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	R20ITHN03	ARTIFICIAL INTELLIGENCE	3	1	0	4
4	R20CSHN06	NATURAL LANGUAGE PROCESSING	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
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-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
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-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	R20ITHN03	ARTIFICIAL INTELLIGENCE	3	1	0	4
4	R20CSHN06	NATURAL LANGUAGE PROCESSING	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						

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

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

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN03	**ARTIFICIAL INTELLIGENCE**						

COURSE OBJECTIVE:

- Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic and learning.
- The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

COURSE OUTCOMES:

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

CO 1: Summarize the characteristics of AI that make it useful to real-world problems. [K2]
CO 2: Analyse different search techniques and predicate logic in artificial Intelligence. [K4]
CO 3: Interpret knowledge representation and symbolic reasoning using different rules. [K2]
CO 4: Apply the basic knowledge on learning and reinforcement learning. [K3]
CO 5: Make use of the power of AI in Natural language processing as an advanced Application of AI. [K3]

SYLLABUS:

UNIT - I

Introduction to AI, Problems, Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the Design of Search Programs.

UNIT - II

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis. **Knowledge Representation Using Predicate Logic:** Representing Simple Facts in logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution.

UNIT - III

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.
Weak slot-and-filler structures: Semantic Nets, Frames, **Strong slot-and-filler structures**: Conceptual dependency, Scripts

UNIT - IV

Learning: Rote learning, learning by taking advice, learning in problem solving,
Reinforcement Learning: Markov Decision Problem, Q-Learning, Q-Learning Algorithm, temporal difference Algorithm

UNIT – V

Natural Language Processing: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural language Processing, Spell Checking.

TEXT BOOKS:

1.Elaine Rich & Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Edition, 3rd Edition, Reprint 2008.
2. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
3. Carl Townsend, "Introduction to TURBO PROLOG", BPB Publications. 2011
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Science/Engineering/Math, 1997.

REFERENCE BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education, 2003
3. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003

WEB REFERENCES

1. https://www.coursera.org/learn/machine-learning
2. https://www.simplilearn.com/big-data-and-analytics/machine-learning
3. https://www.appliedaicourse.com/course/applied-ai-course-online
4. http://nptel.ac.in/courses/106105152

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20CSHN06	**NATURAL LANGUAGE PROCESSING**						

COURSE OBJECTIVES:

- To understand the algorithms available for the processing of linguistic Information and computational properties of natural languages.
- To conceive basic knowledge on various morphological, syntactic and Semantic NLP tasks.
- To familiarize various NLP software libraries and data sets publicly available.
- To develop systems for various NLP problems with moderate complexity.
- To learn various strategies for NLP system evaluation and error analysis.

COURSE OUTCOMES:

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

CO 1: Describe the concepts of morphology, syntax, semantics, discourse &pragmatics of natural language.[K2]

CO 2: Demonstrate understanding of the relationship between NLP and statistics &machine learning.[K2]

CO 3: Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis.[K4]

CO 4: Develop systems for various NLP problems with moderate complexity.[K4]

CO 5: Evaluate NLP systems, identify shortcomings and suggest solutions for these shortcomings.[K4]

SYLLABUS:

UNIT– I

Introduction to NLP: NLP – introduction and applications, NLP phases, Difficulty of NLP including ambiguity;Spelling error and Noisy Channel Model; Concepts of Parts-of-speech and Formal Grammar of English.

UNIT–II

Language Modelling: N-gram and Neural Language Models Language Modelling with N-gram, Simple N-gram models, Smoothing (basic techniques),Evaluating language models; Neural Network basics, Training; Neural Language Model, Case study: application of neural language model in NLP system development.

UNIT-III

Parts-of-speech Tagging Parts-of-speech Tagging: basic concepts; Tagset; Early approaches: Rule based and TBL; POS tagging using HMM, Introduction to POS Tagging using Neural Model.

UNIT-IV

Parsing Basic concepts: top down and bottom up parsing, treebank; Syntactic parsing: CKY parsing; Statistical parsing basics: Probabilistic Context Free Grammar (PCFG); Probabilistic CKY Parsing of PCFGs.

UNIT–V

Semantics Vector Semantics; Words and Vector; Measuring Similarity; Semantics with dense vectors; SVD and Latent Semantic Analysis; Embeddings from prediction: Skip-gram and CBOW; Concept of Word Sense; Introduction to WordNet.

TEXT BOOKS:

1.Jurafsky Dan and Martin James H. “Speech and Language Processing”, 3rd Edition, 2018.

REFERENCE BOOKS:

1.Jurafsky D. and Martin J. H., “Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Upper Saddle River, NJ: Prentice-Hall, 2008.

2. Goldberg Yoav “A Primer on Neural Network Models for Natural Language Processing”.

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	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 ComputerVision 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/#

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
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						

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	-	-	30	70	100	4
SUBJECT CODE: R20ITHN07	**DATA COMMUNICATION**						

COURSE OBJECTIVES:

- To have a detailed study of various analog and digital modulation and demodulationtechniques
- To have a thorough knowledge of various multiplexing schemes and Data communicationprotocols
- 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 ANDNETWORKING: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, TransverseElectromagnetic 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.

HONORS	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	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

writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued, Socketsand 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	EXTERNA LMARKS	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, PhysicalLayer 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. CaseStudies Account and Financial system, Sales automation, and courseware system.

TEXT BOOKS:

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

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						

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 vulnerabilityassessment and auditing methods.[K4]

CO5: Analyze fundamentals of cryptography and how cryptography serves as the central languageof 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, CengageLearning.
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.

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, "SoftwareSecurity Engineering: A guide for Project Managers", Addison-Wesley Professional, 2008.

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 tooperating 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

ystem 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

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 vulnerabilitiesand 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 MalwareCase 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.

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 andScope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories ofCyber Crime, Property CyberCrime.

UNIT–II

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

UNIT–III

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

UNIT–IV

Digital Forensics: Introduction to Digital Forensics, Forensic Software andHardware, Analysis and Advanced Tools, Forensic Technology and Practices, ForensicBallistics andPhotography, Face, Iris and Fingerprint Recognition, Audio VideoAnalysis, Windows System Forensics, Linux System Forensics, NetworkForensics.

UNIT– V

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

REFERENCES:

1. Nelson Phillips and EnfingerSteuart, "Computer Forensics andInvestigations", CengageLearning,New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and ComputerForensics", TataMcGraw-Hill, New Delhi, 2006.
3. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005

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						

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 andQuantization, Relationship between Pixels.

Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete CosineTransform, 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, Linearand 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, LeastMean 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 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.

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 theunderlying trade-offs.
- To recognize personal privacy and security implications of biometrics basedidentification 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 ofFusion 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‖, KluwerAcademic 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 LearningApproach‖Prentice Hall, 2005

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 thespeech
- 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 speechrecognition 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 ofSpeech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of SpeechProduction- 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 ProcessingApproach, The Short Time Autocorrelation Function, The Short Time Average MagnitudeDifferenceFunction, 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 theAutocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection Using LPC Parameters, FormantAnalysis Using LPC Parameters.

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 usingHMMS.

UNIT - V

Speaker Recognition: Recognition techniques, Features that Distinguish Speakers, Speaker RecognitionSystems: Speaker Verification System, Speaker Identification System. Overview of speechEnhancement, 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.,WileyIndia.

REFERENCES:

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

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 deam implementation in keras and tensor flow. NeuralStyle Tranfer:Content loss,Style loss,Total varian losss, network training.

TEXT BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systemsby Aurélien Géron,Orielly.
2. Deep Learning with Python 1st Edition by François Chollet,Mannig Publicatons.
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_erardMedioni and Sing Bing Kang “Emerging topics in computer vision”
4. Emanuele Trucco and AllessandroVerri “Introductory Techniques for 3-D ComputerVision”, 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:

- 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 andedges.
- 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 linearalgebra, 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 coordinatesystem

UNIT- 2

Straight Lines- Slope of a line, Parallel and perpendicular lines, Representations of a Line, Generalequations 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, Inversefunctions

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

UNIT- 5

Graph Theory - Representation of graphs, Breadth-first search, Depth-first search, 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 OfData Science Using Rby Emmert-Streib Frank.