GENERAL GUIDELINES

Do's:-

- Students should be on time for every lecture.
- Students are advised to show due respect to all faculty members.
- Students should keep the Classrooms, Laboratories and Workshops clean and tidy.
- Students must maintain absolute discipline and decorum, while on campus.
- **Students should come prepared with algorithm / flowchart / program / procedure for all the experiments before attending the laboratory session.**
- Students should bring the data sheets and laboratory records completed in all respects to the laboratory.
- Students are advised to clarify their doubts in the respective courses with the faculty.
- Students have to inform their parents that they should follow up the progress of their wards by being in touch with the institution authorities at regular intervals.
- **Students are advised to be present for the mentor meetings conducted by their respective Faculty Advisors, failing which appropriate disciplinary action will be taken.**

Don'ts:-

- Students are not permitted to attend the class without the identity card, once issued.
- **Ragging is strictly prohibited because it is punishable under Karnataka Education Act. Any student involved in ragging, will be severely punished – which includes handing over the case to Police, rustication from the college etc.**
- Writing on desks and walls is strictly prohibited, failing which the students will be fined heavily. If the identity of the individual is not established the entire class / students in the block will be fined.
- **Students must not use their cell phones during class hours. If any student is found using their cell phone during class hours it will be confiscated.**
- Students are not supposed to alter the configuration of the system / any software on the systems.

V SEMESTER (2019-23 BATCH)

Sl. No.	Course Code	Course Title	Hours per week				Credits	Tools / Languages	Course Type
			L	T	P	S	C		
1	UE19CS301	Database Management System	4	0	0	4	4	Postgre SQL 13.3, ERwin	CC
2	UE19CS302	Software Engineering	4	0	0	4	4	GitHub, MS Project, Jenkins	CC
3	UE19CS303	Machine Intelligence*	4	0	0	4	4	Tensorflow 1.15, Keras 2.3.1, Python 3.7	CC
4	UE19CS304	Database Management System Laboratory	0	0	2	1	1	Oracle, MySQL,SQL Server, PostgreSQL	CC
5	UE19CS305	Machine Intelligence Laboratory	0	0	2	1	1	Python(3.7x), sklearn(v0.23), Keras(v2.2.4), Tensorflow(v1.14)	CC
6	UE19CS31X	Elective I	4	0	0	4	4		EC
7	UE19CS32X	Elective II	4	0	0	4	4		EC
8	UE19CS306X	Special Topic- III	2/4/4			2	2		ST
Total			**20/22**	**0**	**4/8**	**24**	**24**		
Elective – I									
9	UE19CS311	Advanced Algorithms%	4	0	0	4	4	C or C++	EC
10	UE19CS312	Data Analytics&	4	0	0	4	4	Python and R	EC
11	UE19CS313	Internet of Things	4	0	0	4	4	Python or C	EC
12	UE19CS314	Applied Cryptography	4	0	0	4	4	Seed virtual machine environment, gcc, python	EC
13	UE19CS315	Fundamentals of Augmented and Virtual Reality!!!	4	0	0	4	4	C, C++, Java, Python using OpenGL	EC
14	UE19CS316	Human Computer Interaction	4	0	0	4	4	C/C++/JAVA/ Python using OpenGL.	EC
Elective – II									

15	UE19CS321	Principles of Programming Languages	4	0	0	4	4	Various compilers and Debuggers as GCC, g++, Ada, Python, Ruby, Java, Prolog, Haskell, GDB, PDB.	EC
16	UE19CS322	Big Data[$]	4	0	0	4	4	Hadoop, HDFS Spark, Streaming spark, HIVE, Hbase, Mllib	EC
17	UE19CS323	Graph Theory, Applications and Combinatorics[!]	4	0	0	4	4	C-Language	EC
18	UE19CS324	Bio-inspired Computing[%]	4	0	0	4	4	Matlab	EC
19	UE19CS325	Advance Computer Networks[%%]	4	0	0	4	4	Claynet, Cisco Packet Tracer	EC
20	UE19CS326	Computer Network Security[%%]	4	0	0	4	4	Seed Ubuntu VM, Wireshark, Snort, NetwoX, Scapy	EC

Note: Desirable Knowledge - Core : [*]- UE19CS203, UE19MA251, UE19CS251.

Desirable Knowledge – Elective I : [%]- UE19CS251, [&]- UE19CS203, [!!!]- UE19CS202.

Desirable Knowledge – Elective II : [$]-UE19CS202, UE19CS251, [!]- UE19CS151, UE19CS202, [%]- UE19CS251, [%%]- UE19CS253.

ELECTIVES TO BE OPTED FOR SPECIALIZATION

Sl. No.	SPECIALIZATION	ELECTIVE – I	ELECTIVE – II
A	System and Core Computing(SCC)	UE19CS311, UE19CS315.	UE19CS321, UE19CS322, UE19CS323.
B	Machine Intelligence and Data Science(MIDS)	UE19CS312, UE19CS313, UE19CS315, UE19CS316.	UE19CS322, UE19CS323, UE19CS324.
C	Network and Cyber Security(NWCS)	UE19CS313, UE19CS314.	UE19CS325, UE19CS326.

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UE19CS311: Advanced Algorithms (4-0-0-4-4)

Faculty: Dr.RS **Total #of Hours: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of portions covered	
			Unit wise Coverage (approx) %	Cumulative Syllabus Coverage %
UNIT I : Basics of Complexity				
1	T1:Ch3,Ch4,Ch17,Ch34	Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions;	20	20
2		Recurrences and Solution of Recurrence equations-The substitution method,		
3		The recurrence tree method, The master method;		
4		Amortized Analysis: Aggregate, Accounting, Potential Methods		
5		NP-Completeness , NP Reduction		
6		-do-		
UNIT 2 : String Algorithms				
7	T1: Ch 32 (Refernce Papers will be provided for Suffix Trees and Applications)	String-Matching Algorithms: Naïve string Matching, String-Matching with Finite Automata	20	40
8		Rabin Karp Algorithm		
9		Knuth-Morris-Pratt algorithm		
10		Boyer-Moore algorithms.		
11		Suffix Trees Application of Suffix Trees, Regular Expression Searchwith Suffix Trees		
UNIT 3 : Maximum Flow, Polynomials and FFT				
12	T1: Ch 26,30	Max Flow: Flow networks and Ford-Fulkerson method;	20	60
13		The Edmonds-Karp Algorithm, MaximumBipartite matching		
14		Polynomials and the FFT: Representation of polynomials; Efficient Polynomial Multiplication		
15		The DFT and FFT		
16		-do-		
17		Efficient implementation of FFT.		
UNIT 4 : Number -Theoretic Algorithms				
18		Number -Theoretic Algorithms: Elementary notions; GCD;Modular Arithmetic; ModularInverse		

19	T1:Ch 31	Solving modular linear equations; The Chinese remainder theorem;	20	80
20		Powers of an element; RSA Cryptosystem		
21		Primality testing; Integer factorization.		
22		--do--		
UNIT 5 : Dynamic Programming, Randomized & Approximation Algorithms				
23	T1: Ch 15, 5, 35	Dynamic Programming: Elements of Dynamic Programming, Rod Cutting,Matrix-Chain Multiplication,	20	100
24		Longest Common Sub Sequence, Coin-Row problems		
25		Randomized Algorithms: Probabilistic Analysis, Indicator Random Variables,Hiring Problem		
26		Approximation algorithms: Vertex Cover Problem, Traveling Salesman Problem		
27		Subset Sum Problem, Linear Programming		
28		-do-		

Literature:

Book Type	Code	Title & Author	*Publication Info*		
			Edition	Publisher	Year
Text Book	T1	"Introduction to Algorithms" T. H Cormen, C E Leiserson, R L Rivest and C Stein	3rd Edition	Prentice-Hall of India	2010
Reference Book	R1	"The Algorithm Manual", Steven Skiena	2nd Edition	Springer, ISBN:9788184898651	2008
Reference Book	R2	"Randomized Algorithms", R Motwani and P Raghavan	-	Cambridge University Press	2011

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UE19CS312: Data Analytics (4-0-0-4-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
			Reference Chapter	Cumulative
1.	Unit: 1 Exploratory Data Analysis and Visualization T1: 2 R1: 2, 3	Introduction to data analytics +data sources and representations	*18*	18
2.		The R programming environment		
3.		Exploring data - basic statistics		
4.		Exploring data – types of data, operations, visualization		
5.		Data visualization + Asking questions + drawing inferences from data		
6.		Data visualization – do's and don'ts with examples		
7.		Data preprocessing: cleaning - dealing with missing data, diagnosing inconsistent data and handling anomalies		
8.		Data preprocessing – cleaning (contd.) + data integration and reduction		
9.		Data reduction (contd.) + transformations – PCA, normalization		
10.		Case study + review of problems		
11.	Unit : 2 Regression Analysis T1: 8, 9,10, 11	Correlation analysis: Pearson, Spearman's, Phi, Point bi-serial correlation	*21*	39
12.		Linear regression: assumptions + OLS solution + evaluation of a SLR model		
13.		Linear regression – Gradient descent + evaluation measures		
14.		Multiple linear regression – assumptions and model		
15.		Multiple regression – model diagnostics		
16.		Multivariate regression + bias-variance trade off + ridge and lasso regression		
17.		Non-linear regression at a glance		
18.		Logistic regression (concept of odds, odds ratio)		
19.		Cross validation + confusion matrices and evaluation metrics		
20.		Evaluation metrics		
21.		Case study + review of problems		
22.				
23.	Unit :3 Time Series T1: 13	Introduction to Time series data, simple average, moving average, exponential average	21	60
24.		Forecasting with exponential average (Holt's, Holt-Winter's)		
25.		Forecasting intermittent demand using Croston's method + Forecasting with Regression		
26.		Stationary Signals and ARMA		
27.		Concept of Stationarity, DF and ADF Test, Transformations		
28.		ARIMA – selection of parameters using ACF, PACF		
29.		Box Jenkins (ARIMA) contd. + ARIMAX, SARIMAX – at a glance		
30.		Evaluating time series models		
31.		Signal representations – spectral domain analysis		
32.		Time series – feature extraction and classification		
33.		Case study + review of problems		
34.				

35.	**Unit : 4** **Recommendation Systems** T1: 12, 14 R1: 6, 8, 9	Introduction to recommendation systems	20	80
36.		Distance and similarity measures		
37.		Collaborative filtering		
38.		Knowledge based filtering using knn		
39.		Decision trees – CART, Ensemble methods and Random Forest		
40.		Brief review of other classifiers: SVM, ANN and data driven approaches		
41.		Brief review of unsupervised learning – clustering algorithms – DBSCAN		
42.		Content based analysis – dealing with textual data		
43.		Text classification and clustering		
44.		Market basket analysis (Apriori algorithm)		
45.		Generation and evaluation of association rules from frequent item sets		
46.		Review of problems		
47.	**Unit : 5** **Advanced techniques** T1: 16 + Additional Reference material	Sparse data processing: Latent semantic analysis	20	100
48.		Discrete Markov Chains		
49.		Classification of states in a Markov Chain		
50.		Markov Chains with Absorbing States		
51.		Expected Duration to Reach a State from Other States		
52.		Confounding variables		
53.		A/B Testing		
54.		Case study (invited talk) + review of problems		
55.				
56.		Review		

Text Book(s):

1. Business Analytics, The Science of Data-Driven Decision Making, U. Dinesh Kumar, Wiley 2017
2. Recommender Systems: The Textbook by Charu C. Agarwal, Springer 2016

Reference(s):

1. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei, The Morgan Kaufmann Series in Data Management Systems, 3rd Edition.
2. The Elements of Statistical Learning, Trevor Friedman, Robert Tibshirani and Jerome Hastie, Data Mining, Inference and Prediction, Springer 2001.
3. Practical Data Science with R, Nina Zumel and John Mount, Manning Publications, 2014.

Programming language:

1. R
2. Python

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UE19CS313: Internet of Things (4-0-0-0-4)

# of Credits: 4 **# of Hours: 56**

Class #	Topics to be Covered	% of Portion covered	
		% of Syllabus	Cumulative %
Unit – 1 Introduction			
1	**What is IoT ?** Genesis of IoT	**17.86**	**17.86**
2	IoT and Digitization, IoT Impact		
3	Case Studies: i. Connected Roadways, ii. Connected Factory,		
4	iii. Smart Connected Buildings, iv. Smart Creatures		
5	Convergence of IT and OT		
6	IoT Challenges		
7	**IoT network Architecture and design:**Drivers, Comparing IoT Architectures		
8	A simplified IoT Architecture		
9	The Core IoT Functional Stack		
10	IoT Data Management and Compute Stack		
Unit – 2 Smart Objects			
11	Smart Objects: The “Things” in IoT, Sensors	**21.43**	**39.29**
12	Actuators, Smart Objects		
13	Sensor Networks		
14	WSNs		
15	**IoT Physical Devices and Endpoints:** Arduino UNO, Introduction to Arduino, Arduino UNO		
16	Fundamentals of Arduino Programming		
17	Interfacing sensors with Arduino		
18	**Raspberry Pi:** Introduction to Raspberry Pi, About the Raspberry Pi Board		
19	Hardware Layout, Operating Systems on Raspberry Pi		
20	Programming Raspberry Pi with Python		
21	Interfacing sensors with Pi -1		
22	Interfacing sensors with Pi - 2		
Unit – 3 Connecting Smart Objects			
23	Connecting Smart Objects	**21.43**	**60.72**
24	Communications Criteria IoT Access Technologies: ZigBee**,** LoRaWAN, NB-IoT, LTE		
25	IoT Data Management and Compute Stack		
26	**IP as the IoT Network Layer:**The Business Case for IP		

27	The need for Optimization		
28	Optimizing IP for IoT		
29	**Application Protocols for IoT: The Transport Layer**		
30	IoT Application Transport Methods		
31	SCADA, Generic Web-Based Protocols		
32	**IoT Application Layer Protocols**		
33	CoAP,		
34	MQTT		
Unit – 4 Data Collection, Storage and Computing Using a Cloud Platform			
35	**Introduction to cloud:** Cloud Computing Paradigm for Data Collection		
36	Storage and Computing		
37	Everything as Service and Cloud Service Models		
38	IoT Cloud-Based Services and Platforms-1		
39	IoT Cloud-Based Services and Platforms-2		
40	IoT Cloud-Based Services and Platforms-3		
41	IoT Cloud-Based Services and Platforms-4	**21.43**	**82.15**
42	Securing IoT : A Brief History of OT Security,Common Challenges in OT Security		
43	How IT and OT Security Practices and Systems Vary		
44	Formal risk analysis structures-OCTAVE and FAIR		
45	The Phased Application of Security in an Operational Environment		
46	Identify and analyze IoT security, Privacy risks		
Unit – 5 Case Studies and Advanced Topics			
47	Smart Cities: Smart Waste Management		
48	Smart Street Lights, Smart Street Parking, Security Without Surveillance		
49	Connected Vehicles		
50	Healthcare: Baby Monitoring, Elderly Monitoring,		
51	Mood Enhancing, Disease Treatment and Progression Monitoring		
52	Enhance Adherence	**17.85**	**100**
53	Agriculture: Precision Agriculture, Connected Livestock, Food Safety		
54	Manufacturing and Logistics: Smart Manufacturing		
55	Industry 4.0 - Future Scenario Production, Smart Packaging		
56	Smart Label Animation – Thinfilm Printed Electronics		

Literature

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Books	T1	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry	1	Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-	2017
Reference Books	R1	"Internet of Things: Architecture and Design Principles", Raj Kamal ; Chapter 6		McGraw-Hill India	2017
	R2	https://proed.stanford.edu/course/view.php?id=191 (Case studies and Assignment).			
	R3	"Internet of Things – A hands-on approach", Arshdeep Bahga, Vijay Madisetti		Universities Press	2015

UE19CS314: Applied Cryptography (4-0-0-4-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title /Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
Unit 1: Classical Ciphers				
1		Introduction to cryptography, cryptanalysis, and cryptology	21.42	21.42
2		Overview of cryptography		
3		Basic cryptographic primitives		
4		Classical ciphers: Substitution cipher – Caesar, Playfair and Hill cipher		
5		Transposition cipher – Rail fence, Columnar and Double columnar		
6		Cryptanalysis of classical ciphers		
7		Introduction to probability, Conditional probability, Law of total probability		
8		Shannon's theorem		
9		One-time-pad encryption		
10		Limitations of One-Time-Pad		
11		Algebraic structures - Rings, Fields, and Groups		
12		Lab 1		
Unit 2: Symmetric Key Cryptography				
13		Introduction to symmetric key cryptography	21.42	42.84
14		Pseudo random numbers		
15		Feistel cipher		
16		S-box and E-box		
17		Initial and Final permutations		
18		Data Encryption Standard (DES)		
19		Cryptanalysis and avalanche effect		
20		Advanced Encryption Standard (AES)		
21		AES key scheduling		
22		Side channel attacks		
23		Block and Stream ciphers		
24		Lab 2		

Unit 3: Public Key Cryptography				
25		Introduction to public key cryptography	21.42	64.26
26		Modes of operation		
27		Prime number, Primitive root		
28		Modular arithmetic		
29		Polynomials		
30		Diffie Hellman Protocol		
31		Elgamal crypto systems		
32		Prime factorization		
33		Rivest–Shamir–Adleman cryptosystem (RSA)		
34		Applications		
35		Lab 3		
36				
Unit 4: Key Management and Hashing Techniques				
37		Key management and distribution (KDC)	17.86	82.12
38		Birthday attack		
39		Entity authentication methods; password, challenge response		
40		Zero knowledge protocols		
41		MD5, One-way function		
42		Collision Resistant Hash Function (CRHF)		
43		Secure Hash Algorithm (SHA)		
44		Applications		
45		Lab 4		
46				
Unit 5: Authentication using Cryptography				
47		Identification protocols	17.86	100
48		Digital Signature (DS)		
49		Elliptic Curve Digital Signature Algorithm (ECDSA)		
50		RSA based signature		
51		Message Authentication Code (MAC)		
52		Cipher Block Chain MAC (CBC MAC)		
53		Applications of cryptography		
54		Quantum resistant cryptography		
55		Lab 5		
56				

Literature

BookType	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Textbooks	T	"Introduction to Modern Cryptography" Jonathan Katz, Yehuda Lindell	2	CRC Press	2015
Reference Books	R	"Cryptography and Network Security" Behrouz A. Foruzan	3	Tata McGraw Hill	2017

Proposed Labs:

Lab 1	Pseudo Random Number Generation
Lab 2	Secret-Key Encryption
Lab 3	RSA Encryption and Signature
Lab 4	Hash Length Extension Attack
Lab 5	MD5 Collision Attack

UE19CS315:Fundamentals of Augmented and Virtual Reality (4-0-0-0-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title /Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
Unit – 1 Graphical System and Programming				
1	R1 1.6	The Programmer's Interface, Graphics Architectures	**22**	**22**
2	R1 1.7, 1.8	Programmable Pipelines and characteristics		
3	R1 2.3	Graphics Programming Interfaces		
4	R1 2.2	Programming Two Dimensional Applications, The OpenGL: The OpenGL API		
5	R1 2.4	Lab1: Primitives and Attributes		
6	R1 2.5	Colour		
7	R1 2.6	Viewing		
8	R1 2.7	Control Functions		
9	R1 2.8	the gasket Program		
10	R1 2.9	Lab 2: Polygon and Recursion		
11	R1 2.10	The Three-dimensional gasket		
12	R1 2.11, 2.12	Adding interaction, adding menus		
Unit – 2 Geometric Objects and Transformations				
13	R1 3.1	Scalars, Points and Vectors	**23**	**45**
14	R1 3.2	Three-Dimensional Primitives		
15	R1 3.3	Coordinate Systems and Frames		
16	R1 3.6	Modelling a Coloured Cube		
17	R1 3.8	Overview of 2D Transformations: Translation and Scaling		
18	R1 3.8	Overview of 2D Transformations: Rotation		
19	R1 3.7	Affine transformations		
20	R1 3.9	Transformation in Homogeneous Coordinates		
21	R1 3.10	Concatenation of Transformations		
22	R1 3.11	Lab 3: OpenGL Transformation Matrices		
23	R1 3.13	Interfaces to Three Dimensional Applications		
24	R1 3.14	Quaternion's		
Unit – 3 Augmented Reality and 3D Modelling				
25	T2. 1	Introduction to Augmented Reality: Definition and Scope, A	**20**	**65**

		Brief History, Examples.		
26	T2. 1	Requirements and Characteristics: Methods of Augmentation		
27	T2. 2	Spatial Display Models, Visual Display		
28	T2. 3	Stationary Tracking Systems, Mobile Sensors		
29	R3	Lab 4: Introduction and Installation		
30		using 3D View, controlling lamps lights		
31		Animating Objects		
32		Modelling with vertices, edges and faces		
33		building a simple boat		
34		modelling organic forms like sea, and terrain		
35		working with camera, Rendering and Compositing		
Unit – 4 Virtual Reality and Game Engineering				
37	T1. 1, 2	Introduction: What is Virtual Reality, Modern VR Experience. Bird's Eye View	**20**	**85**
38	T1. 2	hardware and Software		
39	T1 .2	Physiology of human vision: Eye movement and its implications or VR		
40	T1. 9	Tracking: 2D and 3D orientation		
41	T1. 9	Tracking Position and Orientation		
42	T1. 9	Tracking Attached bodies		
43	T1. 9	3D Scanning of environments		
44	R4	Lab 5: Introduction to Unity, Game Objects, Models, Materials and Textures		
45		Terrains, Environments, Lights and Camera		
46		Game1: Amazing Racer, Scripting I, Scripting II, Collision		
Unit – 5 IO modalities for Human-Computer Interaction				
47	T2. 4, 2.8	Computer Vision and Augmented Reality	**15**	**100**
48	6.2.2	marker tracking, Multiple-Camera Infrared Tracking		
49	6.2.3	Natural Feature Tracking by Detection		
50	6.4.1	Incremental Tracking		
51	6.4.2	Simultaneous Localization and Mapping, Outdoor Tracking		
52	6.4.3	Interaction: Output and input modalities		
53	6.4.4	Haptic interaction		

54	T1. 10 T1. 10 T1. 11	Interaction: Locomotion, Manipulation		
55		Social Interaction, Additional Interaction Mechanisms		
56		Audio: Physiology of human hearing and Auditory Perception		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Books	T1	Steven M. LaValle. Virtual Reality	Online	Cambridge University Press,	2017
	T2	D. Schmalstieg and T. Höllerer. Augmented Reality: Principles and Practice	1	Addison-Wesley Professional	2016
Reference Books	R1	"Interactive Computer Graphics - A top-down approach with shader-based OpenGL"	Int.	Pearson Education	2011
	R2	"OpenGL Programming Guide": Mason Woo, Jackie Neider, Tom Davis, Dave Shrenier	3rd	Addision Wesley,	2014
	R3	Blender 3D Basic, Gordon Fisher	2nd	PACKT Publishing	2014
	R4	Unity Game Development in 24 Hours ,Geig, Mike.	1st	Pearson Education	2015
Note: For working with recent versions of Blender and Unity3D, the course material for UNIT 5 can be substituted with appropriate web content.					

UE19CS316-HUMAN COMPUTER INTERACTION

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of portions covered	
			Reference Chapter	Cumulative
UNIT 1: FOUNDATIONS OF HCI (12 hours)				
1	**Chapter 1-4 T1**	The Human: I/O channels	22	22
2		Memory – Reasoning and problem solving;		
3		The computer:		
4		Devices – Memory – processing and networks;		
5		Interaction: Models – frameworks		
6		Ergonomics		
7		styles		
8		elements		
9		interactivity-		
10		interactivity-		
11		Paradigms.		
12		Paradigms.		
UNIT 2: DESIGN AND SOFTWARE PROCESS (12 hours)				
13	**Chapter 5 -10 T1**	Interactive Design basics	22%	44%
14		process		
15		scenarios		
16		navigation		
17		screen design		
18		Iteration and prototyping		
19		Iteration and prototyping		
20		HCI in software process – software life cycle		
21		usability engineering – Prototyping in practice		
22		design rationale. Design rules –		
23 24		principles, standards, guidelines, rules ,Evaluation Techniques – Universal Design.		
UNIT 3: MODELS AND THEORIES (10 Hours)				
25 26	**Chapter 12-14**	Cognitive models	20%	64%
27		Cognitive models		
28		Cognitive models		

29	**T1**	Socio-Organizational issues and stake holder requirements		
30		Socio-Organizational issues and stake holder requirements		
31		Socio-Organizational issues and stake holder requirements		
32		Communication models		
33		Communication models		
34		Communication models		
35		Collaboration models		
36		GUI Design Aesthetics		
UNIT 4 : TASK ANALYSIS (10 Hours)				
37	**Chapters 15-18** **T1**	Task Analysis	20%	84%
38		Task Analysis-		
39		Dialog notations		
40		Dialog notations		
41		Design,Models of the system		
42		Design,Models of the system		
43		Design,Models of the system		
44		Modeling rich interaction		
45		usability engineering,		
46		State Charts and Petri nets:		
47		case study –Coke machine		
UNIT 5 : OUTSIDE THE BOX: (10 Hours)				
48	**Chapters 19-21** **T1**	groupware, augmented realities, hyper text,	20%	100%
49		groupware		
50		groupware		
51		ubiquotous computing,		
52		ubiquotous computing,		
53		augmented realities		
54		augmented realities		
55		hyper text,		
56		multimedia and World Wide Web,Augmented reality Practice session		

Literature:

Book Type	Code	Title & Author	Publication Info		
			Edition	Publisher	Year
Text Book	T1	Human Computer Interaction , Dix A., Finlay J., Abowd G. D. and Beale R.,	, 3rd Edition	Pearson Education	2005
Text Book	R1	B. Shneiderman; Designing the User Interface,	Indian	Addison Wesley	2000
Text Book	R2	About Face: The Essentials of Interaction Design by Alan Cooper, Robert Reimann, David Cronin. Christopher Nooessel,	4th Edition	WILEY	2009

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UE19CS322: Big Data (4-0-0-4-4)

# of Credits: 4

Unit	Class No	Chapter Title/Reference Literature	Topics to be Covered	% of Portions Covered	
				Reference Chapter	Cumulative
1	1	Big Data Introduction/T1	Big Data definition, Challenges and opportunities with Big Data	1	3.6
1	2	Big Data Characterisitics/T1	Data intensive scientific discovery and the role of Big Data, History	2	7.2
1	3	HDFS/T1	Map Reduce – Storage (HDFS)	2	10.8
1	4	Map Reduce/T1	Map Reduce – Computation model, Map Reduce architecture,	2,4	14.3
1	5	Hands on – Map Reduce/T1	Demo class: Map-Reduce – Hands on programming	2,4	17.9
1	6	YARN/T1	Case Study: Google. YARN introduction.	2	21.5
2	7	Hadoop Ecosystem/T1	Overview of Hadoop Ecosystem – Oozie, Ambari, Sqoop and Flume	2	25
2	8	Matrix Vector Multiplication/T1	Introduction to sample Big Data Algorithms – Sparse Matrices, matrix vector multiplication with MR	4	28.6
2	9	Pagerank/T1	Introduction to sample Big Data Algorithms - Pagerank computations	9	32.2
2	10	Relational Operators with MR/T1	Relational operators on Map-reduce, Select, Project, Join, Grouping, HIVE	4	35.8
2	11	Hands On with HIVE/T1	HIVE hands on	4	39.3
	12.	Hbase-Cassandra/T1	case study: Other storage - Hbase/Cassandra architecture and columnar storage for analytics	3	42.9
3	13	Hadoop issues/T1	Issues with Hadoop, Spark and Scala	5	46.5
3	14	PySpark/T1	PySpark programming model	5	50
3	15	Spark Programming Model/T1	Transformations and Actions, Spark SQL	5	53.6
3	16	Spark Architecture/T1	Spark architecture – RDD, DataFrames, Wide and Narrow dependencies,	5	57.2
3	17	Algorithm Complexity/T3	Complexity of Big Data algorithms – Communication Cost complexity model.	2	60.8
3	18	Hands On with Spark/T1	Spark HandsOn	5	64.3
4	19	Streaming Spark/T1	Streaming analytics use cases, Streaming Spark,	7	67.9

4	20	Kafka/T1	Kafka – use cases, architecture	7	71.5
4	21	Streaming Algorithms 1/T1	Streaming Algorithms - Sampling, set membership	7	75
4	22	Kafka Hands on/T1	Kafka with HandsOn	7	78.6
4	23	Streaming Algorithms 2/T1	Streaming Algorithms - Bloom Filters, Counting Counting unique elements – Flajolet Martin Algorithm.	7	82.2
5	24	ML Algorithms/T1	Clustering Algorithms - kmeans and collaborative filtering	6	85.8
5	25	ML andBig Data/T1	Scaling Neural Networks for Big Data, case study MLLib.	6	89.3
5	26	Project work	Project Work feedback		92.9
5	27	Project work	Project Work feedback		96.5
5	28	Project work	Project Evaluations		100

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T1	Big Data Analytics, Rajkamal, Preeti Saxena,	1st	McGraw Hill Education	2019
	T2	Big Data Simplified, Sourabh Mukherjee, Amit Kumar Das, Sayan Goswami	1st	Pearson	2019
Reference Book/Papers	R1	Mining of Massive Datasets, Anand Rajaraman, Jure Leskovec, Jeffrey D. Ullman	2nd	Cambridge University Press	2014
	R2	Big Data Analytics Beyond Hadoop: Real-Time Applications with Storm, Spark, and More Hadoop Alternatives, Vijay Srinivasa Agneeswaran	1st	Pearson	2014
	R3	Hadoop: The Definitive Guide, Tom White	4th	O'Reilly	2009

UE19CS323: Graph Theory, Applications and Combinatorics : (4-0-0-4-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered	
Unit 1:		**Introduction, paths, cuts and planar Graphs:**	**21.4**	**21.4**
1	**T1: Chapter 1,2,9: 1.1, 1.2, 1.3**	Introduction – Review of Representation and Traversals		
2	**2.1, 2.2**	Introduction – Review of Representation and Traversals		
3	**2.4**	Walks, Paths and Circuits		
4	**2.6, 2.7,2.8**	Euler graphs Hamiltonian paths and circuits		
5	**9.1**	**Find if the graph is Eulerian : Implementation**		
6	**9.2,9.3**	Directed graphs, Digraphs and binary relations		
7	**9.6**	Trees – Properties of trees, Rooted and binary trees		
8	**3.7,4.1**	Spanning trees, Cut sets **MST using Boruvka's Algorithm: Implementation**		
9	**4.2,4.3**	Properties of cut set – All cut sets		
10	**4.4,4.5**	Fundamental circuits and cut sets – Connectivity and Separability		
11	**4.6**	Network flows, isomorphism– Combinational and geometric graphs		
12	**5.1,5.2,5.3,5.5**	Planar graphs –Different representation of a planar graph.		
Unit 2:		**Coloring, Covering and Partitioning**		
13	**T1: Chapter 8: 8.1**	Chromatic number	**21.4**	**42.8**
14	**8.2**	Chromatic partitioning		
15	**8.2**	Chromatic polynomial		
16	**8.3**	Chromatic polynomial **Graph coloring using greedy method: Implementation**		
17	**8.4**	Matchings		
18	**8.4**	Matchings		
19	**8.5**	Coverings		
20	**8.6**	Coverings		
21	**R2**	Four Colour problem		
22	**R2**	Four Colour problem		
23	**R2**	Register Allocation using graph coloring		
24	**R2**	Register Allocation using graph coloring		
Unit 3:		**Graph Applications**		

25	**T1: Chapter 11**	Shortest Path Problem **Bellman Ford : Implementation**	**21.4**	**64.2**
26	**11.5**	Shortest Path Problem		
27	**R2**	Finding Articulation Points **Tarjan'sAlgorithm : Implementation**		
28	**R2**	Reliable Communication Network Problem		
29	**R2**	Chinese Postman Problem		
30	**R2**	Connector Problem		
31	**T1:14.5**	Optimal Assignment Problem		
32	**R3**	Time Table Problem		
33	**R3**	Graph Databases		
34	**R3**	Graph Databases **Creation, Deletion, modification and accessing of data using Neo4j**		
35	**R3**	Graphs for social network analysis		
36	**R3**	Graphs for social network analysis **Social network analysis using Neo4j**		
Unit 4:		**Inclusion, Exclusion, Generating Functions**		
37	**R1**	The principle of inclusion and exclusion	**17.9**	**82.1**
38	**R1**	The principle of inclusion and exclusion		
39	**R1**	Generalizations of the principle		
40	**R1**	derangements		
41	**R1**	Rook polynomials		
42	**R1**	Generating functions: Introductory examples		
43	**R1**	Definition and examples		
44	**R1**	calculational techniques		
45	**R1**	The exponential generating function		
46	**R1**	The summation operator.		
	Unit 5:	**Recurrence Relations**		
47	**R1**	First Order Linear Recurrence Relation	**17.9**	**100**
48	**R1**	The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients		
49	**R1**	The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients		
50	**R1**	The Non-homogeneous Recurrence Relation		
51	**R1**	The Non-homogeneous Recurrence Relation		
52	**R1**	Generating Functions for second order recurrence relations.		
53	**R1**	Generating Functions for second order recurrence relations.		
54	**R1**	Generating Functions for second order recurrence relations.		

55	**R1**	Revisit of previously covered topics		
56	**R1**	Revisit of previously covered topics		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Books	T1	"Graph Theory: With Application to Engineering and Computer Science", Narsingh Deo.	EEE	Prentice Hallof India	2017.
Reference Book	R1	"Discrete and Combinatorial Mathematics", Ralph P.Grimaldi&B.V.Ramana.	5th Edition,	PHI/Pearson education	
	R2	"Graph Theory", F. HARARY,		Addison-Wesley,	1969.
	R3	Graph Theory with Applications, J A Bondy and U. S. R Murthy		Elsevier Science Publishing Co	
	R4	Web based Resources			

Computer Science And Engineering
(Aug – Dec, 2021)

UE19CS324 – Bio-inspired Computing (4:0:0:0:4)

# of Hours: 56

Class #	Chapter Title / Reference Literature	Topics to be Covered	% of Portion covered **% Syllabus %Cumulative**
1	**Unit#1**	Introduction	21.4321.43**%**
2		Introduction	
3	**T :**	Introduction to Evolutionary Computing	
4	**Chapters 1-4**	Evolutionary Algorithms	
5		Introduction and Canonical Genetic Algorithm (CGA)	
6		CGA (continued).Design Choices in Implementing a GA	
7		Choosing a Representation,Initialising the Population, Measuring Fitness	
8		Generating Diversity, choosing Parameter Values	
9		Extending the Genetic Algorithm: Dynamic Environments, Structured Population GAs	
10		Constrained Optimisation, Multi objective Optimisation	
11		Memetic Algorithms, Linkage Learning, Estimation of Distribution Algorithms	
12		Numerical Problems	
13	**T:**	Introduction and Canonical ES Algorithm	21.43%- 42.86%
14	**Chapters 5-7**	Evolutionary Programming	
15		Numerical Problems	
16		Canonical Differential Evolution Algorithm	
17		Extending the Canonical DE Algorithm	
18		Discrete DE	
19		Numerical Problems	
20		Genetic Programming, Bloat in GP	
21		More Complex GP Architectures	
22		GP Variants, Semantics and GP	
23		MATLAB examples	
24		MATLAB examples	
25	**Unit#3**	Search, Particle Swarm Optimisation Algorithm (PSO)	21.43% - 64. 29%
26	**T:**	Comparing PSO and Evolutionary Algorithms	
27	**Chapters8,9**	Maintaining Diversity in PSO, Hybrid PSO Algorithms	
28		Discrete PSO, Evolving a PSO Algorithm	
29		MATLAB examples	
30		Numerical problems	
31		A Taxonomy of Ant Algorithms, Ant Foraging Behaviours	
32		Ant Algorithms for Discrete Optimisation	

33		Ant Algorithms for Continuous Optimisation	
34		Multiple Ant Colonies, Hybrid Ant Foraging Algorithms	
35		Ant-Inspired Clustering Algorithms, Classification with Ant Algorithms, Evolving an Ant Algorithm-	
36		MATLAB codes and Numerical problems	
37	**Unit #4 T : Chapters 10,12**	Honeybee Dance Language, Honeybee Foraging	17.86% - 82.15%
38		Designing a Honeybee Foraging Optimisation Algorithm	
39		Bee Nest Site Selection, Honeybee Mating Optimisation Algorithm	
40		Non-uniform Oscillators and Firefly	
41		The model and optimization	
42		Glow Worm Algorithm, Bat Algorithm	
43		Fish School Algorithm, Locusts.	
44		MATLAB Programs	
45		MATLAB Programs, Numerical Problems	
46		Numerical Problems	
47	**Unit #5 T: Chapter 16**	The Natural Immune System	17.85% - 100%
` 48		Artificial Immune Algorithms	
49		Negative Selection Algorithm, Dendritic Cell Algorithm	
50		Clonal Expansion and Selection Inspired Algorithms	
51		Immune Programming	
52		The Future of Natural Computing Algorithms,Looking Ahead, Open Issues	
53		MATLAB Programs	
54		MATLAB Programs	
55		Revision	
56		Revision	

Literature

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Book	T	Natural Computing Algorithms- Anthony Brabazon, Michael O'Neill, SeánMcGarraghy	1	Springer	2015
Reference Books	R1	Fundamentals of Natural Computing -: Basic Concepts, Algorithms, and Applications - Nunesde Castro, Leandro	1	Chapman & Hall/ CRC, Taylor and Francis Group	2007
	R2	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies-Floreano D. and Mattiussi C	1	MIT Press, Cambridge, MA	2008

UE19CS326: COMPUTER NETWORKSECURITY (4-0-0-0-4)

# of Credits: 4 **# of Hours: 56**

Class #	Chapter Title /Reference Literature	Topics to be Covered	% of Portion covered	
			% of Syllabus	Cumulative %
Unit 1: Introduction and Packet Analysis				
1	R	Plagiarism, CIA, Passive and active attack, Attack surface categories, Vulnerabilities, Threats, Attacks and Assets, Countermeasures, Privacy, General data protection regulation, Security vs Privacy, mitigation & recovery.	**17.86**	**17.86**
2	R	Data breaches, Vulnerabilities by category, Real life examples of Cybercrime, IIoT Cyber-attacks, Vulnerabilities by category, Real life examples of Cybercrime, IIoT Cyber-attacks, Ransomed medical devices, The attack landscape, Malware / Ransomware, Security framework, Job outlook		
3	T	Introduction, Sending packets: Network Interface Card (NIC), BSD packet filter (BPF). Packet sniffing: Receiving packets using sockets, Packet sniffing using Raw sockets.		
4	T	Packet sniffing using PCAP API, Processing captured packets. Packet spoofing: Sending normal packets using sockets, Constructing spoofed raw ICMP packets and UDP packets. Sniffing and then spoofing, Python vs Scapy, Hybrid approach, Endianness.		
5	L	LAB 1 – Packet sniffing & Spoofing		
Unit – 2 OSI Protocol Attacks				
6	T	**Attacks on the TCP protocols:** Introduction, TCP overview, Send and receive buffers, SYN flood attack: TCP 3-way handshake,the SYN flooding attack, Launching the attack using Netwox and C, Countermeasure.	**21.43**	**39.29**
7	T	TCP reset attack: TCP reset attack on Telnet, SSH and video streaming connections. TCP session hijacking attack: TCP session and session hijacking, Launching the attack, Hijacked TCP connection. Reverse shell: working, redirecting IO to TCP connection, Creating reverse shell. Countermeasure		
8	L	LAB 2 - TCP Attacks Lab		

9	T	**MAC layer and attacks:** Introduction, The MAC layer, ARP protocol, ARP cache poisoning attacks, MITM using ARP cache poisoning, Demo, Countermeasure.		
10	T	**Network layer: IP, ICMP and attacks**: Introduction, IP protocol, IP fragmentation, Attacks using IP fragmentation: Problem and solution, Routing and spoofing prevention, ICMP protocol, ICMP redirect attack, Smurf and other ICMP attacks.		
11	R	**Case Study – 1 (I premier casestudy)**		
Unit – 3 DNS AttacksandFirewalls				
12	T	**DNS Attacks:** Introduction, DNS hierarchy, zones and servers, DNS query process, Experiment Setup, Constructing DNS request and response using Scapy, DNS attacks: Overview, Local DNS cache poisoning attack,		
13	T	Remote DNS cache poisoning attack (Kaminsky attack), Reply forgery attacks from malicious DNS servers, Countermeasure against DNS spoofing attacks, DoS attacks on DNS servers.		
14	L	LAB – 3 DNS Attacks Lab	**21.43**	**60.72**
15	T	**Firewall:** Introduction, Requirements of a firewall, Firewall characteristics and Access policy, Types of firewalls, NG firewall, Shortcomings, Firewall location and configuration: DMZ networks, Firewall topologies.		
16	T	Introduction, Build a simple firewall, Netfilter, iptables firewall in Linux, Stateful firewall and connection tracking, Application/Proxy firewall and Web proxy, Evading firewalls		
17	L	LAB – 4 Firewall Exploration Lab		
Unit – 4 IDS, IPS and Virtual Private Networks				
18	T	**Intrusion Detection and Prevention:** Intruders, Intrusion detection, Analysis approaches, Host-based intrusion detection, Network-based intrusion detection,		
19	T	Distributed or hybrid intrusion detection, Honeypots, Example system: Snort, Intrusion prevention system		
20	T	**Virtual Private Network:** Introduction, Why VPN, analogy and tunnelling.Overview of TLS/SSL VPN: Establishing a tunnel, Forwarding and releasing IP packets,	**21.43**	**82.15**
21	T	TLS/SSL VPN details. Building, Setup and Testing VPN. Bypassing Firewall using VPN.		
22	L	LAB -5 VPN		
23	R	Case Study – 2 (University of Virginia)		
Unit – 5 Network Management and Wireless Network Security				
47	R	Risk Management – 1, Terminologies	**17.85**	**100**

48	R	Risk Management – 2, practical examples		
49	T	**The Heartbleed Bug and Attack:** Introduction and the Heartbeat protocol, Launching the attack, Fixing the Heartbleed bug.		
50	L	LAB – 6 Heartbleed Bug and Attack		
51	R	Wireless communications and 802.11 WLAN standards , WEP, Wireless Protected Access (WPA), IEEE 802.1x, 802.11i/ WPA2		
54	R	IEEE 802.1x, 802.11i/ WPA2, Wireless NetworkThreats, ZigBee security, Wireless Mesh Network security		

Literature:

Book Type	Code	Title & Author	Publication Information		
			Edition	Publisher	Year
Text Books	T	Computer & Internet Security – A Hands-on Approach, Wenliang Du	2	Wenliang Du	2019
Reference Books	R	Computer Security: Principles and Practice, William Stallings & Lawrie Brown	2	Pearson	2014