BONAM VENKATA CHALAMAYYA INSTITUTE OF TECHNOLOGY & SCIENCE- An AUTONOMOUS INSTITUTION

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE

B.Tech CSE-HONORS (BR-23 Regulations)

For HONORS DEGREE IN COMPUTER SCIENCE & ENGINEERING PROGRAMME

(Applicable for batches admitted from 2023-24)

COURSES OFFERED FOR HONORS DEGREE IN CSE

Note: ***To obtain Honor's degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.***

Code	Subject Title	L-T-P-C	Sem
23CSHT01	Artificial Neural Networks	3-0-0-3	II-II
23CSHT02	Cyber Security	3-0-0-3	III-I
23CSHT03	Deep Learning for Natural Language Processing	3-0-0-3	III-II
23CSHT04	Reinforcement Learning	3-0-0-3	IV-I
23CSHT05	Computer Vision	3-0-0-3	
23CSHT06	Introduction to Data Science	3-0-0-3	
23CSHT07	**Social Network Analysis**	3-0-0-3	MOOCS
23CSHT08	**Design & Implementation of Human-Computer Interfaces**	3-0-0-3	MOOCS
23CSHT09	**Quantum Algorithms and Cryptography**	3-0-0-3	MOOCS
23CSHT10	**Prompt Engineering for Generative AI**	3-0-0-3	MOOCS
23CSHT11	**Reinforcement Learning**	3-0-0-3	MOOCS
23CSHT12	**GPU Architecture and Programming**	3-0-0-3	MOOCS
23CSHT13	Applied Linear Algebra in AI & ML	3-0-0-3	MOOCS
23CSHT14	Cryptography and Network Security	3-0-0-3	MOOCS
23CSHT15	Privacy and Security in Online Social Media	3-0-0-3	MOOCS
23CSHT16	Computer Vision	3-0-0-3	MOOCS
23CSHT17	Applied Time-Series Analysis	3-0-0-3	MOOCS
23CSHT18	Parallel Computer Architecture	3-0-0-3	MOOCS
23CSHT19	Computational Complexity	3-0-0-3	MOOCS
23CSHT20	Unmanned Arial Systems & Robotics	3-0-0-3	MOOCS

Note: Will add any advanced NPTEL courses introduced by SWAYAM/NPTEL in future with the consent of hon'ble BOS members through email communication.

BR23 B.Tech CSE HONORS SYLLABUS

II YEAR II SEM	Artificial Neural Networks (23CSHT01)	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to make student

Understand the difference between biological neuron and artificial neuron, Explore the building blocks of neural networks and its application areas in order to design and develop applications using neural networks

Course Outcomes:

- Up on completion of this course, the students will be able to:
- **CO1.**Explore the structure and functionality of an artificial neuron and networks formed by it.
- **CO2.**Demonstrate the mathematical analysis involved to activating the neurons.
- **CO3.**Building multi-layer networks and understand how a network can be trained with forward and backward propagation.
- **CO4.**Explore different types of networks and its application areas.
- **CO5.**Building working prototypes to see the real working nature of an Artificial Neural Network.

UNIT I:

Introduction: Key Features, Historical Overview, Potential Application Areas, Biological Neuron, Artificial Neuron, Performance Parameters, Main Architectures of Artificial Neural Networks, Training Processes and Properties of Learning.

UNIT II:

Perceptron Network: Operating Principle of the Perceptron, Mathematical Analysis of the Perceptron, Training Process of the Perceptron.

ADALINE Network and Delta Rule: Operating Principle of the ADALINE, Training Process of the ADALINE, Comparison Between the Training Processes of the Perceptron-and the ADALINE.

UNIT III:

Multilayer Perceptron Networks: Operating Principle, Training Process, Multilayer Perceptron Applications.

Radial Basis Function Networks: Training Process of the RBF Network, Applications of RBF Networks.

Recurrent Hopfield Networks: Operating Principles, Stability Conditions, Associative Memories.

UNIT IV:

Self-Organizing Kohonen Networks: Competitive Learning Process, Kohonen Self-Organizing Maps.

AdaptiveResonanceTheoryNetworks: TopologicalStructure,AdaptiveResonance Principle,Learning Aspects of the ART-1 Network, Training Algorithm of the ART-1 Network, Aspects of the ART-1 OriginalVersion.

UNIT V:

Applications: Introduction, Direct applications, Application areas, Forecast of Stock Market Trends Using Recurrent Networks, Disease Diagnostic System Using ART Networks.

Text Books:

1. Ivan Nunesda Silva, etal.,Artificial Neural Networks: A Practical Course, Springer.
2. B.Yegnanarayana, Artificial neural networks, Prentice Hall of India Ltd.

Reference Books:

1. Simon Haykin, Neural Networks and Learning Machines, Pears on Education.

2. Daniel Graupe, Principles of Artificial Neural Networks,World Scientific Publishing
3. James A.Anderson,"An Introduction to Neural Networks",PHI.\
4. James A Freeman and Davis Skapura,Neural Networks:Algorithms, Applications, and Programming Techniques, Pearson Education.
5. S.Sivanandam, Introduction to Artificial Neural Networks,Vikas Publishing.
6. Sateesh Kumar,"Neural Networks: A Class Room Approach", TMH.
7. S.N.Sivanandam, S.Sumathi, S.N.Deepa, Introduction to Neural Networks using MATLAB 6.0,TMH.
8. Ananda Rao,Srinivas,"Neural Networks", Narosa.
9. Simon Haykin,"Neural networks A comprehensive foundations", Pearson Education.

BR23 B.Tech CSE HONORS SYLLABUS

III YEAR I SEM	Cyber Security (23CSHT02)	L	T	P	C
		3	0	0	3

Course Objectives:

The aim of the course is to

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

Course Outcomes:

CO1: Explain the fundamental concepts of cybercrime, its types, causes, and security challenges, especially in mobile and wireless environments.**Understanding (L2)**
CO2: Analyze various cyber-attack tools and methods (such as phishing, malware, spoofing, DoS/DDoS, SQL injection) and demonstrate defensive techniques.**Analyzing (L4)**
CO3: Apply investigation tools and techniques for cybercrime investigation, including evidence collection, preservation, email/IP tracking, and password recovery.**Applying (L3)**
CO4: Utilize computer forensics methodologies, tools, and procedures for digital investigations across operating systems, networks, and mobile devices.**Applying (L3)**
CO5: Evaluate cybercrime-related laws, especially the Indian IT Act, its amendments, digital signatures, and understand legal implications in the Indian and global context.**Understanding (L2)**

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cybercriminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation ofMobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II: Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III: Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, 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: Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating andTesting Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V: Cyber Crime Legal Perspectives: Introduction, Cybercrime and the Legal Landscape around the World, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment, Cyberlaw, Technology and Students: Indian Scenario.

Text Books:

1. Sunit Belapure Nina Godbole "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

Reference Books:

1. Michael T. Simpson, Kent Backman and James E. Corley, "Hands on Ethical Hacking and Network Defence", Cengage, 2019.
2. Computer Forensics, Computer Crime Investigation by John R. Vacca, Firewall Media, New Delhi.
3. Alfred Basta, Nadine Basta,Mary Brown and Ravinder Kumar "Cyber Security and Cyber Laws" , Cengage,2018.

E-Resources:

1. CERT-In Guidelines- http://www.cert-in.org.in/
2. https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks [Online Course]
3. https://computersecurity.stanford.edu/free-online-videos [Free Online Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu License: Creative Commons BY-NC-SA.

BR23 B.Tech CSE HONORS SYLLABUS

III YEAR II SEM	Deep Learning for NLP (23CSHT03)	L	T	P	C
		3	0	0	3

Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

CO1: Explain the origins, challenges, and fundamental concepts of NLP including language modeling, morphology, tokenization, and spelling correction.**Understanding (L2)**
CO2: Apply word-level analysis techniques such as N-grams, smoothing, and part-of-speech tagging using different models.**Applying (L3)**
CO3: Analyze syntactic structures using context-free grammars, parsing techniques, and probabilistic models for handling ambiguity.**Analyzing (L4)**
CO4: Demonstrate semantic and pragmatic analysis including word sense disambiguation, thematic roles, and similarity measures.**Analyzing (L4)**
CO5: Utilize discourse analysis methods and lexical resources (WordNet, Treebanks, Corpora, etc.) for NLP applications.**Applying (L3)**

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication,2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, OReilly Media,2009.

Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, OReilly Media,2015.
3. Handbook of Natural Language Processing, Second, NitinIndurkhya and Fred J. Damerau, Chapman and Hall/CRC Press, 2010.Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, TanveerSiddiqui, U.S. Tiwary, Oxford University Press,2008.

BR23 B.Tech CSE HONORS SYLLABUS

IV YEAR I SEM	Reinforcement Learning (23CSHT04)	L	T	P	C
		3	0	0	3

Course Objective:
• To provide the fundamentals of Reinforcement learning.
Course Outcomes:
● Enumerate the elements of Reinforcement Learning
● Solve then-armed Bandit problem
● Compare different Finite Mark ov Decision Process
● Discuss about Monte Carlo Methods in solving real world problems
● List the Applications and Case Studies of Reinforcement Learning

Course Outcomes (COs)

CO1: Explain the fundamentals of reinforcement learning, its history, scope, and limitations with real-world examples.**Understanding (L2)**
CO2: Apply and compare multi-armed bandit algorithms such as action-value methods, UCB, and gradient bandits for decision-making problems.**Analyzing (L4)**
CO3: Analyze finite Markov Decision Processes (MDPs) and evaluate value functions, returns, and optimality principles in RL.**Analyzing (L4)**
CO4: Implement Monte Carlo methods for prediction and control, including on-policy and off-policy approaches.**Applying (L3)**
CO5: Evaluate reinforcement learning applications and case studies such as games, robotics, scheduling, and resource allocation.**Understanding (L2)**

UNIT-I: The Reinforcement Learning Problem: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: TicTac-Toe, Summary, History of Reinforcement Learning.
UNIT-II: Multi-arm Bandits: An n-Armed Bandit Problem, Action-Value Methods,Incremental Implementation, tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

UNIT-III: Finite Markov Decision Processes: The Agent–Environment Interface, Goals and Rewards, Returns,UnifiedNotationforEpisodicandContinuingTasks,The Markov Property, MarkovDecisionProcesses,ValueFunctions,OptimalValueFunctions,OptimalityandApproximatio.

UNIT-IV: Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Offpolicy Prediction viaImportance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns
UNIT-V: Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, The Acrobot, Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling.
Text Books:
1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning

AnIntroduction",2ndEdition, The MIT Press,2018
2. Marco Wiering, Martijn van Otterlo Reinforcement Learning: State-of-the Art(Adaptation,Learning,andOptimization(12))2012thEdition

Reference Books:

1. Vincent François-Lavet,Peter Henderson,Riashat Islam, An Introduction to Deep
2. Reinforcement Learning (Foundations and Trends(r) in Machine Learning) , 2019

BR23 B.Tech CSE HONORS SYLLABUS

Honors	Computer Vision (23CSHT05)	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand the Fundamental Concepts related to sources, shadows and shading
- To understand the Geometry of Multiple Views

Course Outcomes (COs)

CO1: Explain the fundamentals of image formation, radiometry, shading, and color models for understanding visual perception.**Understanding (L2)**

CO2: Apply linear filters, Fourier transforms, and edge detection techniques for image analysis, and utilize texture-based methods for shape inference.**Applying (L3)**

CO3: Analyze multiple view geometry, stereopsis, and clustering-based segmentation techniques for image and video processing applications**: Analyzing (L4)**

CO4: Implement model-fitting methods such as the Hough Transform, EM algorithm, and Kalman filtering for robust segmentation and tracking.**Applying (L3)**

CO5: Evaluate geometric camera models, calibration methods, and case studies in robotics and medical imaging for advanced vision applications. **Evaluating (L5)**

UNIT –I:

CAMERAS: Pinhole Cameras Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

UNIT-II:

Linear Filters:Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection:Noise, Estimating Derivatives, Detecting Edges Texture0:Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.

UNIT-III:

The Geometry of Multiple Views: Two Views Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, Using More Cameras Segmentation by Clustering: What Is Segmentation? Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,

UNIT-IV:

Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples

UNIT- V:

Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry,

Case study: Mobile Robot Localization Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Case study: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.
2. R. C. Gonzalez and R. E. Woods "Digital Image Processing" Addison Wesley 2008. 3. Richard Szeliski "Computer Vision: Algorithms and Applications" Springer-Verlag London Limited 2011.

BR23 B.Tech CSE HONORS SYLLABUS

Honors	Introduction to Data Science(23CSHT06)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: From the course the student will learn
1. Knowledge and expertise to become a data scientist.
2. Essential concepts of statistics and machine learning that are vital for data science;
3. Significance of exploratory data analysis (EDA) in data science.
4. Critically evaluate data visualizations presented on the dashboards
5. Suitability and limitations of tools and techniques related to data science process

Course Outcomes (COs)

CO1: Explain the fundamental concepts of data science, the data science process, and the big data ecosystem.**: Understanding (L2)**

CO2: Apply machine learning techniques and Python tools for feature engineering, model building, validation, and prediction in data science projects.**Applying (L3)**

CO3: Analyze big data storage and processing using Hadoop, relational databases, and NoSQL approaches with real-world case studies.**Analyzing (L4)**

CO4: Utilize specialized tools such as Neo4j, Cypher, NLTK, and SQLite for handling graph and text analytics applications**: Applying (L3)**

CO5: Design interactive dashboards, data visualizations, and prototype applications by applying the data science process to real-world problem-solving.**Creating (L6)**

UNIT I: Introduction to Data science, benefits and uses, facets of data, data science process in brief, big data ecosystem and data science

Data Science process: Overview, defining goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory analysis, model building, presenting findings and building applications on top of them

Unit II: Applications of machine learning in Data science, role of ML in DS, Python tools like sklearn, modelling process for feature engineering, model selection, validation and prediction, types of ML, semi-supervised learning

Handling large data: problems and general techniques for handling large data, programming tips for dealing large data, case studies on DS projects for predicting malicious URLs, for building recommender systems

UNIT III: NoSQL movement for handling Bigdata: Distributing data storage and processing with Hadoop framework, case study on risk assessment for loan sanctioning, ACID principle of relational databases, CAP theorem, base principle of NoSQL databases, types of NoSQL databases, case study on disease diagnosis and profiling

UNIT IV: Tools and Applications of Data Science: Introducing **Neo4j**for dealing with graph databases, graph query language **Cypher**, Applications graph databases, Python libraries like nltk and SQLite for handling Text mining and analytics, case study on classifying Reddit posts

UNIT V: Data Visualization and Prototype Application Development: Data Visualization options, Crossfilter, the JavaScript MapReduce library, Creating an interactive dashboard with dc.js, Dashboard development tools. Applying the Data Science process for real world problem solving scenarios as a detailed case study.

Textbook:

1) Davy Cielen, Arno D.B.Meysman, and Mohamed Ali, "Introducing to Data Science using Python tools", Manning Publications Co, Dreamtech press, 2016
2) Prateek Gupta, "Data Science with Jupyter" BPB publishers, 2019 for basics

Reference Books:

1) Joel Grus, "Data Science From Scratch", OReilly, 2019
2) Doing Data Science: Straight Talk From The Frontline, 1 st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

BR23 B.TECH CSE MOOC COURSES
Any of the following 12 Week 3 credit NPTEL MOOC Courses

Code	Subject Title	L-T-P-C	Sem
23CSHT07	**Social Network Analysis**	3-0-0-3	MOOC COURSES
23CSHT08	**Design & Implementation of Human-Computer Interfaces**	3-0-0-3	
23CSHT09	**Quantum Algorithms and Cryptography**	3-0-0-3	
23CSHT10	**Prompt Engineering for Generative AI**	3-0-0-3	
23CSHT11	**Reinforcement Learning**	3-0-0-3	
23CSHT12	**GPU Architecture and Programming**	3-0-0-3	
23CSHT13	Applied Linear Algebra in AI & ML	3-0-0-3	
23CSHT14	Cryptography and Network Security	3-0-0-3	
23CSHT15	Privacy and Security in Online Social Media	3-0-0-3	
23CSHT16	Computer Vision	3-0-0-3	
23CSHT17	Applied Time-Series Analysis	3-0-0-3	
23CSHT18	Parallel Computer Architecture	3-0-0-3	
23CSHT19	Computational Complexity	3-0-0-3	
23CSHT20	Unmanned Arial Systems & Robotics	3-0-0-3	

Note: Will add any advanced NPTEL courses introduced by SWAYAM/NPTEL in future with the consent of hon'ble BOS members through email communication.