SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)
Puducherry - 605107

Department of Information Technology

FIFTH BOARD OF STUDIES MEETING

MINUTES

Date and Time
16.9.2022 at 02.00 PM

2. A. 4. 1

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Information Technology

Minutes of Board of Studies

The Fifth Board of Studies meeting of Department of Information Technology was held on 16th September 2022 from 2:00 P.M to 5:00 P.M in the Application Programming Laboratory, Department of Information Technology with the Head of the Department as the Chair.

The following members were present for the BoS meeting.

Sl.No	Name of the Member with Designation and official Address	Members as Per University norms
1	**Dr. R. Raju, M.Tech, Ph.D** Professor & Head Department of IT, SMVEC	Chairman
2	**Dr. R. Geetha Ramani, M.Tech, Ph.D** Professor, Department of Information Science and Technology, College of Engineering Guindy, Anna University, Chennai	Subject Expert (University Nominee)
3	**Dr. A.S. Anakath, M.E, Ph.D** Professor, Department of IT, E.G.S. Pillay Engineering College, Nagapattinam	Subject Expert (Academic Council Nominee)
4	**Dr. S. Padmavathi, M.E, Ph.D** Professor, Department of IT, Thiagarajar College of Engg., Madurai	Subject Expert (Academic Council Nominee)
5	**Mr. L. Ashok** CEO - Futurenet Technologies (India) Private Limited, Chennai.	Representative from Industry
6	**Dr. G. Arun Kumar** Associate Professor, Department of CSE, Mandanapalli Institute of Technology and Science, Andhra Pradesh	Post Graduate Alumnus (nominated by Principal)
7	**Dr. R.Saravanan, M.E, Ph.D** Associate Professor Department of IT, SMVEC.	Internal Member
8	**Dr. S. Balaji, M.Tech, Ph.D** Associate Professor Department of IT, SMVEC	Internal Member
9	**Dr. Puspita Dash, M.Tech, Ph.D** Associate Professor Department of IT, SMVEC	Internal Member

10	**Dr.N.S.N. Cailassame** Professor& Head, Department of Management Studies, SMVEC	Internal Member
11	**Dr. K. Karthikeyan** Associate Professor , Department. of Chemistry, SMVEC	Internal Member
12	**Prof. M. Devanathan** Assistant Professor, Department of Mathematics, SMVEC	Internal Member
13	**Prof. G. Namitha** Assistant Professor, Department of English, SMVEC	Internal Member
14	**Dr.T.Jayavarthanan** Professor , Department. of Physics, SMVEC	Internal Member

Agenda of the Meeting	
Item:2022.5.1	Welcome Address, Confirmation of minutes of the Fourth BoS meeting held on 28.2.2022
Item:2022.5.2	Briefing the Achievements of Academic year 2021-22
Item:2022.5.3	To discuss, approve and recommend the syllabi for VIII Semester under R2020 regulations for UG Programme: B.Tech. Information Technology in the AY 2022-2023
Item:2022.5.4	To discuss and approve the justification given for all the course outcomes and program outcomes mapped for all the subjects under Regulation 2020
Item:2022.5.5	To ratify the changes carried out in the Continuous Assessment Marks and End Semester Marks for the course General Proficiency – II (U20HSP402) of II Year IV Semester under the Regulation 2020 & ratification for the Skill Development Course 4: Foreign Language/IELTS-I and Skill Development Course 6: Foreign Language/IELTS-II.
Item:2022.5.6	Any other item with the permission of chair

9.4.4.2

Minutes of the Meeting
Dr. R. Raju, Chairman, BoS / B.Tech Information Technology officially announced the opening of the meeting and welcomed the members. He also thanked them for accepting the invitation and giving us their valuable time. The meeting thereafter deliberated on agenda items that had been approved by the Chairman.

Item:2022.5.1 — **Welcome Address, Confirmation of minutes of the Fourth BoS meeting held on 28.2.2022**

The Fourth BoS was held on 28.2.22 and the points discussed were reviewed by the members.
The following variations are incorporated in the syllabus as per the member's suggestion.

Course Code/Course Name	Suggestions
U20ITE719 - Wireless Sensor Network	• The content of the syllabus framed was quiet vague and suggested for reduction of the content
U20ITE720 - Green Computing	• The title of Unit V has been given as Case Studies, suggest a suitable title instead of it
The following suggestion has been stated by BoS members ***To add outcome of the Internship as an annexure in the existing Internship format***	

All the corrections and changes were updated as per the suggestion provided by the BoS members and the same has been approved

Item:2022.5.2 — **Briefing the Achievements of Academic year 2021-22**

The Board of Studies Chairman briefed the achievements of the faculty and students of the Department in the year 2021-2022

Item:2022.5.3 — **To discuss, approve and recommend the syllabi for VIII Semester under R2020 regulations for UG Programme: B.Tech. Information Technology in the AY 2022-23**

The BoS Members recommended to carry out the following changes in the VIII Semester of Regulation 2020.

- The BoS members suggested to interchange the Courses entitled as C# and .Net and Deep Learning (after reframing the syllabus) which is under **Professional Core** and **Professional Elective – VI** respectively. The members stated that the students are in need to gain enough knowledge about the Deep Learning concepts since it is emerging topic of study.
- The BoS members also stated to carry out the same changes in Regulation 2019 also.
- The details of changes suggested are given below

S.No.	Regulation	Course Code	Course Title	Category
1.	R2020	U20ITT819	Deep Learning	**PC**
2.		U20ITE828	C# and .Net	**PE**
3.	R2019	U19ITT81	Deep Learning	**PC**
4.		U19ITE87	C# and .Net	**PE**

encl: Annexure – III

2.A.4.9

2.A.4.10

S.No.	Course Code in Regulation - 2019	Course Code in Regulation - 2020	Course Title	Suggestion
1.	U19ITE80	U20ITE821	Assisstive Technology	• Correction in Subject Title from Assisstive Technology to **Human Computing Interface** • Reframing the syllabus
2.	U19ITE82	U20ITE823	Social Network Analytics	• Correction in Subject Title from Social Network Analytics to **Social Network Analysis** • Reframe the complete syllabus
3.	U19ITE84	U20ITE825	Game Development	• Change of title in Unit III • To reframe the contents in Unit IV and V
4.	U19ITE86	U20ITE827	Computer Animation: Algorithms and Techniques	• Correction in Subject Title from Computer Animation: Algorithms and Techniques to **Computer Animation** • To remove the case study from Unit-V
5.	U19ITE87	U20ITE828	Deep Learning	• Reframe the syllabus
6.	U19ITE88	U20ITE829	High Performance Computing	• Change of title in Unit II from Parallel Program to **Parallel Processing** • To reframe the contents in Unit - V
7.	U19ITE89	U20ITE830	Multimedia Streaming Analytics	• Correction in Subject Title from Multimedia Streaming Analytics to **Streaming Analytics** • Correction in Titles of Unit IV and V and reframe contents

Item:2022.5.4	**To discuss and approve the justification given for all the course outcomes and program outcomes mapped for all the subjects under Regulation 2020**
	The Justification for all the course outcomes and program outcomes and their corresponding mapping for all subjects under Regulation 2020 has been discussed and approved.

Item:2022.5.5	**To ratify the changes carried out in the Continuous Assessment Marks and End Semester Examination Marks for the course General Proficiency – II (U20HSP402) of II Year IV Semester under the Regulation 2020**
	The Changes to be carried has been projected to the BoS members for ratification. The ratification carried out in the split of CAM and ESM which is initially 100 marks allotted for CAM in General Proficiency – II (U20HSP402) which has been changed as follows.

S.No	Course Code	Course Title	Category	Credits	Max. Marks		
					CAM	ESM	Total
1.	U20HSP402	General Proficiency - II	HS	1	50	50	100

encl: Annexure-IV

The ratification seeked for the existing Skill Development Course 4 and 6 Titled as Foreign Language/IELTS-I and Foreign Language/IELTS-II are as follows

S.No	Course Code	Course Title	Category	Credits	Max. Marks		
					CAM	ESM	Total
1.	U20ITS504	Skill Development Course 4 : Career and Professional Skill Development Program - I	EEC	-	100	-	100
2.	U20ITS606	Skill Development Course 6 : Career and Professional Skill Development Program - II	EEC	-	100	-	100

Item:2022.5.6	**Any other item with the permission of chair**
	The BoS members suggested to prepare a Strategic Plan for the Department.

The meeting for the above Agenda regarding B.Tech – Information Technology was concluded by 5:00 pm by **Dr. R.Raju**, Chairman-BoS and Head of Department, Department of Information Technology, Sri Manakula Vinayagar Engineering College.

8.A.4.13

9.A.4.14

Members Present

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. R. Raju, M.Tech, Ph.D.** Professor & Head Department of IT, SMVEC	Chairman	
External Members			
2	**Dr. R. Geetha Ramani, M.Tech, Ph.D.** Professor, Department of Information Science and Technology, College of Engineering Guindy, Anna University, Chennai	Subject Expert	
3	**Dr. A.S. Anakath, M.E, Ph.D.** Professor, Department of IT, E.G.S. Pillay Engineering College, Nagapattinam	Subject Expert	
4	**Dr. S. Padmavathi, M.E, Ph.D.** Professor, Department of IT, Thiagarajar College of Engg., Madurai	Subject Expert	
5	**Mr. L. Ashok** CEO - Futurenet Technologies (India) Private Limited, Chennai.	Member from Industry	
6	**Dr. G. Arun Kumar** Associate Professor, Department of CSE, Madanapalli Institute of Technology and Science, Andhra Pradesh	Member from Meritorious Alumni	
Internal Members			
7	**Dr. R.Saravanan, M.E, Ph.D.** Associate Professor Department of IT, SMVEC	Member	
8	**Dr. S. Balaji, M.Tech, Ph.D.** Associate Professor Department of IT, SMVEC	Member	
9	**Dr. Puspita Dash, M.Tech, Ph.D.** Associate Professor Department of IT, SMVEC	Member	
Co-opted Members			
10	**Dr. N.S.N. Cailassame** Professor& Head, Department of Management Studies, SMVEC	Member	
11	**Dr. K. Karthikeyan** Associate Professor , Department. of Chemistry, SMVEC	Member	
12	**Prof. M. Devanathan** Assistant Professor, Department of Mathematics, SMVEC	Member	

2.A.4.15

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13	**Prof. G. Namitha** Assistant Professor, Department of English, SMVEC	Member	
14	**Dr.T.Jayavarthanan** Professor , Department. of Physics, SMVEC	Member	

Dr. R. Raju
Chairman - BoS (IT)

Dr.V.S.K. Venkatachalapathy
Director cum Principal
Chairman - Academic Council

2.A.4.12

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Department of Information Technology

Annexure - III

Semester – VIII

Curriculum and Revised Syllabus

Professional Core : Deep Learning

Professional Elective- V and VI Courses

R2020 & R2019

2.A.4.19

2.A.4.20

Curriculum – R2020

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20ITT819	Deep Learning	PC	3	0	0	3	25	75	100
2	U20ITE8XX	Professional Elective – V#	PE	3	0	0	3	25	75	100
3	U20ITE8XX	Professional Elective – VI#	PE	3	0	0	3	25	75	100
Practical										
4	U20HSP804	Entrepreneurship Management	HS	0	0	3	1	100	-	100
Project Work										
5	U20ITW803	Project Phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U20ITS809	Skill Development Course 9: NPTEL/MOOC-II	EEC	0	0	0	-	100	-	100
							18	315	285	600

Professional Elective Courses

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	Course Code	Course Title
1	U20ITE821	Human Computing Interface
2	U20ITE822	Business Intelligence
3	U20ITE823	Social Network Analysis
4	U20ITE824	Mixed Reality
5	U20ITE825	Game Development
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20ITE826	Cyber Security
2	U20ITE827	Computer Animation: Algorithms and Techniques
3	U20ITE828	C # and .Net
4	U20ITE829	High Performance Computing
5	U20ITE830	Streaming Analytics

2. A. 4. 21

2.A.4.22

U20ITT819	DEEP LEARNING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand Neural Network basics and Types
- To understand Convolutional Neural Networks and its architecture
- To understand and implement Recurrent Neural Network
- To understand the Boltzmann Machine Spin Glass Model and Deep Belief Networks
- To learn various Applications of Deep Learning

Course Outcomes

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

CO1 - Discuss the basics of Neural Network and its types **(K2)**
CO2 - Describe Convolutional Neural Networks and its architecture **(K2)**
CO3 - Implement Recurrent Neural Network **(K3)**
CO4 - Describe the Spin Glass Model and Deep Belief Networks **(K2)**
CO5 - Apply Deep Learning Techniques **(K3)**

UNIT I INTRODUCTION TO NEURAL NETWORK(NN)

Introduction to NN - Neural Networks and types - Gradient descent - Training Neural Networks - Backpropagation - Deep Learning With Pytorch

UNIT II CONVOLUTIONAL NEURAL NETWORK(CNN)

Convolutional Neural Network - CNNs Architectures - Weight Initialization - Autoencoders - Transfer Learning in PyTorch - Deep Learning for Cancer Detection

UNIT III RECURRENT NEURAL NETWORK(RNN)

Recurrent Neural Network - Long & Short-Term Memory Network - Implementation of RNN & LSTM - Hyperparameters - Embeddings & Word2vec - Sentiment Prediction RNN

UNIT IV BOLTZMANN MACHINES

Introduction to Boltzmann Machine - Energy-Based Models - Restricted Boltzmann Machine - Contrastive Divergence - Deep Belief Networks - Deep Boltzmann Machine

UNIT V DEEP LEARNING APPLICATIONS

Image Processing - Natural Language Processing - Speech Recognition - Video Analytics

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, "Dive into Deep Learning", Amazon Science,2022
2. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018

Reference Books

1. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018
2. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018
3. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016

9.A.4.23

Website References

1. https://link.springer.com/book/10.1007/978-3-319-73004-2
2. http://deeplearning.net/reading-list/

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	3	-	-	-	-	-	-	2	2	2	3
2	3	3	1	1	2	-	-	-	-	-	-	2	2	2	3
3	2	2	2	2	2	-	-	-	-	-	-	2	2	2	3
4	2	2	1	1	-	-	-	-	-	-	-	2	2	2	3
5	3	2	3	3	2	-	-	-	-	-	-	2	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

2.A.4.24

U20ITE821 **HUMAN COMPUTING INTERFACE**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the concept of the Human computer Interaction.
- To learn the design techniques and fundamentals of Human Computer Interaction
- To know the various types of existing interfaces and evaluation techniques
- To understand the appropriate use of computers and other technology in instructional Programming.
- To understand the applications of HCI in emerging trends

Course Outcomes

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

CO1 - Understand the requirements and specifications for the interaction design **(K2)**
CO2 - Design an efficient and user-friendly human computer interface **(K3)**
CO3 - Analyze and implement Communication & Collaborative Models **(K4)**
CO4 - Illustrate Assistive Technology **(K3)**
CO5 - Analyze Ubiquitous computing applications **(K4)**

UNIT I INTRODUCTION **(9Hrs)**

Historical evolution of the field - Concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques - Psychology & design of interactive systems; Computer - Text entry devices Positioning, Pointing & drawing - Display devices for Virtual reality, 3D- Interaction styles - WIMP Interfaces - context; paradigms for Interaction.

UNIT II SOFTWARE PROCESS & DESIGN RULES **(9Hrs)**

Interaction design basics – user focus – scenarios – navigation – screen design & layout ;HCI in software process – life cycle – Usability Engineering – Interactive design & Prototyping - Design rules - Principles for usability - standards - guidelines - golden rules - HCI patterns.

UNIT III COMMUNICATION & COLLABORATIVE MODELS **(9Hrs)**

Goal & task hierarchies - Linguistic models - Physical & device models - architectures; communication & collaboration models - Face - to - face communication - conversation - text based - group working; Task analysis - difference between other techniques - task decomposition - Knowledge based analysis - ER based techniques - uses.

UNIT IV OVERVIEW AND FRAMEWORK **(9Hrs)**

Overview of Assistive Technology, Framework for Assistive technologies - Assistive Technology for People with Disabilities - General purpose Assistive technologies - Human Assistive technology - Assistive Technologies in the context of classroom and work.

UNIT -V UBIQUITOUS COMPUTING & WWW **(9Hrs)**

Ubiquitous computing application research - virtual & augmented reality - Information & data visualization - Web Technology & issues - Static Web content - Dynamic Web content.

Text Books

1. Preece, J., Sharp, H., Rogers, Y. "Interaction Design: Beyond Human-Computer Interaction", Fourth Edition, John Wiley, 2015.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: beyond human-computer interaction", John-Wiley and Sons Inc., 2011.
3. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.
4. Cook and Hussey, "Assistive Technologies, Principles and Practice", Mosby, Second Edition 2008.

9.A.4.25

Reference Books

1. Cooper, Reimann, Cronin, & Noessel, "About Face: The Essentials of Interaction Design", Fourth Edition, 2014.
2. Frank Bentley, Edward Barrett,"Building Mobile Experiences ", MIP Press, Cambridge, 2012.
3. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.

Web References

1. https://nptel.ac.in/courses/106/106/106106177/
2. https://www.udacity.com/course/human-computer-interaction--ud400
3. https://www.coursera.org/courses?query=human%20computer%20interaction

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

2.A.4.26

U20ITE823	SOCIAL NETWORK ANALYSIS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concept of social network analysis and related applications.
- To learn network models and link analysis.
- To analyze and evaluate communities.
- To understand human behaviour in social web and related communities.
- To learn application of social networks.

Course Outcomes

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

CO1 - Discuss the concepts of social network analysis and related applications **(K2)**
CO2 - Discuss the various Network Growth Models **(K2)**
CO3 - Explain the concept of communities in web social networks **(K2)**
CO4 - Explain human behaviour in social web and related communities **(K2)**
CO5 - Create Learning Methods and Applications **(K3)**

UNIT I INTRODUCTION TO NETWORKS AND SOCIETY (9 Hrs)

Social Network Analysis - Applications of Social Network Analysis - Preliminaries - Levels of Social Network Analysis - Historical Development - Graph Visualisation Tools - Network Measures - Network Basics - Node Centrality - Assortativity - Transitivity and Reciprocity - Similarity - Degeneracy.

UNIT II NETWORK GROWTH MODELS AND LINK ANALYSIS (9 Hrs)

Properties of Real - World Networks - Random Network Model - Ring Lattice Network Model Watts - Strogatz Model - Preferential Attachment Model - Price's Model - Local-world Network Growth Model - Network Model with Accelerating Growth - Aging in Preferential Attachment - Applications of Link Analysis - Signed Networks - Strong and Weak Ties - Link Analysis Algorithms

UNIT III EXTRACTION, MINING COMMUNITIES IN WEB SOCIAL NETWORKS (9Hrs)

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES (9 Hrs)

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures

UNIT V LEARING METHODS AND APPLICATIONS OF SOCIAL NETWORKS (9 Hrs)

Machine Learning Pipelines - Intuition behind Representation Learning - Benefits of Representation Learning - Criterion for Graph Representation Learning - Graph Representation Learning Pipeline - Representation Learning Methods. Applications and Case Studies - Malicious Activities on OSNs - Sock puppets in OSNs

Text Books

1. Tanmoy Chakraborty "Social Network Analysis" Wiley Edition: 2021
2. S.Wasserman, K.Faust: Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994 3. Scott, J. (2007).
3. Social network analysis: A handbook (2nd Ed.). Newbury Park, CA: Sage. 4. Knoke (2008). Social Network Analysis, (2nd Ed). Sage.
4. Peter Mika, "Social Networks and the Semantic Web", Springer, First Edition, 2007.
5. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st Edition, 2010.

2.4.4.27

Reference Books

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking -Techniques and applications", Springer, First Edition, 2011.
2. Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web",Springer, 2009.

Web References

1. https://nptel.ac.in/courses/106/106/106106169/
2. https://www.coursera.org/learn/social-media-data-analytics
3. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm https://blockgeeks.com/
4. https://www.talkwalker.com/blog/social-media-analytics-guide

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	3	2	1	1	2	-	-	-	-	-	-	-	-	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

2.A.4.28

U20ITE825	GAME DEVELOPMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concepts of Game design and development.
- To learn the processes, mechanics and issues in Game Design.
- To be exposed to the Core architectures of Game Programming.
- To know about Game programming platforms, frame works and engines.
- To learn how to develop games

Course Outcomes

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

CO1 - Discuss the concepts of Game design and development **(K2)**
CO2 - Design the processes, and use mechanics for game development. **(K3)**
CO3 - Describe the Core architectures of Game Programming. **(K2)**
CO4 - Use Game programming platforms, frame works and engines **(K3)**
CO5 - Create interactive Games. **(K5)**

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING **(9Hrs)**

3D Transformations - 3D Modeling and Rendering - Ray Tracing - Shader Models - Lighting - Color - Texturing - Camera and Projections - Culling and Clipping, Character Animation, Scene Graphs.

UNIT II GAME ENGINE DESIGN **(9Hrs)**

Game engine architecture - Engine support systems - Resources and File systems - Human Interface devices - Collision and rigid body dynamics - Game profiling.

UNIT III GAME PROGRAMMING **(9Hrs)**

Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management

UNIT IV GAMING PLATFORMS AND FRAMEWORKS **(9Hrs)**

Game development Platforms: Introduction to Flash – DirectX - Python gaming modules and packages, Game engines - Unity DX Studio.

UNIT -V GAME DEVELOPMENT **(9Hrs)**

Applications on interactive games: Interactive game developing using DirectX – Python - Developing Tile Based Games - Puzzle games.

Text Books

1. Mike McShaffrfy and David Graham, "Game Coding Complete", Cengage Learning, Fourth Edition, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press, A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2nd Edition, Morgan Kaufmann, 2006.

Reference Books

1. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall / New Riders, 2nd Edition, 2009.
2. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", Course Technology PTR, 3rd Edition, 2011.
3. Jesse Schell, "The Art of Game Design: A book of lenses", CRC Press, 1st Edition, 2008.

Web References

1. https://swayam.gov.in/nd1_noc19_ge32/preview
2. https://www.coursera.org/specializations/game-development
3. www.unity3D.com

2.A.4.29

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	2	-	-	-	-	-	-	2	2	2	3
2	3	2	1	1	2	-	-	-	-	-	-	2	2	2	3
3	2	2	-	-	2	-	-	-	-	-	-	2	2	2	3
4	3	2	1	1	2	-	-	-	-	-	-	2	2	2	3
5	3	2	2	1	2	-	-	-	-	-	-	2	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

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U20ITE827	COMPUTER ANIMATION: ALGORITHMS AND TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the basic animation techniques and concepts covered in the film and video technology.
- Knowledge on algorithms of camera specifications and its renderings motion.
- Emphasis is on creative content, experimentation and critical thinking on character and facial Animation

Course Outcomes

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

CO1 - Understand the Computer animation basics **(K2)**
CO2 - Interpret the concept of Transformation and Orientation **(K2)**
CO3 - Understand the Kinematics and Motion Capture **(K2)**
CO4 - Illustrate Modeling and Animating Human Figures **(K4)**
CO5 - Describe the Models for Animation **(K2)**

UNIT I INTRODUCTION **(9 Hrs)**

Introduction - A brief history of computer animation - Perception - The Heritage of Animation - Computer animation production

UNIT II TRANSFORMATION AND ORIENTATION **(9 Hrs)**

Spaces and transformations - Display pipeline - Transformation matrix - Concatenating transformations - Extracting transformations from a matrix - Description of transformations in the display pipeline. Orientation representation: Fixed-angle representation - Angle and axis representation - Exponential map representation

UNIT III KINEMATICS AND MOTION CAPTURE **(9 Hrs)**

Hierarchical Modelling - Forward kinematics - Inverse kinematics. Motion Capture: Motion capture technologies - Processing the images - Three-dimensional position reconstruction - Fitting to the skeleton - Output from motion capture systems - Manipulating motion capture data

UNIT IV MODELING AND ANIMATING HUMAN FIGURES **(9 Hrs)**

Virtual human representation: Overview - Reaching and grasping - Walking – Coverings. Facial Animation: Facial models - Animating the face - Lip-sync animation

UNIT V BEHAVIORAL AND MODELS FOR ANIMATION **(9 Hrs)**

Behavioral Animation: Primitive behaviors - Knowledge of the environment - Modelling intelligent behavior - Crowds. **Models for Animation:** Implicit surfaces - Plants - Subdivision surfaces

Text Books

1. Rick Parent, "Computer Animation: Algorithms & Techniques", Morgan Kaufmann, 3rd Edition, 2012.
2. Charles Solomon, "The History of Animation: Enchanted Drawings," Wings Books, New York, 1994.

Reference Books

1. Watt and Watt, "Advanced Animation and Rendering," Addison-Wesley, New York, 1992.
2. Ebert, Dave, "Design and Animation of Volume Density Functions," The Journal of Visualization and Computer Animation, Vol. 4, No. 4, 1993, pp. 213-232.
3. Korein, J., and Badler, N., "Temporal Anti-Aliasing in Computer Generated Animation," SIGGRAPH'83, pp. 377-388.

Web Resources

1. https://www.coursera.org/learn/interactive-computer-graphics
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-838-algorithms-for-computer-animation-fall-2002/

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	2	-	-	-	-	-	-	-	2	2	3
2	3	2	2	2	2	-	-	-	-	-	-	-	2	2	3
3	3	2	2	2	2	-	-	-	-	-	-	-	3	2	3
4	3	2	2	-	2	-	-	-	-	-	-	-	2	2	3
5	3	2	2	2	2	-	-	-	-	-	-	-	3	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

U20ITE828	C# AND .NET	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamentals of developing modular application by using object oriented concepts.
- To utilize the C# and .NET framework to build distributed enterprise applications.
- To develop Console Application, Windows Application and Web Applications.
- To connect to multiple data sources and managing them effectively.
- To learn the product development.

Course Outcomes

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

CO1 - Illustrate about MS.NET framework developed by Microsoft. **(K2)**
CO2 - Articulate and implement Applications with C#. **(K2)**
CO3 - Identify the interface for application development. **(K2)**
CO4 - Understand the .NET framework and deployment in the .NET. **(K2)**
CO5 - Explore Assemblies and Deployment in .NET enterprise applications. **(K2)**

UNIT - I INTRODUCTION
(9 Hrs)

The .NET Framework - Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) – Compilation process – Assemblies – Namespaces.

UNIT – II C# FUNDAMENTALS
(9 Hrs)

C# class - object - string formatting - Types - scope - Constants - C# iteration - Control flow - Operators - Array - String - Enumerations - Structures - Custom namespaces. Programming constructs – value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections – Multithreading.

UNIT - III GRAPHICS & WINDOW FORMS
(9 Hrs)

Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Event Handlers -Run time – Graphics programming GDI+.

UNIT - IV DATABASE PROGRAMMING
(9 Hrs)

Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – Data set – Data binding – Data Grid Control – XML based Data sets.

UNIT - V J2EE
(9 Hrs)

Enterprise Edition Overview – Multi-Tier Architecture – Best Practices – Comparison between J2EE and .NET.

Text Books

4. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2002.
5. Herbert Schildt, "C# 3.0 The Complete Reference", McGraw-Hill Professional, Third Edition, 2009.
6. Keogh, "J2EE The Complete Reference", Tata McGraw-Hill, 2015.

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Reference Books

4. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Sixth edition, A Press, 2012.
5. Joh Skeet, C# in depth, Manning publications, Third Edition, 2014. .
6. Adrew Stellman and Jennifer Greene, Head First C#, Third Edition, O'Reilly, 2013.

Web References

3. https://www.c-sharpcorner.com/csharp-tutorials
4. https://www.guru99.com/c-sharp-tutorial.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U20ITE829	HIGH PERFORMANCE COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the challenges in parallel and multi-threaded programming
- Acquire the knowledge about the various parallel programming paradigms, and solutions
- Acquaint the knowledge of Parallel Programming using OpenMP and Message Passing Interface (MPI)

Course Outcomes

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

CO1 - Understand parallel hardware and software. **(K2)**
CO2 - Execute Distributed Memory Programming with MPI **(K3)**
CO3 - Execute Shared Memory Programming with OPENMP **(K3)**
CO4 - Implement Parallel Program **(K3)**
CO5 - Implement for serial Data structures **(K3)**

UNIT I PARALLEL HARDWARE AND SOFTWARE **(9 Hrs)**

Parallel Hardware: SIMD and MIMD systems - Interconnection networks - Cache coherence - Shared memory versus distributed memory.
Parallel Software: Caveats - Coordinating the processes/threads - Shared-memory - Distributed-memory- Programming hybrid systems.

UNIT II DISTRIBUTED MEMORY PROGRAMMING WITH MPI **(9 Hrs)**

MPI program - Compilation and execution - Communicators - SPMD programs - MPI send and receive - Communication - Message matching - Semantics of MPI - Performance Evaluation of MPI Programs.

UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP **(9 Hrs)**

Compiling and running OpenMP programs - The Trapezoidal Rule - Scope of Variables - The Reduction Clause - The parallel for Directive - More About Loops in OpenMP: Sorting - Scheduling Loops.

UNIT IV PROGRAM DEVELOPMENT - n-Body Solvers **(9 Hrs)**

Two n-Body Solvers: Two serial programs - Parallelizing the n-body solvers - Parallelizing the basic solver using OpenMP - Parallelizing the reduced solver using OpenMP - Evaluating the OpenMP codes- Parallelizing the solvers using pthreads .

UNIT V PROGRAM DEVELOPMENT - Tree Search **(9 Hrs)**

Recursive depth-first search - Non recursive depth-first search - Data structures for the serial implementations - Performance of the serial implementations - Parallelizing tree search - A static parallelization of tree search using pthreads - Dynamic parallelization of tree search using pthreads.

Text Books

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003
4. Shameem Akhter and Jason Roberts, Multi-core Programming, Intel Press, 2006

Reference Books

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011
2. Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998
3. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984

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Web References

1. https://www.udacity.com/course/high-performance-computing--ud281
2. https://hpc.llnl.gov/training/tutorials

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

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U20ITE830	STREAMING ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Gain knowledge about the Streaming Data and Static Data used in a business environment.
- Impart knowledge on the Data flows, processing & storing streaming data.
- Understand the knowledge on streaming metrics.

Course Outcomes

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

CO1 - Understand the need for stream computing **(K2)**

CO2 - Comprehend the architecture of streaming analytics **(K2)**

CO3 - Explore the new initiatives for enhancing data flow management and processing **(K2)**

CO4 - Recognize the Storing technologies for streaming data **(K2)**

CO5 - Apply the knowledge of streaming metrics for Analysis and Visualization **(K3)**

UNIT I INTRODUCTION TO STREAM COMPUTING **(9 Hrs)**

Streaming Data - Sources - Difference between Streaming Data and Static Data. Overview of Large Scale. Stream Processing Engines - Issues in Stream Processing

UNIT II STREAMING ANALYTICS ARCHITECTURE **(9 Hrs)**

Designing Real-Time Streaming Architectures: Real-Time Architecture Components - Features of a Real-Time Architecture - Languages for Real-Time Programming. Service Configuration and Management: Maintaining Distributed State - Apache Zookeeper

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UNIT III DATA FLOW & PROCESSING **(9 Hrs)**

Distributed Data Flows - Apache Kafka - Apache Flume. Processing Streaming Data: Distributed Streaming Data Processing - Processing Data with STORM - Processing Data with SAMZA

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UNIT IV STORING STREAMING DATA **(9 Hrs)**

Consistent Hashing - "NoSQL" Storage Systems - Other Storage Technologies - Relational Databases - Warehousing

UNIT V ANALYSIS AND VISUALIZATION **(9 Hrs)**

Delivering Streaming Metrics: Streaming Web Applications - Visualizing Data - Mobile Streaming Applications. Exact Aggregation and Delivery: Timed Counting and Summation - Stochastic Optimization. Statistical Approximation of Streaming Data: Random Number Generation - Sampling Procedures

Text Books

1. Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 2014.
2. Andrew Psaltis, "Streaming Data: Understanding the real-time pipeline", Manning, 2017.
3. Bill Franks, Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics, Wiley, 2012.

Reference Books

1. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
2. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos , Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2011.

Web References

1. https://www.classcentral.com/course/real-time-streaming-big-data-950
2. flume.apache.org
3. zookeeper.apache.org

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CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

Curriculum – R2019

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19ITT81	Deep Learning	PC	3	0	0	3	25	75	100
2	U19ITE8X	Professional Elective – V#	PE	3	0	0	3	25	75	100
3	U19ITE8X	Professional Elective – VI#	PE	3	0	0	3	25	75	100
Practical										
4	U19ITP81	Entrepreneurship Management	HS	0	0	3	1	100	-	100
Project Work										
5	U19ITW81	Project Phase – II	PW	0	0	16	8	40	60	100
Employability Enhancement Course										
6	U19ITS81	Skill Development Course 10: NPTEL/MOOC-II	EEC	0	0	0	-	100	-	100
							18	315	285	600

Professional Elective Courses

Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ITE80	Human Computing Interface
2	U19ITE81	Business Intelligence
3	U19ITE82	Social Network Analysis
4	U19ITE83	Mixed Reality
5	U19ITE84	Game Development
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19ITE85	Cyber Security
2	U19ITE86	Computer Animation: Algorithms and Techniques
3	U19ITE87	C # and .Net
4	U19ITE88	High Performance Computing
5	U19ITE89	Streaming Analytics

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U19ITT81	DEEP LEARNING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand Neural Network basics and Types
- To understand Convolutional Neural Networks and its architecture
- To understand and implement Recurrent Neural Network
- To understand the Boltzmann Machine Spin Glass Model and Deep Belief Networks
- To learn various Applications of Deep Learning

Course Outcomes

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

CO1 - Discuss the basics of Neural Network and its types **(K2)**
CO2 - Describe Convolutional Neural Networks and its architecture **(K2)**
CO3 - Implement Recurrent Neural Network **(K3)**
CO4 - Describe the Spin Glass Model and Deep Belief Networks **(K2)**
CO5 - Apply Deep Learning Techniques **(K3)**

UNIT I INTRODUCTION TO NEURAL NETWORK(NN)

Introduction to NN - Neural Networks and types - Gradient descent - Training Neural Networks - Backpropagation - Deep Learning With Pytorch

UNIT II CONVOLUTIONAL NEURAL NETWORK(CNN)

Convolutional Neural Network - CNNs Architectures - Weight Initialization - Autoencoders - Transfer Learning in PyTorch - Deep Learning for Cancer Detection

UNIT III RECURRENT NEURAL NETWORK(RNN)

Recurrent Neural Network - Long & Short-Term Memory Network - Implementation of RNN & LSTM - Hyperparameters - Embeddings & Word2vec - Sentiment Prediction RNN

UNIT IV BOLTZMANN MACHINES

Introduction to Boltzmann Machine - Energy-Based Models - Restricted Boltzmann Machine - Contrastive Divergence - Deep Belief Networks - Deep Boltzmann Machine

UNIT V DEEP LEARNING APPLICATIONS

Image Processing - Natural Language Processing - Speech Recognition - Video Analytics

Text Books

1. Aston Zhang, Zack C. Lipton, Mu Li, Alex J. Smola, "Dive into Deep Learning", Amazon Science,2018
2. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018

Reference Books

1. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018
2. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018
3. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016

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Website References

1. https://link.springer.com/book/10.1007/978-3-319-73004-2
2. http://deeplearning.net/reading-list/

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	3	-	-	-	-	-	-	2	2	2	3
2	3	3	1	1	2	-	-	-	-	-	-	2	2	2	3
3	2	2	2	2	2	-	-	-	-	-	-	2	2	2	3
4	2	2	1	1	-	-	-	-	-	-	-	2	2	2	3
5	3	2	3	3	2	-	-	-	-	-	-	2	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

U19ITE80	HUMAN COMPUTING INTERFACE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concept of the Human computer Interaction.
- To learn the design techniques and fundamentals of Human Computer Interaction
- To know the various types of existing interfaces and evaluation techniques
- To understand the appropriate use of computers and other technology in instructional Programming.
- To understand the applications of HCI in emerging trends

Course Outcomes

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

CO1 - Understand the requirements and specifications for the interaction design **(K2)**
CO2 - Design an efficient and user-friendly human computer interface **(K3)**
CO3 - Analyze and implement Communication & Collaborative Models **(K4)**
CO4 - Illustrate Assistive Technology **(K3)**
CO5 - Analyze Ubiquitous computing applications **(K4)**

UNIT I INTRODUCTION **(9Hrs)**

Historical evolution of the field - Concept of usability - definition and elaboration, HCI and software engineering, GUI design and aesthetics, Prototyping techniques - Psychology & design of interactive systems; Computer - Text entry devices Positioning, Pointing & drawing - Display devices for Virtual reality, 3D- Interaction styles - WIMP Interfaces - context; paradigms for Interaction.

UNIT II SOFTWARE PROCESS & DESIGN RULES **(9Hrs)**

Interaction design basics – user focus – scenarios – navigation – screen design & layout ;HCI in software process – life cycle – Usability Engineering – Interactive design & Prototyping - Design rules - Principles for usability - standards - guidelines - golden rules - HCI patterns.

UNIT III COMMUNICATION & COLLABORATIVE MODELS **(9Hrs)**

Goal & task hierarchies - Linguistic models - Physical & device models - architectures; communication & collaboration models - Face - to - face communication - conversation - text based - group working; Task analysis - difference between other techniques - task decomposition - Knowledge based analysis - ER based techniques - uses.

UNIT IV OVERVIEW AND FRAMEWORK **(9Hrs)**

Overview of Assistive Technology, Framework for Assistive technologies - Assistive Technology for People with Disabilities - General purpose Assistive technologies - Human Assistive technology - Assistive Technologies in the context of classroom and work.

UNIT -V UBIQUITOUS COMPUTING & WWW **(9Hrs)**

Ubiquitous computing application research - virtual & augmented reality - Information & data visualization - Web Technology & issues - Static Web content - Dynamic Web content.

Text Books

1. Preece, J., Sharp, H., Rogers, Y. "Interaction Design: Beyond Human-Computer Interaction", Fourth Edition, John Wiley, 2015.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: beyond human-computer interaction", John-Wiley and Sons Inc., 2011.
3. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, "Human Computer Interaction", Pearson Education, Third Edition, 2004.
4. Cook and Hussey, "Assistive Technologies, Principles and Practice", Mosby, Second Edition 2008.

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Reference Books

1. Cooper, Reimann, Cronin, & Noessel, "About Face: The Essentials of Interaction Design", Fourth Edition, 2014.
2. Frank Bentley, Edward Barrett,"Building Mobile Experiences ", MIP Press, Cambridge, 2012.
3. Jonathan Lazar Jinjuan, Heidi Feng, Harry Hochheiser, "Research Methods in Human-Computer Interaction", Wiley, 2010.

Web References

1. https://nptel.ac.in/courses/106/106/106106177/
2. https://www.udacity.com/course/human-computer-interaction--ud400
3. https://www.coursera.org/courses?query=human%20computer%20interaction

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

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U19ITE82	SOCIAL NETWORK ANALYSIS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concept of social network analysis and related applications.
- To learn network models and link analysis.
- To analyze and evaluate communities.
- To understand human behaviour in social web and related communities.
- To learn application of social networks.

Course Outcomes

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

CO1 - Discuss the concepts of social network analysis and related applications **(K2)**
CO2 - Discuss the various Network Growth Models **(K2)**
CO3 - Explain the concept of communities in web social networks **(K2)**
CO4 - Explain human behaviour in social web and related communities **(K2)**
CO5 - Create Learning Methods and Applications **(K3)**

UNIT I INTRODUCTION TO NETWORKS AND SOCIETY **(9 Hrs)**

Social Network Analysis - Applications of Social Network Analysis - Preliminaries - Levels of Social Network Analysis - Historical Development - Graph Visualisation Tools - Network Measures - Network Basics - Node Centrality - Assortativity - Transitivity and Reciprocity - Similarity - Degeneracy.

UNIT II NETWORK GROWTH MODELS AND LINK ANALYSIS **(9 Hrs)**

Properties of Real - World Networks - Random Network Model - Ring Lattice Network Model Watts - Strogatz Model - Preferential Attachment Model - Price's Model - Local-world Network Growth Model - Network Model with Accelerating Growth - Aging in Preferential Attachment - Applications of Link Analysis - Signed Networks - Strong and Weak Ties - Link Analysis Algorithms

UNIT III EXTRACTION, MINING COMMUNITIES IN WEB SOCIAL NETWORKS **(9Hrs)**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES **(9 Hrs)**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures

UNIT V LEARING METHODS AND APPLICATIONS OF SOCIAL NETWORKS **(9 Hrs)**

Machine Learning Pipelines - Intuition behind Representation Learning - Benefits of Representation Learning - Criterion for Graph Representation Learning - Graph Representation Learning Pipeline - Representation Learning Methods. Applications and Case Studies - Malicious Activities on OSNs - Sock puppets in OSNs

Text Books

1. Tanmoy Chakraborty "Social Network Analysis" Wiley Edition: 2021
2. S.Wasserman, K.Faust: Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994 3. Scott, J. (2007).
3. Social network analysis: A handbook (2nd Ed.). Newbury Park, CA: Sage. 4. Knoke (2008). Social Network Analysis, (2nd Ed). Sage.
4. Peter Mika, "Social Networks and the Semantic Web", Springer, First Edition, 2007.
5. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st Edition, 2010.

Reference Books

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking -Techniques and applications", Springer, First Edition, 2011.
2. Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web",Springer, 2009.

Web References

1. https://nptel.ac.in/courses/106/106/106106169/
2. https://www.coursera.org/learn/social-media-data-analytics
3. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm https://blockgeeks.com/
4. https://www.talkwalker.com/blog/social-media-analytics-guide

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	3	2	1	1	2	-	-	-	-	-	-	-	-	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

2.A.4.46

U19ITE84 **GAME DEVELOPMENT**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the concepts of Game design and development.
- To learn the processes, mechanics and issues in Game Design.
- To be exposed to the Core architectures of Game Programming.
- To know about Game programming platforms, frame works and engines.
- To learn how to develop games

Course Outcomes

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

CO1 - Discuss the concepts of Game design and development **(K2)**
CO2 - Design the processes, and use mechanics for game development. **(K3)**
CO3 - Describe the Core architectures of Game Programming. **(K2)**
CO4 - Use Game programming platforms, frame works and engines **(K3)**
CO5 - Create interactive Games. **(K5)**

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING (9Hrs)

3D Transformations - 3D Modeling and Rendering - Ray Tracing - Shader Models - Lighting - Color - Texturing - Camera and Projections - Culling and Clipping, Character Animation, Scene Graphs.

UNIT II GAME ENGINE DESIGN (9Hrs)

Game engine architecture - Engine support systems - Resources and File systems - Human Interface devices - Collision and rigid body dynamics - Game profiling.

UNIT III GAME PROGRAMMING (9Hrs)

Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management

UNIT IV GAMING PLATFORMS AND FRAMEWORKS (9Hrs)

Game development Platforms: Introduction to Flash – DirectX - Python gaming modules and packages, Game engines - Unity DX Studio.

UNIT -V GAME DEVELOPMENT (9Hrs)

Applications on interactive games: Interactive game developing using DirectX – Python - Developing Tile Based Games - Puzzle games.

Text Books

1. Mike McShaffrfy and David Graham, "Game Coding Complete", Cengage Learning, Fourth Edition, 2012.
2. Jason Gregory, "Game Engine Architecture", CRC Press, A K Peters, 2009.
3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" 2nd Edition, Morgan Kaufmann, 2006.

Reference Books

1. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall / New Riders, 2nd Edition, 2009.
2. Eric Lengyel, "Mathematics for 3D Game Programming and Computer Graphics", Course Technology PTR, 3rd Edition, 2011.
3. Jesse Schell, "The Art of Game Design: A book of lenses", CRC Press, 1st Edition, 2008.

Web References

1. https://swayam.gov.in/nd1_noc19_ge32/preview
2. https://www.coursera.org/specializations/game-development
3. www.unity3D.com

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CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	2	-	-	-	-	-	-	2	2	2	3
2	3	2	1	1	2	-	-	-	-	-	-	2	2	2	3
3	2	2	-	-	2	-	-	-	-	-	-	2	2	2	3
4	3	2	1	1	2	-	-	-	-	-	-	2	2	2	3
5	3	2	2	1	2	-	-	-	-	-	-	2	2	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

2.A.4.48

U19ITE86 **COMPUTER ANIMATION: ALGORITHMS AND TECHNIQUES**

L	T	P	C
3	0	0	3

Course Objectives

- Understand the basic animation techniques and concepts covered in the film and video technology.
- Knowledge on algorithms of camera specifications and its renderings motion.
- Emphasis is on creative content, experimentation and critical thinking on character and facial Animation

Course Outcomes

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

CO1 - Understand the Computer animation basics **(K2)**
CO2 - Interpret the concept of Transformation and Orientation **(K2)**
CO3 - Understand the Kinematics and Motion Capture **(K2)**
CO4 - Illustrate Modeling and Animating Human Figures **(K4)**
CO5 - Describe the Models for Animation **(K2)**

UNIT I INTRODUCTION **(9 Hrs)**

Introduction - A brief history of computer animation - Perception - The Heritage of Animation - Computer animation production

UNIT II TRANSFORMATION AND ORIENTATION **(9 Hrs)**

Spaces and transformations - Display pipeline - Transformation matrix - Concatenating transformations - Extracting transformations from a matrix - Description of transformations in the display pipeline. Orientation representation: Fixed-angle representation - Angle and axis representation - Exponential map representation

UNIT III KINEMATICS AND MOTION CAPTURE **(9 Hrs)**

Hierarchical Modelling - Forward kinematics - Inverse kinematics. Motion Capture: Motion capture technologies - Processing the images - Three-dimensional position reconstruction - Fitting to the skeleton - Output from motion capture systems - Manipulating motion capture data

UNIT IV MODELING AND ANIMATING HUMAN FIGURES **(9 Hrs)**

Virtual human representation: Overview - Reaching and grasping - Walking – Coverings. Facial Animation: Facial models - Animating the face - Lip-sync animation

UNIT V BEHAVIORAL AND MODELS FOR ANIMATION **(9 Hrs)**

Behavioral Animation: Primitive behaviors - Knowledge of the environment - Modelling intelligent behavior - Crowds. **Models for Animation:** Implicit surfaces - Plants - Subdivision surfaces

Text Books

1. Rick Parent, "Computer Animation: Algorithms & Techniques", Morgan Kaufmann, 3rd Edition, 2012.
2. Charles Solomon, "The History of Animation: Enchanted Drawings," Wings Books, New York, 1994.

Reference Books

1. Watt and Watt, "Advanced Animation and Rendering," Addison-Wesley, New York, 1992.
2. Ebert, Dave, "Design and Animation of Volume Density Functions," The Journal of Visualization and Computer Animation, Vol. 4, No. 4, 1993, pp. 213-232.
3. Korein, J., and Badler, N., "Temporal Anti-Aliasing in Computer Generated Animation," SIGGRAPH'83, pp. 377-388.

Web Resources

1. https://www.coursera.org/learn/interactive-computer-graphics
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-838-algorithms-for-computer-animation-fall-2002/

CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	2	-	-	-	-	-	-	-	2	2	3
2	3	2	2	2	2	-	-	-	-	-	-	-	2	2	3
3	3	2	2	2	2	-	-	-	-	-	-	-	3	2	3
4	3	2	2	-	2	-	-	-	-	-	-	-	2	2	3
5	3	2	2	2	2	-	-	-	-	-	-	-	3	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

U19ITE87	C# AND .NET	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamentals of developing modular application by using object oriented concepts.
- To utilize the C# and .NET framework to build distributed enterprise applications.
- To develop Console Application, Windows Application and Web Applications.
- To connect to multiple data sources and managing them effectively.
- To learn the product development.

Course Outcomes

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

CO1 - Illustrate about MS.NET framework developed by Microsoft. **(K2)**
CO2 - Articulate and implement Applications with C#. **(K2)**
CO3 - Identify the interface for application development. **(K2)**
CO4 - Understand the .NET framework and deployment in the .NET. **(K2)**
CO5 - Explore Assemblies and Deployment in .NET enterprise applications. **(K2)**

UNIT - I INTRODUCTION
(9 Hrs)

The .NET Framework - Common language Runtime (CLR) – Common Type System (CTS) – Common language Specification (CLS) – Compilation process – Assemblies – Namespaces.

UNIT – II C# FUNDAMENTALS
(9 Hrs)

C# class - object - string formatting - Types - scope - Constants - C# iteration - Control flow - Operators - Array - String - Enumerations - Structures - Custom namespaces. Programming constructs – value types and reference types – object oriented concepts – Encapsulation – Inheritance – polymorphism – Interfaces – collections – Multithreading.

UNIT - III GRAPHICS & WINDOW FORMS
(9 Hrs)

Tool box controls – Container control – Menu – Tool bar – Tool tip Controls during design time – Event Handlers -Run time – Graphics programming GDI+.

UNIT - IV DATABASE PROGRAMMING
(9 Hrs)

Data Access with ADO.NET – Architecture – Data reader – Data Adapter – Command – Connection – Data set – Data binding – Data Grid Control – XML based Data sets.

UNIT - V J2EE
(9 Hrs)

Enterprise Edition Overview – Multi-Tier Architecture – Best Practices – Comparison between J2EE and .NET.

Text Books

1. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2002.
2. Herbert Schildt, "C# 3.0 The Complete Reference", McGraw-Hill Professional, Third Edition, 2009.
3. Keogh, "J2EE The Complete Reference", Tata McGraw-Hill, 2015.

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Reference Books

1. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Sixth edition, A Press, 2012.
2. Joh Skeet, C# in depth, Manning publications, Third Edition, 2014. .
3. Adrew Stellman and Jennifer Greene, Head First C#, Third Edition, O'Reilly, 2013.

Web References

1. https://www.c-sharpcorner.com/csharp-tutorials
2. https://www.guru99.com/c-sharp-tutorial.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	2	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ITE88	HIGH PERFORMANCE COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand the challenges in parallel and multi-threaded programming
- Acquire the knowledge about the various parallel programming paradigms, and solutions
- Acquaint the knowledge of Parallel Programming using OpenMP and Message Passing Interface (MPI)

Course Outcomes

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

CO1 - Understand parallel hardware and software. **(K2)**
CO2 - Execute Distributed Memory Programming with MPI **(K3)**
CO3 - Execute Shared Memory Programming with OPENMP (**K3)**
CO4 - Implement Parallel Program **(K3)**
CO5 - Implement for serial Data structures **(K3)**

UNIT I PARALLEL HARDWARE AND SOFTWARE (9 Hrs)

Parallel Hardware: SIMD and MIMD systems - Interconnection networks - Cache coherence - Shared memory versus distributed memory.
Parallel Software: Caveats - Coordinating the processes/threads - Shared-memory - Distributed-memory- Programming hybrid systems.

UNIT II DISTRIBUTED MEMORY PROGRAMMING WITH MPI (9 Hrs)

MPI program - Compilation and execution - Communicators - SPMD programs - MPI send and receive - Communication - Message matching - Semantics of MPI - Performance Evaluation of MPI Programs.

UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP (9 Hrs)

Compiling and running OpenMP programs - The Trapezoidal Rule - Scope of Variables - The Reduction Clause - The parallel for Directive - More About Loops in OpenMP: Sorting - Scheduling Loops.

UNIT IV PROGRAM DEVELOPMENT - n-Body Solvers (9 Hrs)

Two n-Body Solvers: Two serial programs - Parallelizing the n-body solvers - Parallelizing the basic solver using OpenMP - Parallelizing the reduced solver using OpenMP - Evaluating the OpenMP codes- Parallelizing the solvers using pthreads .

UNIT V PROGRAM DEVELOPMENT - Tree Search (9 Hrs)

Recursive depth-first search - Non recursive depth-first search - Data structures for the serial implementations - Performance of the serial implementations - Parallelizing tree search - A static parallelization of tree search using pthreads - Dynamic parallelization of tree search using pthreads.

Text Books

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003
4. Shameem Akhter and Jason Roberts, Multi-core Programming, Intel Press, 2006

Reference Books

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011
2. Charles Severance, Kevin Dowd, High Performance Computing, O'Reilly Media, 2nd Edition, 1998
3. Kai Hwang, Faye Alaye Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1984

Web References

1. https://www.udacity.com/course/high-performance-computing--ud281
2. https://hpc.llnl.gov/training/tutorials

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3

Correlation Level: 1-Low, 2-Medium, 3- High

U19ITE89	STREAMING ANALYTICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Gain knowledge about the Streaming Data and Static Data used in a business environment.
- Impart knowledge on the Data flows, processing & storing streaming data.
- Understand the knowledge on streaming metrics.

Course Outcomes

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

CO1 - Understand the need for stream computing **(K2)**
CO2 - Comprehend the architecture of streaming analytics **(K2)**
CO3 - Explore the new initiatives for enhancing data flow management and processing **(K2)**
CO4 - Recognize the Storing technologies for streaming data **(K2)**
CO5 - Apply the knowledge of streaming metrics for Analysis and Visualization **(K3)**

UNIT I INTRODUCTION TO STREAM COMPUTING **(9 Hrs)**

Streaming Data - Sources - Difference between Streaming Data and Static Data. Overview of Large Scale. Stream Processing Engines - Issues in Stream Processing

UNIT II STREAMING ANALYTICS ARCHITECTURE **(9 Hrs)**

Designing Real-Time Streaming Architectures: Real-Time Architecture Components - Features of a Real-Time Architecture - Languages for Real-Time Programming. Service Configuration and Management: Maintaining Distributed State - Apache Zookeeper

UNIT III DATA FLOW & PROCESSING **(9 Hrs)**

Distributed Data Flows - Apache Kafka - Apache Flume. Processing Streaming Data: Distributed Streaming Data Processing - Processing Data with STORM - Processing Data with SAMZA

UNIT IV STORING STREAMING DATA **(9 Hrs)**

Consistent Hashing - "NoSQL" Storage Systems - Other Storage Technologies - Relational Databases - Warehousing

UNIT V ANALYSIS AND VISUALIZATION **(9 Hrs)**

Delivering Streaming Metrics: Streaming Web Applications - Visualizing Data - Mobile Streaming Applications. Exact Aggregation and Delivery: Timed Counting and Summation - Stochastic Optimization. Statistical Approximation of Streaming Data: Random Number Generation - Sampling Procedures

Text Books

1. Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 2014.
2. Andrew Psaltis, "Streaming Data: Understanding the real-time pipeline", Manning, 2017.
3. Bill Franks, Taming The Big Data Tidal Wave Finding Opportunities In Huge Data Streams With Advanced Analytics, Wiley, 2012.

Reference Books

1. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014.
2. Paul C Zikopoulos, Chris Eaton, Paul Zikopoulos , Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw-Hill, 2011.

Web References

1. https://www.classcentral.com/course/real-time-streaming-big-data-950
2. flume.apache.org
3. zookeeper.apache.org

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CO-PO-PSO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
3	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
4	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
5	2	1	-	-	2	-	-	-	-	-	-	-	-	2	3
Correlation Level: 1-Low, 2-Medium, 3- High															

Annexure - IV

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST432	Discrete Mathematics and Graph Theory	BS	2	2	0	3	25	75	100
2	U20EST467	Programming in Java	ES	3	0	0	3	25	75	100
3	U20ITT408	Operating System	PC	3	0	0	3	25	75	100
4	U20ITT409	Web Application Development	PC	3	0	0	3	25	75	100
5	U20ITE4XX	Professional Elective - I#	PE	3	0	0	3	25	75	100
6	U20XXO4XX	Open Elective – I$	OE	3	0	0	3	25	75	100
Practical										
7	U20HSP402	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U20ESP468	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
9	U20ITP404	Operating System Laboratory	PC	0	0	2	1	50	50	100
10	U20ITP405	Web Application Development Laboratory	PC	0	0	2	1	50	50	100
Employability Enhancement Course										
11	U20ITC4XX	Certification Course - IV**	EEC	0	0	4	-	100	-	100
12	U20ITS403	Skill Development Course 3*	EEC	0	0	2	-	100	-	100
Mandatory Course										
13	U20ITM404	NSS	MC	0	0	2	-	100	-	100
							22	650	650	1300

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