

DEPARTMENT OF CSE (AI)

HONORS

POOL-1

DATA SCIENCE & ADVANCED SOFTWARE ENGINEERING: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20CSHN02	DATA ANALYTICS & VISUALIZATION	3	1	0	4
2	R20CSHN01	DEVOPS	3	1	0	4
3	R20AIHN04	SPEECH PROCESSING	3	1	0	4
4	R20AIHN03	REENFORCEMENT LEARNING	3	1	0	4
5	R20CSHN05	COMPUTER VISION	3	1	0	4

In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering

POOL-2

COMPUTER NETWORKS: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20ITHN07	DATA COMMUNICATION	3	1	0	4
2	R20ITHN08	INTERNETWORKING TCP/IP	3	1	0	4
3	R20ITHN09	NETWORK PROGRAMMING	3	1	0	4
4	R20ITHN10	WIRELESS NETWORK TECHNOLOGIES	3	1	0	4
5	R20ITHN11	CLIENT SERVER COMPUTING	3	1	0	4

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DEPARTMENT OF CSE (AI)

POOL-3

CYBER SECURITY: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20ITHN12	CYBER SECURITY ESSENTIALS	3	1	0	4
2	R20ITHN13	SECURE CODING	3	1	0	4
3	R20ITHN14	VULNERABILITY ASSESSMENT & PENETRATION TESTING	3	1	0	4
4	R20ITHN15	MALWARE ANALYSIS	3	1	0	4
5	R20ITHN16	CYBER CRIME INVESTIGATION AND DIGITAL FORENSICS	3	1	0	4

In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering

POOL-4

PATTERN RECOGNITION: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20ITHN17	DIGITAL IMAGE PROCESSING	3	1	0	4
2	R20ITHN18	BIO METRICS	3	1	0	4
3	R20ITHN19	SPEECH PROCESSING	3	1	0	4
4	R20ITHN20	ADVANCED COMPUTER VISION	3	1	0	4
5	R20ITHN21	MATHEMATICAL ESSENTIAL FOR DATA SCIENCE	3	1	0	4

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2	R20CSHN01	DEVOPS	3	1	0	4
3	R20AIHN04	SPEECH PROCESSING	3	1	0	4
4	R20AIHN03	REENFORCEMENT LEARNING	3	1	0	4
5	R20CSHN05	COMPUTER VISION	3	1	0	4

In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering

DEPARTMENT OF CSE (AI)

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20CSHN02	DATA ANALYTICS AND VISUALIZATION						

COURSE OBJECTIVE:

- This course provides a comprehensive knowledge of data science and analytics techniques using Python. With this students will learn the essential concepts of Python programming and gain deepknowledge in data analytics and data visualization.

COURSE OUTCOMES:

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

CO 1: Apply principles of NumPy and Pandas to the analysis of data. [K3]

CO 2: Make use of various file formats in loading and storage of data. [K3]

CO 3: Identify and apply the need and importance of pre-processing techniques [K3].

CO 4: Show the results and present them in a pictorial format [K2].

SYLLABUS:

UNIT-I

Introduction to Data Analytics, A data scientist role, NumPy Basics: The NumPy ndarray: A Multidimensional Array Object(Creating ndarrays ,Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Boolean Indexing, Fancy Indexing, Transposing Arrays and Swapping Axes), Data Processing Using Arrays(Expressing Conditional Logic as Array Operations and Sorting , Unique and Other Set Logic).

UNIT-II

Getting Started with pandas: Introduction to pandas Data Structures(Series,DataFrame,Index Objects),Essential Functionality(Reindexing,Dropping entries from an axis, Indexing, selection, and filtering,Arithmetic and data alignment, Sorting and ranking, Axis indexes with duplicate values), Handling Missing Data(Filtering Out Missing Data, Filling in Missing Data).

UNIT-III

Data Loading, Storage, and File Formats : Reading and Writing Data in Text Format(Reading Text Files in Pieces, Writing Data Out to Text Format, Manually Working with Delimited Formats, JSON Data, XML and HTML: Web Scraping), Binary Data Formats(Using HDF5 Format, Reading Microsoft Excel Files).

UNIT-IV

Data Wrangling: Clean, Transform, Merge, Reshape: Combining and Merging Data Sets(Database-style DataFrame Merges, Merging on Index, Concatenating Along an Axis, Combining Data with Overlap), Reshaping and Pivoting(Reshaping with Hierarchical Indexing, Data Transformation(Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values.

UNIT-V

Plotting and Visualization: A Brief matplotlib API Primer (Figures and Subplots,Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File), Plotting Functions in pandas. Data Aggregation and Group Operations: Group By Mechanisms, Data Aggregation(Column-wise and Multiple Function Application, Returning Aggregated Data in “unindexed” Form), Group-wise Operations.

TEXT BOOKS:

1. Wes McKinney, "Python for Data Analysis", O'REILLY, ISBN:978-1-449-31979-3, 1st edition, October 2012.

REFERENCE BOOKS:

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.
2. Joel Grus, "Data Science from Scratch", O'REILLY, 1st edition, April 2015

DEPARTMENT OF CSE (AI)

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20CSHN01	DEVOPS						

COURSE OBJECTIVES:

- DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance

COURSE OUTCOMES:

At the end of the course, student will be able to

CO 1: Demonstrate the phases of software development life cycle. [K2]

CO 2: Outline the basic Fundamentals of DevOps. [K2]

CO 3: Adopt the DevOps technology into the project. [K6]

CO 4: Evaluate the CI/CD concepts and metrics to track CI/CD practices. [K5]

CO 5: Summarize the importance of DevOps maturity models. [K2]

SYLLABUS:

UNIT- I

Phases of Software Development life cycle. Values and principles of agile software development.

UNIT- II

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of Applications, DevOps delivery pipeline, DevOps eco system.

UNIT- III

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack Implementation, People aspect, processes

UNIT- IV

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

UNIT- V

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity Model, DevOps maturity Assessment.

TEXT BOOKS:

1. Gene Kim , John Willis , Patrick Debois, “The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations” Jez Humb,O’Reilly Publications
2. Mike Loukides, “What is Devops? Infrastructure as code” O’Reilly publications.
3. Jez Humble and David Farley, “Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation”,
4. Dave Harrison, Knox Lively, “Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and Microservices.
5. Joakim Verona , Packt, “Practical Devops”

REFERENCE BOOKS:

1. Mandi Walls, “Building a DevOps Culture”, O’Reilly publications
2. Viktor Farcic, “The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Micro services”

WEB REFERENCES:

1. <https://www.youtube.com/watch?v=hQcFE0RD0cQ>
2. https://www.youtube.com/watch?v=YSkDtQ2RA_c
3. <https://www.svrtechnologies.video/courses/devops-training-free/lectures/10955807>
4. https://www.youtube.com/watch?v=MOZMw5_fBFA

DEPARTMENT OF CSE (AI)

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20AIHN04	SPEECH PROCESSING						

OBJECTIVES:

- To understand the fundamentals of the speech processing
- Explore the various speech models
- Gather knowledge about the phonetics and pronunciation processing
- Perform wavelet analysis of speech
- To understand the concepts of speech recognition

COURSE OUTCOMES:

On Successful completion of the course, Students will be able to

CO1: Create new algorithms with speech processing.[K4]

CO2: Derive new speech models.[K4]

CO3: Perform various language phonetic analysis.[K3]

CO4: Create a new speech identification system.[K5]

CO5: Generate a new speech recognition system.[K3]

SYLLABUS:

UNIT- I

Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N grams

UNIT- II

SPEECH MODELLING:

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation- based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling.

UNIT-III

SPEECH PRONUNCIATION AND SIGNAL PROCESSING:

Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology.

UNIT-IV

SPEECH IDENTIFICATION:

Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis - evaluation

UNIT-V

SPEECH RECOGNITION:

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (‘_stack’) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans.

TEXT BOOK:

1. Daniel Jurafsky and James H. Martin, — Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition, Pearson education, 2013.

REFERENCES:

1. Kai-Fu Lee, —Automatic Speech Recognition, The Springer International Series in Engineering and Computer Science, 1999.
2. Himanshu Chaurasiya, —Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
3. Claudio Becchetti, Klucio Prina Ricotti, —Speech Recognition: Theory and C++ implementation, Wiley publications 2008.
4. Ikrami Eldirawy , Wesam Ashour, —Visual Speech Recognition, Wiley publications , 2011

DEPARTMENT OF CSE (AI)

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20AIHN03	REENFORCEMENT LEARNING						

OBJECTIVES:

- Good understanding of various types of algorithms for Reinforcement Learning
- Be able to design an RL system

COURSE OUTCOMES:

Upon completion of this course, the student should be able to:

CO1: Summarize the relevance of Reinforcement Learning and how does it complement other ML Techniques.[K2]

CO2: Analyze various RL algorithms.[K4]

CO3: Formulate a problem as a Reinforcement Learning problem and solve it [K3]

CO4: Implement RL algorithms using Python [K3]

SYLLABUS:

UNIT-I

INTRODUCTION: Notation, what is Reinforcement Learning (RL)?,687-Gridworld: A Simple Environment, Describing the Agent and Environment Mathematically, Creating MDPs, Planning and RL , Additional Terminology, Notation, and Assumptions.

UNIT-II

BLACK-BOX OPTIMIZATION FOR RL: Hello Environment! , Black-Box Optimization (BBO) for Policy Search, Evaluating RL Algorithms.

VALUE FUNCTIONS: State-Value Function, Action-Value Function, The Bellman Equation for v , The Bellman Equation for q π ,Optimal Value Functions ,Bellman Optimality Equation for v *

UNIT-III

POLICY ITERATION AND VALUE ITERATION: Policy Evaluation, Policy Improvement, Value Iteration, The Bellman Operator and Convergence of Value Iteration.

MONTE CARLO METHODS: Monte Carlo Policy Evaluation, Gradient-Based Monte Carlo Algorithm.

UNIT-IV

TEMPORAL DIFFERENENCE (TD) LEARNING: Function Approximation, Maximum Likelihood Model of an MDP versus Temporal Difference Learning, Sarsa: Using TD for control, Q-Learning: Off-Policy TD-Control.

UNIT-V

HIGH-CONFIDENCE POLICY IMPROVEMENT: Off-Policy Policy Evaluation, High-Confidence Off-Policy Evaluation (HCOPE) , High-Confidence Policy Improvement, λ -Return Algorithm .

BACKWARDS VIEW OF TD(λ) : True Online Temporal Difference Learning ,Sarsa(λ) and Q(λ), Policy Gradient Algorithms , Policy Gradient Theorem , Proof of the Policy Gradient Theorem.

TEXT BOOKS:

1. Sutton and Barto, Reinforcement Learning: An Introduction, The MIT Press Cambridge, Massachusetts London, England, 2015
2. Csaba Szepesvari, Algorithms for Reinforcement Learning, Morgan & Claypool, United States, 2010

REFERENCES:

1. AnandRajaRaman, Jure Leskovec and J.D. Ullman, "Mining of Massive Data sets", ebook, Publisher, 2014.
2. Kevin P. Murphy, "Machine Learning, a Probabilistic Perspective", The MIT Press Cambridge, Massachusetts, 2012.
3. Tomasz Drabas, Denny Lee , "Learning Pyspark", Packt, February 2017.
4. Jeff M. Phillips, "Coresets and Sketches", arXiv:1601.00617, 20

WEB REFERENCES:

1. <https://elearning.di.unipi.it/course/view.php?id=227>
2. https://mrcet.com/downloads/digital_notes/IT/R17A1201%20ML.pdf

DEPARTMENT OF CSE (AI)

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	4	-	-	30	70	100	4
SUBJECT CODE: R20CSHN05	COMPUTER VISION						

COURSE OBJECTIVES:

- The objective of the course is to enable the student to understand, grasp principal ideas, techniques and technologies of computervision
- Interpret visual information and apply that knowledge to develop various applications.

COURSE OUTCOMES:

After completion of this course, the students would be able to

CO1: Summarize image representation and modelling. [K2]

CO2: Apply image transformation methods. [K3]

CO3: Interpret image processing algorithms. [K3]

CO4: Analyze transformation, pose consistency and segmentation algorithms.[K4]

CO5: Analyze and implement computer vision techniques by means of Python using the OPENCV library. [K4]

SYLLABUS:

UNIT- I

Cameras: Sensing, Sources, Shadows, and Shading: Qualitative Radiometry, Sources and their effects, Local shading models, Application: photometric stereo, Inter-reflections: global shading models Color: The physics of color, Human color Perception, Representing color, A Model for image color, Surface color from image color Linear Filters: Linear filters and convolution, Shift Invariant linear systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique: Scale and Image Pyramids.

UNIT- II

Edge Detection: Noise, Estimating Derivatives, Detecting Edges Texture: Representing Texture, Analysis Using Oriented Pyramids, Application: pooled texture representation, Synthesizing Textures for Rendering, Image denoising, Shape from Texture The Geometry of Multiple Views: Two Views, Three Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras.

UNIT- III

Segmentation by Clustering: Human Vision: Grouping and Gestalt, Applications: shot boundary detection and background subtraction, Image segmentation by clustering pixels, Segmentation by Graph- Theoretic Clustering, Segmentation by fitting a model: The Hough Transform, Fitting Lines, Fitting Curves, Robustness, Missing Data Problems

UNIT- IV

Segmentation and Fitting using probabilistic methods: Fitting, and Segmentation, The EM Algorithm in practice, Model selection: best Fit, Model-Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses Using Invariants, Verification

UNIT- V

Application: Registrations in Medical Imaging Systems, Curved Surfaces and Alignment, Geometric Templates from Spatial Relations: Simple Relations between object and image, Primitives, Templates, and Geometric Inference, Applications : Range Data: Object Recognition.

TEXT BOOKS:

1. Forsyth David A and Ponce J, “Computer Vision – A Modern Approach”, Pearson Publication, (2003).

REFERENCE BOOKS:

1. R. Szeliski ,”Computer Vision: Algorithms and Applications”, Springer Verlag, (2011)
2. Milan Soanka, Vaclav Hlavac and Roger Boyle, “Digital Image Processing and Computer Vision”, Cengage Learning.
3. R.C. Gonzalez and R.E. Woods,” Digital Image Processing”, Pearson Education, 3rd Edition.

WEB REFERENCES:

1. Edx Computer Vision and Image Analysis <https://www.edx.org/course/computer-vision-and-image-analysis-2>
2. Coursera Computer Vision <https://www.coursera.org/learn/computer-vision-basics/home/welcome>
3. Udemy Deep Learning and Computer Vision A-Z <https://www.udemy.com/course/computer-vision-a-z/> Nptel
4. Introduction to Computer Vision <https://nptel.ac.in/courses/106105216/#>

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POOL-2

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	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN07	DATA COMMUNICATION						

COURSE OBJECTIVES:

- To have a detailed study of various analog and digital modulation and demodulation techniques
- To have a thorough knowledge of various multiplexing schemes and Data communication protocols
- To know about the standards and mechanisms of television systems.

COURSE OUTCOMES:

By the end of this course, the student will be able to

CO1: Summarize the knowledge of working of basic communication systems.[K2]

CO2: Analyze about the Transmission media.[K4]

CO3: Analyze about Digital Transmission and Multiplexing.[K4]

CO4: Summarize about Wireless Communication systems.[K2]

CO5: Analyze indepth knowlwdge about Telephone Instruments and Cellular Systems.[K4]

SYLLABUS:

UNIT- I

INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING: Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Networks, Alternate Protocol Suites.

SIGNALS, NOISE, MODULATION, AND DEMODULATION: Signal Analysis, Electrical Noise and Signal-to- Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.

UNIT-II

METALLIC CABLE TRANSMISSION MEDIA: Metallic Transmission Lines, Transverse Electromagnetic Waves, Characteristics of Electromagnetic Waves

OPTICAL FIBER TRANSMISSION MEDIA: Advantages of Optical Fiber cables, Disadvantages of Optical Fiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.

UNIT-III

DIGITAL TRANSMISSION: Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage to- Quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM.

MULTIPLEXING AND T CARRIERS : Time- Division Multiplexing, T1 Digital Carrier System, Digital Line Encoding, T Carrier systems, Frequency- Division Multiplexing, Wavelength- Division Multiplexing, Synchronous Optical Network.

UNIT- IV

WIRELESS COMMUNICATIONS SYSTEMS: Electromagnetic Polarization, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.

UNIT-V

TELEPHONE INSTRUMENTS AND SIGNALS: The Subscriber Loop, Standard Telephone Set, Basic Telephone Call Procedures, Call Progress Tones and Signals, Cordless Telephones, Caller ID, Electronic Telephones, Paging systems.

CELLULAR TELEPHONE SYSTEMS: First- Generation Analog Cellular Telephone, Personal Communications system, Second-Generation Cellular Telephone Systems, N-AMPS, Digital Cellular Telephone, Interim Standard, Global system for Mobile Communications.

TEXT BOOKS:

1. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education.

REFERENCE BOOKS:

1. Data Communications and Networking, Behrouz A Forouzan, Fourth Edition.TMH.
2. Data and Computer communications, 8/e, William Stallings, PHI.
3. Computer Communications and Networking Technologies, Gallow, Second Edition Thomson
4. Computer Networking and Internet, Fred Halsll, Lingana Gouda Kulkarni, Fifth Edition,Pearson Education.

DEPARTMENT OF CSE (AI)

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	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN08	INTERNETWORKING WITH TCP/IP						

COURSE OBJECTIVES:

- To understand the fundamental concepts in Internetworking, Internet Addressing, IP, UDP, and TCP Protocols, Routing Architecture, Network Virtualization and Software Defined Networking

COURSE OUTCOMES:

By the end of this course, the student will be able to Understand

CO1: Summarize working of Internetworking, Internet Addressing.[K2]

CO2: Analyze IP, UDP, and TCP Protocols.[K4]

CO3: Apply Routing Architecture, Network Virtualization.[K3]

CO4: Apply Internet Multicasting.[K3]

CO5: Analyze Software Defined Networking.[K4]

SYLLABUS:

UNIT – I

Introduction and Overview, Overview of Underlying Network Technologies, Internetworking Concept and Architectural Model, Protocol Layering Internet Addressing, Mapping Internet Addresses To Physical Addresses (ARP), Internet Protocol: Connectionless Datagram Delivery(IPv4, Ipv6) CIDR Sub netting.

UNIT – II

Internet Protocol: Forwarding IP Datagrams, Internet Protocol: Error And Control Messages (ICMP), User Datagram Protocol (UDP)

UNIT – III

Reliable Stream Transport Service (TCP) Routing Architecture: Cores, Peers, And Algorithms, Routing Among Autonomous Systems (BGP), Routing Within An Autonomous System (RIP, RIPng, OSPF, IS-IS).

UNIT – IV

Internet Multicasting , Label Switching, Flows, And MPLS, Packet Classification, Mobility And Mobile IP, Network Virtualization: VPNs, NATs, And Overlays Bootstrap And Auto configuration (DHCP, NDP, Ipv6-ND), Voice And Video Over IP (RTP, RSVP, QoS)

UNIT – V

Software Defined Networking (SDN, OpenFlow)

TEXT BOOKS:

1. Behrouz A Forouzan, “TCP/IP Protocol Suite”, TMH, 3rd Edition
2. B.A. Forouzan, “Data communication & Networking”, TMH, 4th Edition.

REFERENCES:

1. Mahbub Hasan & Raj Jain, ” High performance TCP/IP Networking”, PHI -2005
2. Douglas. E.Comer, “Internetworking with TCP/IP “, Volume I PHI
3. Larry L. Perterson and Bruce S. Davie , “Computer Networks- A Systems Approach”, 2011, Morgan Kaufmann
4. Jochen Schiiler, “Mobile Communications”, Pearson, 2nd Edition.
5. Douglas E Comer, “Internetworking with TCP/IP Principles, Protocol, and Architecture” , Volume I, 6th Edition, Pearson Education, 2013
6. William Stallings, “Data and Computer Communications”, 9th Edition, Pearson Education, 2011

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN09	NETWORK PROGRAMMING						

COURSE OBJECTIVES:

- To understand to Linux utilities
- To understand file handling, signals
- To understand IPC, network programming in Java
- To learn the basics of socket programming using TCP and UDP Sockets.
- To understand simple network management protocols & practical issues.

COURSE OUTCOMES:

By the end of this course, the student will be able to

- CO1:** Summarize socket API based programs.[K2]
- CO2:** Design and implement client-server applications using TCP and UDP sockets.[K3]
- CO3:** Analyze network programs.[K4]
- CO4:** Design and implement client/server programs using a variety of protocols and platforms.[K3]
- CO1:** Implement specific network programming constructs on Unix platforms to create robust real-world sockets-based applications.[K3]

SYLLABUS:

UNIT – I

Introduction to Network Programming: OSI model, Unix standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

Sockets : Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.

UNIT – II

TCP client server : Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.

Elementary UDP sockets: Introduction UDP Echo server function, lost datagram, summary of UDPexample, Lack of flow control with UDP, determining outgoing interface with UDP.

I/O Multiplexing: I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server,

UNIT – III

Socket options: getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.

Advanced I/O Functions-Introduction, Socket Timeouts, recv and send Functions, readv and

writv Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued, Sockets and Standard I/O, T/TCP: TCP for Transactions.

UNIT – IV

Elementary name and Address conversions: DNS, gethost by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.

Daemon Processes and inetd Superserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd Function

Broadcasting-Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions.

Multicasting-Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast_join and Related Functions, dg_cli Function Using Multicasting, Receiving Mbone Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol, SNTP (Continued)

UNIT-V

Raw Sockets-Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon, Datalink Access- Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux: **SOCK_PACKET**, **libpcap**: Packet Capture Library, Examining the UDP Checksum Field. Remote Login: Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.

TEXT BOOKS:

1. UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education
2. UNIX Network Programming, 1st Edition, - W. Richard Stevens. PHI.

REFERENCES:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	1	-	30	70	100	4
SUBJECT CODE: R20ITHN10	WIRELESS NETWORK TECHNOLOGIES						

COURSE OBJECTIVES:

- This course examines common and different aspects of wired and wireless networks. The topics covered are: antenna basics, radio propagation, coding and error control, MAC protocols, network layer protocols to address mobility, TCP and wireless, wireless LANs and ad-hoc networks, cellular communication concepts, wireless mesh networks, long-distance and last-hop wireless technologies, and security in wireless systems.

COURSE OUTCOMES:

At the end of this course, students will be able to

CO1: Summarize Cellular communication concepts.[K2]

CO2: Analyze the mobile radio propagation.[K4]

CO3: Analyze the wireless network different type of MAC protocols.[K4]

CO4: Summarize wireless Local and Wide area networks and their specifications.[

CO5: Analyze and Familiar with some of the existing and emerging wireless standards.

SYLLABUS:

UNIT – I

Wireless Network Architecture:

The OSI Network Model, Network Layer Technologies, Data Link Layer Technologies, Physical Layer Technologies, Operating System Considerations

Wired Network Topologies – A Refresher, Wireless Network Topologies, Wireless LAN Devices, Wireless PAN Devices, Wireless MAN Devices.

UNIT – II

Wireless Communication:

Radio Communication Basics: The RF Spectrum, Spread Spectrum Transmission, Wireless Multiplexing and Multiple Access Techniques, Digital Modulation Technique, RF Signal Propagation and Reception, Ultra Wideband Radio, MIMO Radio, Near Field Communications

Infrared Communication Basics: The Ir Spectrum, Infrared Propagation and Reception

UNIT – III

Wireless LAN Standards:

The 802.11 WLAN Standards, The 802.11 MAC Layer, 802.11 PHY Layer, 802.11 Enhancements, Other WLAN Standards.

Implementing Wireless LANs: Evaluating Wireless LAN Requirements, Planning and Designing the Wireless LAN, Pilot Testing, Installation and Configuration, Operation and Support

UNIT – IV

Wireless PAN Implementation: Introduction, Bluetooth (IEEE 802.15.1), Wireless USB ,Contents vii
ZigBee (IEEE 802.15.4),IRDA,Near Field Communications

Implementing Wireless PANs:

Wireless PAN Technology Choices,Pilot Testing ,Wireless PAN Security

UNIT – V

Wireless MANs (WiMaX):

802.16 standards, Voice and QoS support

Trends: Overlay networks

The Future of Wireless Networking Technology:

Wireless Mesh Network Routing, Network Independent Roaming, Gigabit Wireless LANs,
Cognitive Radio

TEXT BOOKS:

1. Wireless Networking Technology: From Principles to Successful Implementation -Steve Rackley
2. Principles of Wireless Networks, K. Pahlavan and P. Krishnamurthy, Pearson Education,2002.
3. Wireless Communication and Networks, W. Stallings, Pearson Education, 2002.
4. Mobile Communications, Jochen Schiller, Addison Wesley, 2003.

REFERENCES:

1. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
2. Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005.
3. Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
4. Wireless Communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN11	CLIENT SERVER COMPUTING						

COURSE OBJECTIVES:

- To understand how to establish communication between client and server.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Recognize and describe the working of Computer Networks, Client server computing.

CO2: Illustrate reference models with layers, protocols and interfaces.

CO3: Summarize functionalities of different Layers.

CO4: Combine and distinguish functionalities of different Layers.

CO5: Model the Client- Server computing using different media.

CO6: Apply client –server computing in real life application development.

SYLLABUS:**UNIT- I**

The business opportunity driving forces, major issues in information technology right sizing - review of host and non-distributed computing. Basis of distributed computing decomposition approaches layers vs tiers.

UNIT- II

Networking, Types of network, Basis of client / server computing components. Benefits, Evaluation of Client-server computing, Client / server computing approaches, applications development, cost implementation. TCP/IP Protocol suit.

UNIT- III

Open System Standards For Client/Server Computing: Understanding Client / Server computing, Dispelling the Myths, Obstacles Upfront and Hidden Open system and standards, Factors for success. Socket programming and socket API.

Two Tier Computing: Introduction client Tier, Hardware and Software requirements operating system services, Types of Client Server -Tier, Types of Server-Eight layers of Software.

UNIT- IV

Three-Tier Computing: Introduction and comparison of two and three tier- Client side, server side and middleware side, Hardware and Software requirements, Transaction servers, TP lite Vs TP Heavy. CGI scripting.

Middleware: Hardware and Software requirements, Netware connectivity, Types of Middleware, Data Base middleware Standards.

UNIT- V

Multi Tier Computing: Overview, Benefits, Disadvantages, Components, Tier separations and interaction Thin Client Computing: Introduction to computing models–

Comparison, Components, environments.

Front End Tools: Overview, The Client components, Essential features of a front-end tools.
Case Studies Account and Financial system, Sales automation, and courseware system.

TEXT BOOKS:

1. Dawana Travis Dewire, "Client/Server Computing", Tata McGraw -Hill Publishing Company Limited, New Delhi, 2003.
2. Patrick Smith and Steve Guengesich, "Client/Server Computing", Prentice Hall of India, New Delhi, 2002.

REFERENCES:

1. Robert Orfali, Dan Harkey and Jeri Edwards, "Essential Client/Server Survival Guide", Galgotia Publications, New Delhi, 2001.
2. Joel P Kaster, "Understanding Thin Client/Server Computing", Prentice Hall of India, New Delhi, 2001.
3. Jein Edwards, "3 tier Client/server at Work", Wiley Computer Publishing, USA, 1999.
4. Ashhofaiol Tomy Martin, "Building N - tier Applications with COM and VB 6.0", Wiley Computer Publishing, Singapore, 1999.
5. Travis Derive D, "Second - generation Client/Server Computing" McGraw Hill, New Delhi, 1997.
6. Karen Watterson, "Client/Server Technology for "Managers " Addition -Wesley, USA, 1996.
7. Larry J Vaughn, "Client/Server System Design and implementation", Mc Graw Hill inc, USA, 1995

DEPARTMENT OF INFORMATION TECHNOLOGY

POOL-3

CYBER SECURITY: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20ITHN12	CYBER SECURITY ESSENTIALS	3	1	0	4
2	R20ITHN13	SECURE CODING	3	1	0	4
3	R20ITHN14	VULNERABILITY ASSESSMENT & PENETRATION TESTING	3	1	0	4
4	R20ITHN15	MALWARE ANALYSIS	3	1	0	4
5	R20ITHN16	CYBER CRIME INVESTIGATION AND DIGITAL FORENSICS	3	1	0	4

In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering

DEPARTMENT OF INFORMATION TECHNOLOGY

~ 2 ~HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN12	CYBER SECURITY ESSENTIALS						

COURSE OBJECTIVE:

- To introduce information security concepts to undergraduate engineering students, so they can defend their personal and organizational information from probable security attacks and incidents.

COURSE OUTCOMES:

By the end of this course, the student will be able to

CO1: Summarize the basics and need for information security.[K2]

CO2: Analyze, and evaluate infrastructure and network vulnerabilities.[K4]

CO3: Analyze different access control and authentication methods.[K4]

CO4: Analyze to assess current and anticipated security risks and vulnerabilities with vulnerability assessment and auditing methods.[K4]

CO5: Analyze fundamentals of cryptography and how cryptography serves as the central language of information security.[K4]

SYLLABUS:

UNIT-I

Introduction to Security: Challenges of Securing Information, Definition of Information Security, Attackers, Attacks and Defenses.

Systems Threats and Risks: Software-Based Attacks, Hardware-Based Attacks, Attacks on Virtualized Systems, Hardening the Operating System, Preventing Attacks that Target the Web Browser, Hardening Web Servers, Protecting Systems from Communications-Based Attacks, Applying Software Security Applications.

UNIT-II

Network Vulnerabilities and Attacks: Network Vulnerabilities, Categories of Attacks, Methods of Network Attacks.

Network Defenses: Crafting a Secure Network, Applying Network Security Devices, Host and Network Intrusion Prevention Systems (HIPS/NIPS), Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware.

UNIT-III

Access Control: Access Control Models and Practices, Logical Access Control Methods, Physical Access Control.

Authentication: Definition of Authentication, Authentication Credentials, Extended Authentication Protocols, Remote Authentication and Security.

UNIT-IV

Vulnerability Assessment: Risk Management, Assessment, and Mitigation, Identifying Vulnerabilities.**Security Audit:** Privilege Auditing, Usage Auditing, Monitoring Methodologies and Tools.

UNIT-V

Cryptography: Introduction to Cryptography, Cryptographic Algorithms, Using Cryptography on Files and Disks, Digital Certificates, Public Key Infrastructure, Key Management.

TEXT BOOK:

1. Security Guide to Network Security Fundamentals, Third Edition, Mark Ciampa, Cengage Learning.

REFERENCES:

1. Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning.
2. Information Security: The Complete Reference, Rhodes-Ousley, Mark, Second Edition, McGraw-Hill.
3. Information Security: Principles and Practices, Mark S. Merkow, Jim Breithaupt, 2nd Edition, Pearson Education.

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN13	SECURE CODING						

COURSE OBJECTIVES:

- Understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
- Knowledge of outline of the techniques for developing a secure application.
- Recognize opportunities to apply secure coding principles.

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Summarize secure systems and various security attacks.[K2]

CO2: Implement the development of process of software leads to secure coding practices.[K3]

CO3: Apply Secure programs and various risk in the software.[K3]

CO4: Analyze various errors that lead to vulnerabilities.[K4]

CO5: Design Real time software and vulnerabilities.[K3]

SYLLABUS:

UNIT-I

Introduction-Need for secure systems, Proactive security development process, Security principles to live by and threat modeling.

UNIT-II

Secure Coding in C-Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities

UNIT-III

Secure Coding in C++ and Java-Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double free vulnerabilities, Integer security, Mitigation strategies

UNIT-IV

Database and Web Specific Input Issues-Quoting the Input, use of stored procedures, Building SQL statements securely, XSS related attacks and remedies

UNIT-V

Software Security Engineering-Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design.

TEXT BOOK:

1. Michael Howard, David LeBlanc, “Writing Secure Code”, Microsoft Press, 2nd Edition, 2003.

REFERENCES:

1. Robert C. Seacord, “Secure Coding in C and C++”, Pearson Education, 2nd edition, 2013.
2. Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, “Software Security Engineering: A guide for Project Managers”, Addison-Wesley Professional, 2008.

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN14	VULNERABILITY ASSESSMENT & PENETRATION TESTING						

COURSE OBJECTIVES:

- To identify security vulnerabilities and weaknesses in the target applications.
- To identify how security controls can be improved to prevent hackers gaining access to operating systems and networked environments.
- To test and exploit systems using various tools.
- To understand the impact of hacking in real time machines.

COURSE OUTCOMES:

By the end of this course, the student will be able to

- CO1:** Explain Penetration testing phases
- CO2:** Illustrate information gathering methodologies
- CO3:** Apply System Hacking Techniques in real time applications
- CO4:** Explore advanced System hacking
- CO5:** Describe Bypassing WLAN Authentication

SYLLABUS:

UNIT-I

Introduction-Penetration Testing phases/Testing Process, types and Techniques, Blue/Red Teaming, Strategies of Testing, Non-Disclosure Agreement Checklist, Phases of hacking, Open- source/proprietary Pentest Methodologies

UNIT -II

Information Gathering and Scanning-

Information gathering methodologies- Foot printing, Competitive Intelligence- DNS Enumerations- Social Engineering attacks, Port Scanning-Network Scanning- Vulnerability Scanning- NMAP scanning tool- OS Fingerprinting-Enumeration.

UNIT-III

System Hacking

Password cracking techniques- Key loggers- Escalating privileges- Hiding Files, Double Encoding, Steganography technologies and its Countermeasures. Active and passive sniffing- ARP Poisoning, MAC Flooding- SQL Injection - Error- based, Union-based, Time-based, Blind SQL, Out-of-band. Injection Prevention Techniques.

UNIT- IV

Advanced System Hacking:

Broken Authentication, Sensitive Data Exposure, XML External Entities, Broken Access Code, XSS- Stored, Reflected, DOM Based

UNIT-V

Wireless Pentest:

Wi-Fi Authentication Modes, Bypassing WLAN Authentication, Types of Wireless Encryption, WLAN Encryption Flaws, AP Attack, Attacks on the WLAN Infrastructure, DoS-Layer1, Layer2, Layer 3, DDoS Attack, Client Misassociation, Wireless Hacking Methodology, Wireless Traffic Analysis

TEXTBOOKS:

1. Kali Linux 2: Windows Penetration Testing, By Wolf Halton, Bo Weaver , June 2016PacktPublishing

REFERENCES:

1. Mastering Modern Web Penetration Testing By Prakhar Prasad, October 2016PacktPublishing.
2. SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN15	MALWARE ANALYSIS						

COURSE OBJECTIVES:

- To understand the purpose of computer infection program.
- To implement the covert channel and mechanisms.
- To test and exploit various malware in open-source environment.
- To analyze and design the famous virus and worms.
- Understand the Reverse Engineering (RE) Methodology
- Disassemble products and specify the interactions between its subsystems and their functionality

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Summarize the characteristics of Malware and its effects on Computing systems.[K2]

CO2: Analyze the given system scenario using the appropriate tools to Identify the vulnerabilities and to perform Malware analysis.[K4]

CO3: Analyze the given Portable Executable and Non-Portable Executable files using Static dynamic analysis techniques.[K4]

CO4: Demonstrate the Malware functionalities.[K2]

CO5: Apply anti-reverse engineering in different Applications.[K3]

SYLLABUS:

UNIT-I

Malware Basics- General Aspect of Computer infection program, Non Self Reproducing Malware, How does Virus Operate, Virus Nomenclature, Worm Nomenclature, Recent Malware Case Studies.

UNIT- II

Basic Analysis- Antivirus Scanning, x86 Disassembly, Hashing, Finding Strings, Packed Malware, PE File Format, Linked Libraries & Functions, PE Header File & Section.

UNIT-III

Advanced Static & Dynamic Analysis- IDA Pro, Recognizing C code constructs, Analyzing malicious windows program, Debugging, OllyDbg, Kernel Debugging with WinDbg, Malware Focused Network Signatures.

UNIT-IV

Malware Functionalities- Malware Behavior, Covert Malware Launch, Data Encoding, Shell code Analysis.

UNIT-V

Reverse Engineering Malware (REM): REM Methodology, Resources for Reverse- Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining Clam AV-Signatures.

TEXT BOOKS:

1. MICHAEL SIKORSKI, Andrew Honig “Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software” publisher Williampollock

REFERENCES:

1. ErciFiliol, “Computer Viruses: from theory to applications”, Springer, 1st edition, 2005.

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN16	CYBER CRIME INVESTIGATION AND DIGITAL FORENSICS						

COURSE OBJECTIVES:

- Able to identify security risks and take preventive steps
- To understand the forensics fundamentals.
- To understand the evidence capturing process.
- To understand the preservation of digital evidence

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1: Acquire the definition of computer forensics fundamentals.[K2]

CO2: Analyze the types of computer forensics technology.[K4]

CO3: Analyze various computer forensics systems.[K4]

CO4: Analyze the methods for data recovery, evidence collection and data seizure.[K4]

CO5: Summarize duplication and preservation of digital evidence.[K2]

SYLLABUS:

UNIT-I

Introduction: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

UNIT-II

Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

UNIT-III

Investigation: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT-IV

Digital Forensics: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

UNIT– V

Laws And Acts: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

REFERENCES:

1. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics”, Tata McGraw-Hill, New Delhi, 2006.
3. Robert M Slade, “Software Forensics”, Tata McGraw - Hill, New Delhi, 2005

DEPARTMENT OF INFORMATION TECHNOLOGY

POOL-4

PATTERN RECOGNITION: (any four of the following subjects which are not chosen as professional electives are to be considered for Honors Degree)

S. NO.	SUBJECT CODE	SUBJECT	L	T	P	CREDITS
1	R20ITHN17	DIGITAL IMAGE PROCESSING	3	1	0	4
2	R20ITHN18	BIO METRICS	3	1	0	4
3	R20ITHN19	SPEECH PROCESSING	3	1	0	4
4	R20ITHN20	ADVANCED COMPUTER VISION	3	1	0	4
5	R20ITHN21	MATHEMATICAL ESSENTIAL FOR DATA SCIENCE	3	1	0	4

In addition to any of the four subjects, MOOC/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are compulsory in the domain of Electrical and Electronics Engineering

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN17	DIGITAL IMAGE PROCESSING						

COURSE OBJECTIVES:

The objective of this course is to

- Comprehend the relation between human visual system and machine perception and processing of digital images.
- Provide a detailed approach towards image processing applications like enhancement, Segmentation, and compression.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Apply the spatial and frequency domain image transforms.[K3]

CO2: Apply image enhancement techniques.[K3]

CO3: Analyze restoration of images.[K4]

CO4: Analyze segmentation of images.[K4]

CO5: Apply image compression techniques and evaluate the basic compression algorithms.[K3]

SYLLABUS:

UNIT - I

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform.

UNIT - II

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

UNIT - III

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

UNIT – IV

Image Segmentation: Detection of Discontinuities, Edge Linking And Boundary Detection, thresholding, Region Oriented Segmentation.

Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element

DEPARTMENT OF INFORMATION TECHNOLOGY

Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

UNIT - V

Image Compression: Redundancies and their Removal Methods, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

TEXT BOOKS:

1. Digital Image Processing - Rafael C. Gonzalez, Richard E. Woods, 3rd Edition, Pearson.
2. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar- MC

GRAW HILL

EDUCATION.

REFERENCES:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIPTools - Scotte Umbaugh, 2nd Ed, CRC Press, 2011
2. Digital Image Processing using MATLAB – Rafael C. Gonzalez, Richard E Woods and Steven L.Eddings, 2nd Edition, MC GRAW HILL EDUCATION, 2010.
3. Digital Image Processing and Computer Vision – Somka, Hlavac, Boyle-Cengage Learning (Indianedition) 2008.
4. Introductory Computer Vision Imaging Techniques and Solutions- Adrian low, 2008,2 nd Edition.

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN18	BIO METRICS						

COURSE OBJECTIVE:

- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Summarize basic concepts of biometric technology. [K2]

CO1: Analyze fingerprint technology. [K4]

CO1: Analyze face recognition systems. [K4]

CO1: Examine voice based biometric recognition. [K3]

CO1: Examine Multi-biometric systems. [K3]

SYLLABUS:

UNIT-I

INTRODUCTION TO BIOMETRICS

Introduction and background – biometric technologies – passive biometrics – active biometrics - Biometrics Vs traditional techniques – Benefits of biometrics - Operation of a biometric system – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, FTA rate and rate- Need for strong authentication – Protecting privacy and biometrics and policy – Biometric applications.

UNIT-II

FINGERPRINT IDENTIFICATION TECHNOLOGY

Fingerprint Patterns, Fingerprint Features, Fingerprint Image, width between two ridges - Fingerprint Image Processing - Minutiae Determination - Fingerprint Matching: Fingerprint Classification, Matching policies.

UNIT-III

FACE RECOGNITION

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition, Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT-IV

VOICE SCAN

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.

UNIT-V

FUSION IN BIOMETRICS

Introduction to Multibiometric - Advantages of multimodal system, Information Fusion in Biometrics - Issues in Designing a Multibiometric System - Sources of Multiple Evidence - Levels of Fusion in Biometrics – Sensor level, Feature level, Rank level, Decision level fusion - Score level Fusion. Examples –gait based biometric systems.

TEXT BOOKS:

1. James Wayman, Anil Jain, Davide Maltoni, Dario Maio, —Biometric Systems, Technology Design and Performance Evaluation, Springer.
2. David D. Zhang, —Automated Biometrics: Technologies and Systems, Kluwer Academic Publishers, New Delhi.
3. Arun A. Ross, Karthik Nandakumar, A.K. Jain, —Handbook of Multibiometrics, Springer, New Delhi.

REFERENCES:

1. Paul Reid, —Biometrics for Network Security, Pearson Education, 2004.
2. Nalini K Ratha, Ruud Bolle, —Automatic fingerprint Recognition System, Springer. L C Jain, I Hayashi, S B Lee, U Halici, —Intelligent Biometric Techniques in
3. Fingerprint and Face Recognition, CRC Press, 1999.
4. John Chirillo, Scott Blaul, —Implementing Biometric Security, John Wiley, 2003.
5. S.Y. Kung, S.H. Lin, M.W. Mak, —Biometric Authentication: A Machine Learning Approach, Prentice Hall, 2005

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN19	SPEECH PROCESSING						

COURSE OBJECTIVES:

The objective of this course is to

- The aim of the course is to make the students to understand the basic characteristics of the speech
- Signal about the production and perception of speech by humans.
- To describe the basic techniques and practical aspects of speech analysis.
- To make the students to understand different speech processing applications such as speech recognition and speaker recognition.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Summarize and describe the mechanisms of speech production.[K2]

CO2: Examine the speech sounds from the acoustic characteristics.[K3]

CO3: Analyze the speech signal in time and frequency domains [K4]

CO4: Analyze the speech signal in terms of the parameters of a source-filter model.[K4]

CO5: Design a simple speaker recognition system.[K3]

SYLLABUS:

UNIT - I

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform Lossless Tube Model, Effect of Losses In Vocal Tract, Effect of Radiation at Lips, Digital Models for Speech Signals.

UNIT - II

Time Domain Models for Speech Processing: Introduction, Window Considerations, Short-Time-Energy and Average Magnitude Short Time Average Zero Crossing Rate, Speech Vs Silence Discrimination Using Energy and Zero Crossing, Pitch Period Estimation using a Parallel Processing Approach, The Short Time Autocorrelation Function, The Short Time Average Magnitude Difference Function, Pitch Period Estimation using The Autocorrelation Function.

UNIT - III

Linear Predictive Coding (LPC) Analysis: Basic Principles of Linear Predictive Analysis, The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution For the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection Using LPC Parameters, Formant Analysis Using LPC Parameters.

DEPARTMENT OF INFORMATION TECHNOLOGY

UNIT - IV

Automatic Speech & Speaker Recognition: Basic Pattern Recognition Approaches, Parametric Representation of Speech, Evaluating the Similarity of Speech Patterns, Isolated Digit Recognition System, Continuous Digit Recognition System Hidden Markov Model (HMM) For Speech: Hidden Markov Model (HMM) for Speech Recognition, Viterbi algorithm, Training and Testing using HMMS.

UNIT - V

Speaker Recognition: Recognition techniques, Features that Distinguish Speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System. Overview of speech Enhancement, speech synthesis.

TEXTBOOKS:

1. Digital Processing of Speech Signals: L.R Rabinar and R W Jhaung, Pearson Education.
2. Digital Processing of Speech Signals: L.R. Rabiner and S. W. Schafer, Pearson Education.
3. Speech Communications: Human & Machine - Douglas O'Shaughnessy, 2nd Ed., Wiley India.

REFERENCES:

1. Discrete Time Speech Signal Processing: Principles and Practice, Thomas F. Quateri, 1st Edition, Pearson Education.
2. Speech & Audio Signal Processing: Ben Gold & Nelson Morgan, 1st Edition, Wiley.

DEPARTMENT OF INFORMATION TECHNOLOGY

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN20	ADVANCED COMPUTER VISION						

COURSE OBJECTIVES:

- Able to apply the core theories and algorithms of computer vision and video processing
- Understand the state-of-the-art of computer vision and image/video processing,
 - Apply the applications such as vision-based modeling and interaction.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- CO1:** Summarize basic concepts, terminology, theories, models and methods in the field of computervision.[K2]
- CO1:** Examine to know principles of human visual system.[K3]
- CO2:** Examine the advanced methods of computer vision related to GAN, RNN,DeepDream implementation.[K3]
- CO3:** Apply a design of a computer vision system for a specific problem.[K3]
- CO4:** Apply applications of RNN in real time applications.[K3]

SYLLABUS:

UNIT – I

Introduction to Deep Learning, Tensor flow and Keras:

What is Deep learning? Why Deep learning, Advantages, and limitations of Deep learning. Tensor flow basics, how to build Deep learning models with Keras and Tensor flow as backend.Tensor board for visualizations.

UNIT - II

CNN for Vision Tasks:Introduction to CNN, Deep Convolutional networks, LeNet,VGG16Net,Classification of MNISThand written digits by CNN and FCNN models.

UNIT - III

Generative Adversal Networks (GAN's):

What is GAN?,DGAN,Some interesting GAN structures,SRGAN,Cycle GAN, info GAN.MNISTusing GAN in Tensorflow.

UNIT - IV

Recurrent Neural Networks:

The basic RNN, RNN Cell,RNN variants, RNN topologes,Example applications of RNN. Imagecaptioning and Annotation.

UNIT - V

Deep Dream and Neural Style Transfer:

How the Deep dream algorithm works,Deep dream implementation in keras and tensor flow. NeuralStyle Tranfer:Content loss,Style loss,Total varian loss,

network training.

TEXT BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by [Aurélien Géron](#), Orielly.
2. Deep Learning with Python 1st Edition by François Chollet, Mannig Publications.
3. Mastering Computer Vision with TensorFlow 2.x: Build advanced computer vision applications using machine learning and deep learning techniques by [Krishnendu Kar](#), Packt Publications.
4. Deep Learning with TensorFlow 2 and Keras: Regression, ConvNets, GANs, RNNs, NLP, and more with TensorFlow 2 and the Keras API, 2nd Edition

REFERENCES:

1. Richard Szeliksy “Computer Vision: Algorithms and Applications” (<http://szeliski.org/Book/>)
2. Haralick & Shapiro, “Computer and Robot Vision”, Vol II
3. G. erard Medioni and Sing Bing Kang “Emerging topics in computer vision”
4. Emanuele Trucco and Alessandro Verri “Introductory Techniques for 3-D Computer Vision”, Prentice Hall, 1998.
5. Olivier Faugeras, “Three-Dimensional Computer Vision”, The MIT Press, 1993

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN21	MATHEMATICAL ESSENTIAL FOR DATA SCIENCE						

COURSE OBJECTIVES:

DEPARTMENT OF INFORMATION TECHNOLOGY

- Recall the basics of sets, natural numbers, integers, rational numbers, and real numbers.
- Learn to use the coordinate system, and plot straight lines.
- Identify the properties and differences between linear, quadratic, polynomial, exponential, and logarithmic functions.
- Find roots, maxima and minima of polynomials using algorithmic methods.
- Learn to represent sets and relations between set elements as discrete graphs using nodes and edges.
- Formulate some common real-life problems on graphs and solve them

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Summarize basic mathematical concepts in data science, relating to linear algebra, probability, and calculus.[K2]

CO1: Employ methods related to these concepts in a variety of data science applications.[K3]

CO1: Apply logical thinking to problem-solving in context.[K3]

CO1: Examine appropriate technology to aid problem-solving and data analysis.[K3]

CO1: Examine skills in writing mathematics.[K3]

SYLLABUS:

UNIT-1

Set Theory - Number system, Sets and their operations

Relations and functions - Relations and their types, Functions and their types, Rectangular coordinate system

UNIT- 2

Straight Lines- Slope of a line, Parallel and perpendicular lines, Representations of a Line, General equations of a line, Straight-line fit

Quadratic Functions - Quadratic functions, Minima, maxima, vertex, and slope, Quadratic Equations

UNIT- 3

Algebra of Polynomials - Addition, subtraction, multiplication, and division, Algorithms

UNIT- 4

Graphs of Polynomials - X-intercepts, multiplicities, end behavior, and turning points, Graphing & polynomial creation

Functions - Horizontal and vertical line tests, Exponential functions, Composite functions, Inverse functions

Logarithmic Functions - Properties, Graphs, Exponential equations, Logarithmic equations

UNIT- 5

Graph Theory - Representation of graphs, Breadth-first search, Depth-first search,

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Applications of BFS and DFS. Directed Acyclic Graphs - Complexity of BFS and DFS, Topological sorting and longest path, Transitive closure, Matrix multiplication. Graph theory Algorithms - Single source shortest paths, Dijkstra's algorithm, Bellman-Ford algorithm, All-pairs shortest paths, Floyd–Warshall algorithm, Minimum cost spanning trees, Prim's algorithm, Kruskal's algorithm

TEXT BOOK:

1. Introductory Algebra: a real-world approach (4th Edition) - by Ignacio Bello

REFERENCES:

1. Mathematical Foundations Of Data Science Using R by Emmert-Streib Frank.