAM - Example Problems -Statistics of Extremes: Extension of the PMRM : A Review of the Partitioned Multiobjective Risk Method - Statistics of Extremes -Incorporating the Statistics of Extremes into the PMRM- Sensitivity Analysis of the Approximation of $f_4(\cdot)$ - Generalized Quantification of Risk of Extreme Events.

UNIT V PRINCIPLES AND GUIDELINES FOR PROJECT RISK 9
MANAGEMENT

Introduction -Definitions and Principles of Project Risk Management- Project Risk Management Methods - Aircraft Development Example-Quantitative Risk Assessment and Management of Software Acquisition- Critical Factors That Affect Software Nontechnical Risk -Basis for Variances in Cost Estimation-Discrete Dynamic Modeling.

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain about Risk modeling principles and its assessment.
- CO2:** Summarize the activities for risk identification and filtering.
- CO3:** Interpret risk modeling and assessment.

CO4: Demonstrate multi objective risk impact analysis.

CO5: Summarize the activities for project risk management.

TEXT BOOK

1. Yacov Y Haimes, *Risk Modelling, Assessment and Management*, 4th ed, Wiley Publishers.

REFERENCE BOOK

1. Charles Yoe, *Principles of Risk Analysis: Decision Making Under Uncertainty*, 2nd ed, CRC Press.

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to:

- Understand the basics of cloud computing along with virtualization.
- Demonstrate hypervisor types in server virtualization.
- Discuss virtualization solutions.
- Explain migration concepts in virtualization.
- Familiarize with cloud software environment and security in cloud

UNIT I INTRODUCTION TO VIRTUALIZATION 6

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization.

UNIT II SERVER VIRUALIZATION 6

Virtual machine basics, types of virtual machines, hypervisor concepts and types. Server Virtualization: Understanding Server Virtualization, types of server virtualization.

UNIT III VIRTUALIZATION SOLUTIONS 6

Understanding Microsoft’s Virtualization solutions: Microsoft’s Infrastructure Optimization Model, Virtualization and the Infrastructure Optimization Model, Benefits of Virtualization, Achieving the Benefits of Datacenter Virtualization, Achieving the Benefits of Client Virtualization, Achieving the Benefits of Cloud Virtualization

UNIT IV HIBERNATE 6

Introduction, Layers in cloud architecture, Cloud Service models, Cloud deployment model: Advantages of Cloud computing. Challenges while migrating to Cloud, Broad approaches to migrating into the cloud - why migrate -deciding on cloud migration, the Seven-step model of migration into a cloud.

UNIT V CLOUD TECHNOLOGIES AND SECURITY IN CLOUD

6

Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine – Amazon Web Services – Open Stack – Security Overview – Cloud Security Challenges –Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM –Security Standards

TOTAL: 30 PERIODS

OUTCOMES

- CO1:** Summarize the basic concepts of virtualization.
- CO2:** Explain hypervisor types in virtualization.
- CO3:** Explain virtualization solutions.
- CO4:** Illustrate migration concepts in virtualization.
- CO5:** Paraphrase software environment and security in cloud.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
3. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
4. Show the virtual machine migration based on the certain condition from one node to the other
5. Find a procedure to transfer the files from one virtual machine to another virtual machine.
6. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

PRACTICAL : 30 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 8 GB RAM)	30
2.	Ubuntu OS (Preferred) or CentOS	30
3.	Printer	1
4.	Virtual box, VMware Workstation, Cloud Environment Creation, OpenStack	30

TOTAL: 60 PERIODS

TEXT BOOKS

1. Marshall, David, Reynolds, Wade A McCrory, Dave, 2006, *Advanced Server Virtualization: VMware and Microsoft Platforms in the Virtual Data Center*, 1st ed, Auerbach Publications.
2. Kai Hwang, Geoffery C Fox & Jack J Dongarra, 2012, *Distributed and Cloud Computing: Clusters, Grids, Clouds and the Future of Internet*, 1st ed, Morgan Kaufman Publisher, Elsevier.

REFERENCE BOOKS

1. Michael Miller, 2008, *Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online*, Que Publications.
2. Rajkumar Buyya, James Broberg & Andrzej Goscinski, 2011, *Cloud Computing (Principles and Paradigms)*, John Wiley & Sons, Inc.
3. Toby Velte, Anthony Velte & Robert Elsenpeter, 2010, *Cloud Computing - A Practical Approach*, Tata Mcgraw Hill.

OAD171

**ARTIFICIAL INTELLIGENCE AND MACHINE
LEARNING**

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in Artificial Intelligence
- Understand the concepts of Machine Learning and Probability Theory.
- Appreciate supervised learning and their applications.
- Understand unsupervised learning like clustering and EM algorithms

UNIT I INTRODUCTION 9

Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT II PROBLEM SOLVING METHODS 9

Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.

UNIT III INTRODUCTION TO MACHINE LEARNING 9

Machine Learning –Types of Machine Learning –Supervised Learning –Unsupervised Learning –Basic Concepts in Machine Learning –Machine Learning Process –Weight Space –Testing Machine Learning Algorithms –A Brief Review of Probability Theory –Turning Data into Probabilities –The Bias-Variance Trade-off.

UNIT IV SUPERVISED LEARNING 9

Linear Models for Regression –Linear Basis Function Models –The Bias-Variance Decomposition –Bayesian Linear Regression –Common Regression Algorithms – Simple Linear Regression –Multiple Linear Regression –Linear Models for Classification –Discriminant Functions –Probabilistic Generative Models – Probabilistic Discriminative Models –Laplace Approximation –Bayesian Logistic Regression –Common Classification.

UNIT V UNSUPERVISED LEARNING

9

Mixture Models and EM–K-Means Clustering –Dirichlet Process Mixture Models – Spectral Clustering –Hierarchical Clustering –The Curse of Dimensionality – Dimensionality Reduction –Principal Component Analysis –Latent Variable Models(LVM) –Latent Dirichlet Allocation (LDA).

TOTAL: 45 PERIODS

OUTCOMES

- CO1:** Explain the various characteristics of intelligent agents.
- CO2:** Make use of searching strategies to solve various real time problems
- CO3:** Summarize the machine learning concepts.
- CO4:** Apply suitable classification or regression algorithm for an application.
- CO5:** Apply clustering algorithms for different types of applications.

TEXT BOOKS

1. Russell, S & Norvig, P, 2009, *Artificial Intelligence: A Modern Approach*, 3rd ed, Prentice Hall.
2. Ethem Alpaydin, 2015, *Introduction to Machine Learning*, 3rd ed, Prentice Hall of India.

REFERENCE BOOKS

1. Tim Jones, M, 2008, *Artificial Intelligence: A Systems Approach (Computer Science)*, 1st ed, Jones and Bartlett Publishers.
2. Nils J Nilsson, 2009, *The Quest for Artificial Intelligence*, Cambridge University Press.
3. Christopher Bishop, 2006, *Pattern Recognition and Machine Learning*, Springer.
4. Kevin P Murphy, 2012, *Machine Learning: A Probabilistic Perspective*, MIT Press.