

COMPUTER SCIENCE AND ENGINEERING/CS

**DR. A.P.J. ABDUL KALAM TECHNICAL
UNIVERSITY, UTTAR PRADESH, LUCKNOW**



EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. FOURTH (IV) YEAR

(COMPUTER SCIENCE AND ENGINEERING/CS)

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

COMPUTER SCIENCE AND ENGINEERING/CS

B.TECH

(COMPUTER SCIENCE & ENGINEERING/CS) CURRICULUM STRUCTURE

SEMESTER- VII													
Sl. No.	Subject	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
	Codes		L	T	P	CT	TA	Total	PS	TE	PE		
1	KHU701/KHU702	HSMC -1 / HSMC-2	3	0	0	30	20	50		100		150	3
2	KCS07X	Departmental Elective-IV	3	0	0	30	20	50		100		150	3
3	KCS07X	Departmental Elective-V	3	0	0	30	20	50		100		150	3
4	KOE07X	Open Elective-II	3	0	0	30	20	50		100		150	3
5	KCS751A	The Department may conduct one Lab of either of the two Electives (4 or 5) based on the elective chosen for the curriculum. The Department shall on its own prepare complete list of practical for the Lab and arrange for proper setup and conduct accordingly.	0	0	2				25		25	50	1
6	KCS752	Mini Project or Internship Assessment*	0	0	2				50			50	1
7	KCS753	Project	0	0	8				50		100	150	4
8		MOOCs (Essential for Hons. Degree)											
		Total	12	0	12							850	18
*The Mini Project or internship (4 - 6 weeks) conducted during summer break after VI semester and will be assessed during VII semester.													
SEMESTER- VIII													
Sl. No.	Subject	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
	Codes		L	T	P	CT	TA	Total	PS	TE	PE		
1	KHU801/KHU802	HSMC-2 [#] /HSMC-1 [#]	3	0	0	30	20	50		100		150	3
2	KOE08X	Open Elective-III	3	0	0	30	20	50		100		150	3
3	KOE08X	Open Elective-IV	3	0	0	30	20	50		100		150	3
4	KCS851	Project	0	0	18				100		300	400	9
5		MOOCs (Essential for Hons. Degree)											
		Total	9	0	18							850	18

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Departmental Elective-IV

1. KCS071 Artificial Intelligence
2. KCS072 Natural language processing
3. KCS073 High Performance Computing
4. KCS074 Cryptography and Network Security
5. KCS075 Design & Development of Applications
6. KCS076 Software Testing
7. KCS077 Distributed Systems

Departmental Elective-V

1. KCS078 Deep Learning
2. KCS079 Service Oriented Architecture
3. KCS710 Quantum Computing
4. KCS711 Mobile Computing
5. KCS712 Internet of Things
6. KCS713 Cloud Computing
7. KCS714 Blockchain Architecture Design

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B.TECH. (CSE/CS)

SEVENTH SEMESTER (DETAILED SYLLABUS)

Artificial Intelligence (KCS071)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents.	K ₂
CO 2	Understand search techniques and gaming theory.	K ₂ , K ₃
CO 3	The student will learn to apply knowledge representation techniques and problem solving strategies to common AI applications.	K ₃ , K ₄
CO 4	Student should be aware of techniques used for classification and clustering.	K ₂ , K ₃
CO 5	Student should aware of basics of pattern recognition and steps required for it.	K ₂ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION : Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.	08
II	PROBLEM SOLVING METHODS: Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games	08
III	KNOWLEDGE REPRESENTATION: First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information	08
IV	SOFTWARE AGENTS: Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.	08
V	APPLICATIONS: AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving	08
Text books:		
<ol style="list-style-type: none"> 1. S. Russell and P. Norvig, “Artificial Intelligence: A Modern Approach”, Prentice Hall, Third Edition, 2009. 2. I. Bratko, “Prolog: Programming for Artificial Intelligence”, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011. 3. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science)”, Jones and Bartlett Publishers, Inc.First Edition, 2008 4. Nils J. Nilsson, —The Quest for Artificial Intelligence”, Cambridge University Press, 2009. 5. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard”, Fifth Edition, Springer, 2003. 6. Gerhard Weiss, —Multi Agent Systems”, Second Edition, MIT Press, 2013. 7. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents”, Cambridge University Press, 2010. 		

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Natural Language Processing (KC072)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To learn the fundamentals of natural language processing	K ₁ , K ₂
CO 2	To understand the use of CFG and PCFG in NLP	K ₁ , K ₂
CO 3	To understand the role of semantics of sentences and pragmatic	K ₂
CO 4	To Introduce Speech Production And Related Parameters Of Speech.	K ₁ , K ₂
CO 5	To Show The Computation And Use Of Techniques Such As Short Time Fourier Transform, Linear Predictive Coefficients And Other Coefficients In The Analysis Of Speech.	K ₃ , K ₄
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
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 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.	08
II	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.	08
III	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.	08
IV	BASIC CONCEPTS of Speech Processing : Speech Fundamentals: Articulatory Phonetics – Production And Classification Of Speech Sounds; Acoustic Phonetics – Acoustics Of Speech Production; Review Of Digital Signal Processing Concepts; Short-Time Fourier Transform, Filter-Bank And LPC Methods.	08
V	SPEECH-ANALYSIS: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances And Filtering, Likelihood Distortions, Spectral Distortion Using A Warped Frequency Scale, LPC, PLP And MFCC Coefficients, Time Alignment And Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths. SPEECH MODELING : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	08

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Text books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.
3. Lawrence Rabiner And Biing-Hwang Juang, “Fundamentals Of Speech Recognition”, Pearson Education, 2003.
4. Daniel Jurafsky And James H Martin, “Speech And Language Processing – An Introduction To Natural Language Processing, Computational Linguistics, And Speech Recognition”, Pearson Education, 2002.
5. Frederick Jelinek, “Statistical Methods Of Speech Recognition”, MIT Press, 1997.
6. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015
7. Richard M Reese, —Natural Language Processing with Java, O'Reilly Media, 2015.
8. Nitin Indurkha and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
9. Tanveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

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High Performance Computing (KCS073)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Able to understand the basic concept of Computer architecture and Modern Processor	K2
CO 2	Able to understand the basic concepts of access optimization and parallel computers	K2, K3
CO 3	Able to describe different parallel processing platforms involved in achieving high performance computing	K3 , K4
CO 4	Develop efficient and high performance parallel programming.	K2 , K3
CO 5	Able to learn parallel programming using message passing paradigm.	K2 , K4
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Overview of Grid Computing Technology , History of Grid Computing, High Performance Computing, Cluster Computing. Peer-to-Peer Computing, Internet Computing, Grid Computing Model and Protocols, Types of Grids: Desktop Grids, Cluster Grids, Data Grids, High-Performance Grids, Applications and Architectures of High Performance Grids, High Performance Application Development Environment.	08
II	Open Grid Services Architecture: Introduction, Requirements, Capabilities, Security Considerations, GLOBUS Toolkit	08
III	Overview of Cluster Computing: Cluster Computer and its Architecture, Clusters Classifications, Components for Clusters, Cluster Middleware and SSI, Resource Management and Scheduling, Programming, Environments and Tools, Cluster Applications, Cluster Systems,	08
IV	Beowulf Cluster: The Beowulf Model, Application Domains, Beowulf System Architecture, Software Practices, Parallel Programming with MPL, Parallel Virtual Machine (PVM).	08
V	Overview of Cloud Computing: Types of Cloud, Cyber infrastructure, Service Oriented Architecture Cloud Computing Components: Infrastructure, Storage, Platform, Application, Services, Clients, Cloud Computing Architecture.	08
Text books:		
<ol style="list-style-type: none"> 1. Laurence T.Yang, Minyi Guo – High Performance Computing Paradigm and Infrastructure John Wiley 2. Ahmar Abbas, “Grid Computing: Practical Guide to Technology & Applications”, Firewall Media, 2004. 3. Joshy Joseph and Craig Fellenstein , “Grid Computing” Pearson Education, 2004. 4. Ian Foster, et al.,“The Open Grid Services Architecture”, Version 1.5 (GFD.80). Open Grid Forum, 2006. 5. RajkumarBuyya. High Performance Cluster Computing: Architectures and Systems. PrenticeHall India, 1999. 		

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Cryptography & Network Security (KCS074)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Classify the symmetric encryption techniques and Illustrate various Public key cryptographic techniques.	K2 , K3
CO 2	Understand security protocols for protecting data on networks and be able to digitally sign emails and files.	K1 , K2
CO 3	Understand vulnerability assessments and the weakness of using passwords for authentication	K4
CO 4	Be able to perform simple vulnerability assessments and password audits	K3
CO 5	Summarize the intrusion detection and its solutions to overcome the attacks.	K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to security attacks, services and mechanism, Classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers. Modern Block Ciphers: Block ciphers principles, Shannon's theory of confusion and diffusion, fiestal structure, Data encryption standard(DES), Strength of DES, Idea of differential cryptanalysis, block cipher modes of operations, Triple DES	08
II	Introduction to group, field, finite field of the form GF(p), modular arithmetic, prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES) encryption and decryption Fermat's and Euler's theorem, Primarily testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, security of RSA	08
III	Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks, security of hash functions, Secure hash algorithm (SHA) Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), proof of digital signature algorithm,	08
IV	Key Management and distribution: Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. Authentication Applications: Kerberos, Electronic mail security: pretty good privacy (PGP), S/MIME.	08
V	IP Security: Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. Introduction to Secure Socket Layer, Secure electronic, transaction (SET) System Security: Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls	08
Text books:		
<ol style="list-style-type: none"> 1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education. 2. Behrouz A. Frouzan: Cryptography and Network Security, McGraw Hill . 3. C K Shyamala, N Harini, Dr. T.R.Padmnabhan Cryptography and Security ,Wiley 4. Bruce Schiener, "Applied Cryptography". John Wiley & Sons 5. Bernard Menezes," Network Security and Cryptography", Cengage Learning. 6. AtulKahate, "Cryptography and Network Security", McGraw Hill 		

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Design & Development Of Applications (KCS075)		
	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Be exposed to technology and business trends impacting mobile applications	K1 , K2
CO 2	Be competent with the characterization and architecture of mobile applications.	K3
CO 3	Be competent with understanding enterprise scale requirements of mobile applications.	K1 , K2
CO 4	Be competent with designing and developing mobile applications using one application development framework.	K3
CO 5	Be exposed to Android and iOS platforms to develop the mobile applications	K1 , K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION: Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications	08
II	BASIC DESIGN: Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability	08
III	ADVANCED DESIGN: Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.	08
IV	TECHNOLOGY I – ANDROID: Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications.	08
V	TECHNOLOGY II –iOS: Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wi-Fi - iPhone marketplace. Swift: Introduction to Swift, features of swift	08
Text books:		
<ol style="list-style-type: none"> 1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012 2. AnubhavPradhan , Anil V Despane Composing Mobile Apps,Learn ,explore,apply 3. James Dovey and Ash Farrow, “Beginning Objective C”, Apress, 2012 4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012 5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6. Development: Exploring the iOS SDK”, Apress, 2013. 		

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Software Testing (KCS076)		
Course Outcome (CO)	Bloom's Knowledge Level (KL)	
At the end of course , the student will be able to understand		
CO 1	Have an ability to apply software testing knowledge and engineering methods.	K2 , K3
CO 2	Have an ability to design and conduct a software test process for a software testing project.	K3, K4
CO 3	Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.	K1 , K2
CO 4	Have an ability understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.	K1 , K2
CO 5	Have basic understanding and knowledge of contemporary issues in software testing, such as component-based software testing problems.	K2
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Review of Software Engineering: Overview of Software Evolution, SDLC, Testing Process, Terminologies in Testing: Error, Fault, Failure, Verification, Validation, Difference Between Verification and Validation, Test Cases, Testing Suite, Test ,Oracles, Impracticality of Testing All Data; Impracticality of Testing AllPaths. Verification: Verification Methods, SRS Verification, Source Code Reviews, User Documentation Verification, Software, Project Audit, Tailoring Software Quality Assurance Program by Reviews, Walkthrough, Inspection and Configuration Audits	08
II	Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique. Structural Testing: Control Flow Testing, Path Testing, Independent Paths, Generation of Graph from Program, Identification of Independent Paths, Cyclomatic Complexity, Data Flow Testing, Mutation Testing	08
III	Regression Testing: What is Regression Testing? Regression Test cases selection, Reducing the number of test cases, Code coverage prioritization technique. Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis	08
IV	Software Testing Activities: Levels of Testing, Debugging, Testing techniques and their applicability, Exploratory Testing Automated Test Data Generation: Test Data, Approaches to test data generation, test data generation using genetic algorithm, Test Data Generation Tools, Software Testing Tools, and Software test Plan.	08
V	Object Oriented Testing: Definition, Issues, Class Testing, Object Oriented Integration and System Testing. Testing Web Applications: Web Testing, User Interface Testing, Usability Testing, Security Testing, Performance Testing, Database testing, Post Deployment Testing	08
Text books:		
<ol style="list-style-type: none"> 1. Yogesh Singh, "Software Testing", Cambridge University Press, New York, 2012 2. K.K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International Publishers, New Delhi, 2003. 3. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Fifth Edition, McGraw-Hill International Edition, New Delhi,2001. 4. Marc Roper, "Software Testing", McGraw-Hill Book Co., London, 1994. 5. M.C. Trivedi, Software Testing & Audit, Khanna Publishing House 6. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984 		

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DISTRIBUTED SYSTEM (KCS077)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	To provide hardware and software issues in modern distributed systems.	K1 , K2
CO 2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.	K2
CO 3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.	K4
CO 4	To know about Shared Memory Techniques and have Sufficient knowledge about file access	K1
CO 5	Have knowledge of Synchronization and Deadlock.	K1
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Architectural models, Fundamental Models. Theoretical Foundation for Distributed System: Limitation of Distributed system, absence of global clock, shared memory, Logical clocks ,Lamport's & vectors logical clocks. Concepts in Message Passing Systems: causal order, total order, total causal order, Techniques for Message Ordering, Causal ordering of messages, global state, termination detection.	08
II	Distributed Mutual Exclusion: Classification of distributed mutual exclusion, requirement of mutual exclusion theorem, Token based and non token based algorithms, performance metric for distributed mutual exclusion algorithms. Distributed Deadlock Detection: system model, resource Vs communication deadlocks, deadlock prevention, avoidance, detection & resolution, centralized dead lock detection, distributed dead lock detection, path pushing algorithms, edge chasing algorithms.	08
III	Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem, Atomic Commit in Distributed Database system. Distributed Resource Management: Issues in distributed File Systems, Mechanism for building distributed file systems, Design issues in Distributed Shared Memory, Algorithm for Implementation of Distributed Shared Memory.	08
IV	Failure Recovery in Distributed Systems: Concepts in Backward and Forward recovery, Recovery in Concurrent systems, Obtaining consistent Checkpoints, Recovery in Distributed Database Systems. Fault Tolerance: Issues in Fault Tolerance, Commit Protocols, Voting protocols, Dynamic voting protocols	08
V	Transactions and Concurrency Control: Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. Distributed Transactions: Flat and nested distributed transactions, Atomic Commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. Replication: System model and group communication, Fault - tolerant services, highly available services, Transactions with replicated data.	08
Text books:		
<ol style="list-style-type: none"> 1. Singhal & Shivaratri, "Advanced Concept in Operating Systems", McGraw Hill 2. Ramakrishna,Gehrke," Database Management Systems", McGraw Hill 3. Vijay K.Garg Elements of Distributed Computing , Wiley 4. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education 5. Tenanuanbaum, Steen," Distributed Systems", PHI 		

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Deep Learning (KCS078)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	To present the mathematical, statistical and computational challenges of building neural networks	K ₁ , K ₂
CO 2	To study the concepts of deep learning	K ₁ , K ₂
CO 3	To introduce dimensionality reduction techniques	K ₂
CO 4	To enable the students to know deep learning techniques to support real-time applications	K ₂ , K ₃
CO 5	To examine the case studies of deep learning techniques	K ₃ , K ₆
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates	08
II	DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning	08
III	DIMENSIONALITY REDUCTION 9 Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization	08
IV	OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience	08
V	CASE STUDY AND APPLICATIONS : Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding- Gathering Image Captions	08
Text books:		
<ol style="list-style-type: none"> 1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015. 2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013. 3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016. 4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015. 		
Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cs41/preview		

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Service Oriented Architecture (KCS079)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able :		
CO 1	Comprehend the need for SOA and its systematic evolution.	K1 , K2
CO 2	Apply SOA technologies to enterprise domain.	K3
CO 3	Design and analyze various SOA patterns and techniques.	K4
CO 4	Compare and evaluate best strategies and practices of SOA.	K2
CO 5	Understand the business case for SOA	K1
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	<p>Introduction: SOA and MSA Basics: Service Orientation in Daily Life, Evolution of SOA and MSA. Service oriented Architecture and Microservices architecture – Drivers for SOA, Dimensions of SOA, Conceptual Model of SOA, Standards and Guidelines for SOA, Emergence of MSA.</p> <p>Enterprise-Wide SOA: Considerations for Enterprise-wide SOA, Strawman Architecture for Enterprise-wide SOA, Enterprise SOA Reference Architecture, Object-oriented Analysis and Design (OOAD) Process, Service-oriented Analysis and Design (SOAD) Process, SOA Methodology for Enterprise</p>	08
II	<p>Service-Oriented Applications: Considerations for Service-oriented Applications, Patterns for SOA, Pattern-based Architecture for Service-oriented Applications, Composite Applications, Composite Application Programming Model.</p> <p>Service-Oriented Analysis and Design: Need for Models, Principles of Service Design, Nonfunctional Properties for Services, Design of Activity Services (or Business Services), Design of Data Services, Design of Client Services, Design of Business Process Services.</p>	08
III	<p>Technologies for SOA: Technologies for Service Enablement, Technologies for Service Integration, Technologies for Service Orchestration.</p> <p>SOA Governance and Implementation: Strategic Architecture Governance, Service Design-time Governance, Service Run-time Governance, Approach for Enterprise-wide SOA Implementation.</p>	08
IV	<p>Big Data and SOA: Concepts, Big Data and its characteristics, Technologies for Big Data, Service-orientation for Big Data Solutions.</p> <p>Business Case for SOA: Stakeholder Objectives, Benefits of SOA, Cost Savings, Return on Investment (ROI), Build a Case for SOA</p>	08
V	<p>SOA Best Practices: SOA Strategy – Best Practices, SOA Development – Best Practices, SOA Governance – Best Practices.</p> <p>EA and SOA for Business and IT Alignment: Enterprise Architecture, Need for Business and It Alignment, EA and SOA for Business and It Alignment</p>	08
Text books:		
<ol style="list-style-type: none"> 1. Shankar Kambhampaty; Service - Oriented Architecture & Microservices Architecture: For Enterprise, Cloud, Big Data and Mobile; Wiley; 3rd Edition; 2018; ISBN: 9788126564064. 2. Icon Group International; The 2018-2023 World Outlook for Service-Oriented Architecture (SOA) Software and Services; ICON Group International; 1st Edition, 2017; ASIN: B06WGPN8YD. 3. Thomas Erl; Service Oriented Architecture Concepts Technology & Design; Pearson Education Limited; 2015; ISBN-13: 9788131714904. 4. Guido Schmutz, Peter Welkenbach, Daniel Liebhart; Service Oriented Architecture An Integration Blueprint; Shroff Publishers & Distributors; 2010; ISBN-13: 9789350231081 		

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Quantum Computing (KCS710)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.	K ₁ , K ₂
CO 2	Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.	K ₂ , K ₃
CO 3	Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).	K ₂ , K ₃
CO 4	Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.	K ₃ , K ₄
CO 5	Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.	K ₃ , K ₆
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	08
II	Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	08
III	Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	08
IV	Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	08
V	Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	08
Text books:		
<ol style="list-style-type: none"> 1. Micheal A. Nielsen. & Issac L. Chiang, “Quantum Computation and Quantum Information”, Cambridge University Press, Fint South Asian edition, 2002. 2. Eleanor G. Rieffel, Wolfgang H. Polak , “Quantum Computing - A Gentle Introduction” (Scientific and Engineering Computation) Paperback – Import, Oct 2014 3. Computing since Democritus by Scott Aaronson, Computer Science: An Introduction by N. David Mermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists. 		

COMPUTER SCIENCE AND ENGINEERING/CS

Mobile Computing (KCS711)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Explain and discuss issues in mobile computing and illustrate overview of wireless telephony and channel allocation in cellular systems.	K1, K4
CO 2	Explore the concept of Wireless Networking and Wireless LAN.	K1
CO 3	Analyse and comprehend Data management issues like data replication for mobile computers, adaptive clustering for mobile wireless networks and Disconnected operations.	K4
CO 4	Identify Mobile computing Agents and state the issues pertaining to security and fault tolerance in mobile computing environment.	K1, K2
CO 5	Compare and contrast various routing protocols and will identify and interpret the performance of network systems using Adhoc networks.	K2
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.	08
II	Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.	08
III	Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	08
IV	Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.	08
V	Ad Hoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.	08
Text books:		
<ol style="list-style-type: none"> 1. J. Schiller, Mobile Communications, Addison Wesley. 2. A. Mehrotra, GSM System Engineering. 3. M. V. D. Heijden, M. Taylor, Understanding WAP, Artech House. 4. Charles Perkins, Mobile IP, Addison Wesley. 5. Charles Perkins, Ad hoc Networks, Addison Wesley. 		

COMPUTER SCIENCE AND ENGINEERING/CS

Internet of Things (KCS712)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course, the student will be able to understand		
CO 1	Demonstrate basic concepts, principles and challenges in IoT.	K1,K2
CO 2	Illustrate functioning of hardware devices and sensors used for IoT.	K2
CO 3	Analyze network communication aspects and protocols used in IoT.	K4
CO 4	Apply IoT for developing real life applications using Arduinio programming.	K3
CP 5	To develop IoT infrastructure for popular applications	K ₂ , K ₃
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	08
II	Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	08
III	Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	08
IV	Programming the Arduinio: Arduinio Platform Boards Anatomy, Arduinio IDE, coding, using emulator, using libraries, additions in arduinio, programming the arduinio for IoT.	08
V	Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	08
Text books:		
<ol style="list-style-type: none"> 1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", wiley 2. Jeeva Jose, Internet of Things, Khanna Publishing House 3. Michael Miller "The Internet of Things" by Pearson 4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016 5. Arshdeep Bahga, Vijay Madiseti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014 6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India 		

COMPUTER SCIENCE AND ENGINEERING/CS

Cloud Computing (KCS713)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Describe architecture and underlying principles of cloud computing.	K ₃
CO 2	Explain need, types and tools of Virtualization for cloud.	K ₃ , K ₄
CO 3	Describe Services Oriented Architecture and various types of cloud services.	K ₂ , K ₃
CO 4	Explain Inter cloud resources management cloud storage services and their providers Assess security services and standards for cloud computing.	K ₂ , K ₄
CO 5	Analyze advanced cloud technologies.	K ₃ , K ₆
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction To Cloud Computing: Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.	08
II	Cloud Enabling Technologies Service Oriented Architecture: REST and Systems of Systems – Web Services – Publish, Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices –Virtualization Support and Disaster Recovery.	08
III	Cloud Architecture, Services And Storage: Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	08
IV	Resource Management And Security In Cloud: Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.	08
V	Cloud Technologies And Advancements Hadoop: MapReduce – Virtual Box – Google App Engine – Programming Environment for Google App Engine – Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.	08
Text books:		
<ol style="list-style-type: none"> 1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012. 2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security, CRC Press, 2017. 3. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013. 4. Toby Velte, Anthony Velte, Robert Elsenpeter, “Cloud Computing – A Practical Approach, Tata Mcgraw Hill, 2009. 5. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O’Reilly, 2009. 		

COMPUTER SCIENCE AND ENGINEERING/CS

Block chain Architecture Design (KCS714)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to		
CO 1	Describe the basic understanding of Blockchain architecture along with its primitive.	K ₁ , K ₂
CO 2	Explain the requirements for basic protocol along with scalability aspects.	K ₂ , K ₃
CO 3	Design and deploy the consensus process using frontend and backend.	K ₃ , K ₄
CO 4	Apply Blockchain techniques for different use cases like Finance, Trade/Supply and Government activities.	K ₄ , K ₅
DETAILED SYLLABUS		3-0-0
Unit	Topic	Proposed Lecture
I	Introduction to Blockchain: Digital Money to Distributed Ledgers , Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature,) Hashchain to Blockchain, Basic consensus mechanisms	08
II	Consensus: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains	08
III	Hyperledger Fabric (A): Decomposing the consensus process , Hyperledger fabric components, Chaincode Design and Implementation Hyperledger Fabric (B): Beyond Chaincode: fabric SDK and Front End (b) Hyperledger composer tool	08
IV	Use case 1 : Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc	08
V	Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain	08
Text books:		
<ol style="list-style-type: none"> 1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos 2. Blockchain by Melanie Swa, O'Reilly 3. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric 4. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html 		

COMPUTER SCIENCE AND ENGINEERING/CS

Mini Project or Internship Assessment (KCS 354 , KCS 554 , KCS 752)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Developing a technical artifact requiring new technical skills and effectively utilizing a new software tool to complete a task	K ₄ , K ₅
CO 2	Writing requirements documentation, Selecting appropriate technologies, identifying and creating appropriate test cases for systems.	K ₅ , K ₆
CO 3	Demonstrating understanding of professional customs & practices and working with professional standards.	K ₄ , K ₅
CO 4	Improving problem-solving, critical thinking skills and report writing.	K ₄ , K ₅
CO 5	Learning professional skills like exercising leadership, behaving professionally, behaving ethically, listening effectively, participating as a member of a team, developing appropriate workplace attitudes.	K ₂ , K ₄

Project (KCS 753 , KCS 851)		
Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of course , the student will be able to understand		
CO 1	Analyze and understand the real life problem and apply their knowledge to get programming solution.	K ₄ , K ₅
CO 2	Engage in the creative design process through the integration and application of diverse technical knowledge and expertise to meet customer needs and address social issues.	K ₄ , K ₅
CO 3	Use the various tools and techniques, coding practices for developing real life solution to the problem.	K ₅ , K ₆
CO 4	Find out the errors in software solutions and establishing the process to design maintainable software applications	K ₄ , K ₅
CO 5	Write the report about what they are doing in project and learning the team working skills	K ₅ , K ₆

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
UTTAR PRADESH, LUCKNOW



EVALUATION SCHEME & SYLLABUS

FOR

III & IV
OPEN ELECTIVES LIST

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2021-22]

Note:

1. The Student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the degree programme.
2. ** It is mandatory that for these subjects (KOE089, KOE098 & KOE099) only Trained Faculty (who had done the FDP for these courses) will teach the courses.

B. TECH.
VIII Semester (2021-22)
OPEN ELECTIVE –III

KOE-080	FUNDAMENTALS OF DRONE TECHNOLOGY
KOE-081	CLOUD COMPUTING
KOE-082	BIO MEDICAL SIGNAL PROCESSING
KOE-083	ENTREPRENEURSHIP DEVELOPMENT
KOE-084	INTRODUCTION TO SMART GRID
KOE-085	QUALITY MANAGEMENT
KOE-086	INDUSTRIAL OPTIMIZATION TECHNIQUES
KOE-087	VIROLOGY
KOE-088	NATURAL LANGUAGE PROCESSING
KOE-089	**HUMAN VALUES IN MADHYASTH DARSHAN

OPEN ELECTIVE –IV

KOE-090	ELECTRIC VEHICLES
KOE-091	AUTOMATION AND ROBOTICS
KOE-092	COMPUTERIZED PROCESS CONTROL
KOE-093	DATA WAREHOUSING & DATA MINING
KOE-094	DIGITAL AND SOCIAL MEDIA MARKETING
KOE-095	MODELING OF FIELD-EFFECT NANO DEVICES
KOE-096	MODELLING AND SIMULATION OF DYNAMIC SYSTEMS
KOE-097	BIG DATA
KOE-098	**HUMAN VALUES IN BUDDHA AND JAIN DARSHAN
KOE-099	**HUMAN VALUES IN VEDIC DARSANA

OPEN ELECTIVE –III

KOE-080	FUNDAMENTALS OF DRONE TECHNOLOGY
KOE-081	CLOUD COMPUTING
KOE-082	BIO MEDICAL SIGNAL PROCESSING
KOE-083	ENTREPRENEURSHIP DEVELOPMENT
KOE-084	INTRODUCTION TO SMART GRID
KOE-085	QUALITY MANAGEMENT
KOE-086	INDUSTRIAL OPTIMIZATION TECHNIQUES
KOE-087	VIROLOGY
KOE-088	NATURAL LANGUAGE PROCESSING
KOE-089	**HUMAN VALUES IN MADHYASTH DARSHAN

** It is mandatory that for these subjects (KOE089) only Trained Faculty (who had done the FDP for these courses) will teach the courses.

KOE080: FUNDAMENTALS OF DRONE TECHNOLOGY (UNMANNED AERIAL VEHICLES)

The course is an introduction to flight dynamics and control of aerial vehicles such as drones, UAVs and other such aircrafts, and the current development in the field. It is suitable for graduate and post graduate level with the following course objectives and outcomes.

Eligible Branch: Electronics & Communication, Instrumentation, Aeronautical, Electrical Engineering & Allied Branch, Mechanical, Computer Science & other allied relevant branches.

COURSE OBJECTIVES: The course should enable the students to:

1. To make the students to understand the basic concepts of UAV drone systems.
2. To introduce the stability and control of an aircraft

KOE080: FUNDAMENTALS OF DRONE TECHNOLOGY		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Drones: Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, applications.	08
II	Design of UAV Drone Systems: Introduction to Design and Selection of the System, Aerodynamics and Airframe Configurations, Characteristics of Aircraft Types, Design Standards and Regulatory Aspects-India Specific, Design for Stealth.	08
III	Avionics Hardware of Drones: Autopilot, AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration.	08
IV	Communication, Payloads and Controls: Payloads, Telemetry, Tracking, controls-PID feedback, radio control frequency range, modems, memory system, simulation, ground test-analysis-trouble shooting.	08
V	Navigation and Testing: Waypoints navigation, ground control software, System Ground Testing, System In-flight Testing, Future Prospects and Challenges	08

COURSE OUTCOMES: The student should able to:

1. Ability to design UAV drone system
2. To understand working of different types of engines and its area of applications.
3. To understand static and dynamic stability dynamic instability and control concepts
4. To know the loads taken by aircraft and type of construction and also construction materials in them.

Text Books:

1. Reg Austin “Unmanned Aircraft Systems UAV design, development and deployment”, Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007
4. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998
5. Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics.

KOE081: CLOUD COMPUTING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing-issues in Clouds - Eucalyptus - Nimbus - Open Nebula, CloudSim.	08
II	Cloud Services: Types of Cloud services: Software as a Service-Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	Collaborating Using Cloud Services: Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	Virtualization for Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.	08
V	Security, Standards and Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – MapReduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	08

Text Books:

1. David E.Y. Sarna, “Implementing and Developing Cloud Application”, CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, McGrawHill 2010.
4. Haley Beard, “Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs”, Emereo Pty Limited, July 2008.

KOE082: BIOMEDICAL SIGNAL PROCESSING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Bio-Medical Signals: Classification, Acquisition and Difficulties during Acquisition. Basics of Electrocardiography, Electroencephalography, Electromyography & electro-retinography Role of Computers in the Analysis, Processing, Monitoring & Control and image reconstruction in bio-medical field.	08
II	ECG: Measurement of Amplitude and Time Intervals, QRS Detection (Different Methods), ST Segment Analysis, Removal of Baseline Wander and Power line Interferences, Arrhythmia Analysis, Portable Arrhythmia Monitors.	08
III	Data Reduction: Turning Point algorithm, AZTEC Algorithm, Fan Algorithm, Huffman and Modified Huffman Coding, Run Length Coding.	08
IV	EEG: Neurological Signal Processing, EEG characteristic, linear prediction theory, Sleep EEG, Dynamics of Sleep/Wake transition. Study of pattern of brain waves, Epilepsy-Transition, detection and Estimation. EEG Analysis By Spectral Estimation: The Bt Method, Periodogram, Maximum Entropy Method & AR Method, Moving Average Method. The ARMA Methods, Maximum Likelihood Method.	08
V	EP Estimation: by Signal Averaging, Adaptive Filtering:- General Structures of Adaptive filters, LMS Adaptive Filter, Adaptive Noise Cancelling, Wavelet Detection:- Introduction, Detection By Structural features, Matched Filtering, Adaptive Wavelet Detection, Detection of Overlapping Wavelets.	08

Text Books:

1. Willis J. Tomkin, "Biomedical Digital Signal Processing", PHI.
2. D. C. Reddy, "Biomedical Signal Processing", McGraw Hill
3. Crommwell Weibel and Pfeifer, "Biomedical Instrumentation and Measurement", PHI

Reference Books:

1. Arnon Cohen, "Biomedical Signal Processing (volume-I)", Licrc Press\
2. Rangaraj M. Rangayyan, "Biomedical Signal Analysis A Case Study Approach", John Wiley and Sons Inc.
3. John G. Webster, "Medical instrumentation Application and Design", John Wiley & Sons Inc

KOE083: ENTREPRENEURSHIP DEVELOPMENT		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.	08
II	Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods.	08
III	Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation of financial reports, accounts and stores studies.	08
IV	Project Planning and control: The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication.	08
V	Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.	08

Text Books:

1. Forbat, John, "Entrepreneurship" New Age International.
2. Havinal, Veerbhadrappa, "Management and Entrepreneurship" New Age International
3. Joseph, L. Massod, "Essential of Management", Prentice Hall of India

KOE084: INTRODUCTION TO SMART GRID		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction: Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.	08
II	Smart Grid Technologies: Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.	08
III	Smart Grid Technologies: Smart Substations, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.	08
IV	Microgrids and Distributed Energy Resources: Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.	08
V	Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring	08

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press.
3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
4. Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grids", Wiley Blackwell 19.
5. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press.

Reference Books:

1. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.
2. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.
3. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer
4. R.C. Dugan, Mark F. McGranahan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.

KOE085: QUALITY MANAGEMENT		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.	08
II	Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.	08
III	Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts	08
IV	Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.	08
V	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	08

Text Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, .
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill

KOE086: INDUSTRIAL OPTIMIZATION TECHNIQUES		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	I Linear Programming: Historical development of optimization, engineering application of optimization, formulation of design problems as a mathematical programming problem. Graphical method of solution, Simplex method, Dual Simplex method and its application in engineering. Transportation and Assignment: Introduction, Mathematical formulations, optimal solution of transportation model. Assignment problems: mathematical formulation, solution of Assignment models (Hungarian method), variation of the Assignment problem, the travelling sales man problem and their application in Engineering.	08
II	Sequencing and Network Analysis: Introduction of sequencing, General assumptions, n Jobs through 2 machines, n jobs through 3 machines, n jobs through m machines, 2 jobs through m machines and their applications in Engineering. Network Analysis: Introduction, Network logic (Network or arrow diagram), Rules for drawing network diagrams, time analysis, forward and backward computation CPM and PERT, and their applications in Engineering.	08
III	Theory of Games and Queuing Models: Introduction, 2 person zero sum games, Maximin and minimax principle, game with saddle point and without saddle point, Principle of dominance, Rectangular games, graphical solution of $2 \times n$ or $m \times 2$ games. Queuing model: Introduction, Application of Queuing model, generalized Poisson queuing model, single server models and multiple channel Queuing model and their applications in Engineering.	08
IV	Dynamic Programming and Simulation: Introduction Formulation of Dynamic Programming Problem, Dynamic Programming Algorithm, Forward recursions, Capital Budgeting Problem, Cargo-loading Problem. Solution of LPP by DPP Simulation: Introduction, definition and types of simulation, need for Simulation advantage and disadvantage, application of simulation, simulation procedure, Monte Carlo simulation and their applications in Engineering.	08
V	Inventory Control and Replacement Models: Introduction, types of inventories, Inventory cost, Deterministic and probabilistic (nondeterministic) inventory models and their application in engineering. Replacement models: Introduction, definition, Replacement of items that deteriorate, Replacement of items that fail suddenly, Equipment Renewal Problem, Individual and Group Replacement policies & their applications in Engineering	08

Text Books:

1. Singiresu S. Rao. "Engineering Optimization" Theory and Practice". New Age International, New Delhi.
2. R. Panneerselvam. "Operations Research ". Prentice- Hall of India, New Delhi
3. Eliezer Naddor. "Inventory Systems". John Wiley & Sons, Inc. New York

Reference Books:

1. H.A. Taha: Operations Research – An Introduction, Macmillan Publishing Company, Inc., New York.
2. K. Swarup, P.K. Gupta, M. Mohan: "Operations Research", Sultan Chand and Sons, New Delhi.
3. P.K. Gupta, D.S. Hira: "Operations Research" – An Introduction, S. Chand & Company Limited, New Delhi.
4. S.S. Rao: "Optimization Theory and Applications", Wiley Eastern Ltd., New Delhi.
5. J.K. Sharma: "Operations Research: Theory and Applications", Mac Millan India

KOE 087: VIROLOGY

OBJECTIVE:

The objective of this course is to help the student learn molecular virology by general principles as opposed to describing each virus family. The rules for viral replication that all viruses follow are illustrated and discussed: while pointing out to the specific features of each virus, the course aims to reveal unity in the virus world rather than diversity. Host-pathogen interactions and examples of viral diseases will be discussed, with particular emphasis on the main principles of vaccine and antiviral drug development

DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	General Concepts: Virus history, Diversity, shapes, sizes and components of genomes. Isolation and purification of viruses and components.	08
II	Consequences of virus infection to animals and human. Viral infection: affect on host macromolecules. Viral infection: establishment of the antiviral state. Viruses counter attack mechanisms. Viral diagnostic techniques: Rapid Antigen testing, RTPCR.	08
III	Classification of viruses and nomenclatures. +strand RNA viruses- Picorna viruses. Flavi viruses- West Nile virus and Dengue virus. Corona viruses- SARS pathogens. Small DNA viruses: parvo- and polyoma viruses. Large DNA viruses: Herpes-adeno-, and poxviruses. Miscellaneous viruses.	08
IV	-ve strand RNA viruses Paramyxo viruses. Orthomyxo viruses: Influenza pathogenesis and Bird flu. Rhabdo viruses: Rabies pathogenesis.. dsRNA viruses- Reo viruses. Retroviruses: structure, classification, life cycle; reverse transcription. Retroviruses: HIV, viral pathogenesis and AIDS.	08
V	Antivirals and viral vaccines Viral Vaccines Conventional vaccines- killed and attenuated, modern vaccines recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines), vaccine delivery and adjuvants, large scale manufacturing- QA/QC issues. Antivirals Interferons, designing and screening of antivirals, mechanism of action, antiviral libraries, antiretrovirals- mechanism of action and drug resistance. Modern approaches of virus control Anti-sense RNA, siRNA, ribozymes.	08

Reference Books:

1. Antiviral Agents, Vaccines and immunotherapies. Stephen K. Tying. ISBN 9780367393748 CRC
2. Basic Virology – Edward K Wanger. Blackwell Publication
3. Fundamentals of molecular virology – Acheson and Nicholas H, 2011
4. Principles of Virology 2nd edition by S.J. Flint, L.W. Enquist, R.M. Krug, V.R. Racaniello, and A.M. Skalka ASM Press
5. Medical Virology 4th edition by David O. White and Frank J. Fenner. Academic Press.

KOE088: NATURAL LANGUAGE PROCESSING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.	08
II	Introduction to semantics and knowledge representation, some applications like machine translation, database interface.	08
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	08
IV	Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	08
V	Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	08

Text Books:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, “NLP: A Paninian Perspective”, Prentice Hall, New Delhi.
2. James Allen, “Natural Language Understanding”, Pearson Education.
3. D. Jurafsky, J. H. Martin, “Speech and Language Processing”, Pearson Education.
4. L. M. Ivarasca, S. C. Shapiro, “Natural Language Processing and Language Representation”, AAAI Press, 2000.
5. T. Winograd, Language as a Cognitive Process, Addison-Wesley.

KOE089: HUMAN VALUES IN MADHYASTH DARSHAN		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
	<p>Catalogue Description: Madhyasth Darshan is a new emerging philosophy that describes the existential realities along with its implication in behaviour and work at the level of individual as well as society. This philosophy has been propounded by Shri A. Nagraj in seventies.</p> <p>It is to be kept in mind that Darshan means realisation which calls for developing the capacity to see the reality in oneself directly. So, any study of Darshan shall help develop this capacity in the students through proper steps of practices and shall not just provide the information.</p>	08
I	<p>Module I: Introduction to Madhyasth Darshan and its Basics Need to study Madhyasth Darshan; introduction, basic formulations of the darshan; the complete expanse of study and the natural outcome of living according to the darshan.</p>	08
II	<p>Module II: Submergence of Nature in Space The ever-present existence in the form of nature submerged in space; nature classified into two categories – material and consciousness, and four orders; the form, property, natural characteristic and self-organization of the four orders, General direction and process of evolution in the nature/ existence.</p>	08
III	<p>Module III: Human Being as an indivisible part of Nature Human being as an indivisible part of nature; various types (five classes) of human beings; human being in the combination of self and body; purpose of self as realization, prosperity for the body; need of behavior and work for attaining the goals of realization and prosperity</p>	08
IV	<p>Module IV: Fulfillment of human goal of realization and prosperity Following natural, social and psychological principles for actualizing the human goal; form of conducive society and order for such practices, study process- achieving realization through self-study and practice while living in such a society (social order).</p>	08
V	<p>Module V: Human Conduct based on Madhyasth Darshan Description of such a realized self, continuity of happiness, peace, satisfaction and bliss through realization, conduct of a realized human being. Possibility of finding solutions to present day problems (such as inequality of rich and poor, man and woman etc.) in the light of it.</p>	

Text Books:

1. Nagraj, A., “*Manav Vyavahar Darshan*”, Jeevan Vidya Prakashan, 3rd edition, 2003

References:

1. Nagraj, A., “*Vyavaharvadi Samajshastra*”, Jeevan Vidya Prakashan, 2nd edition, 2009.
2. Nagraj, A., “*Avartanasheel Arthashastra*”, Jeevan Vidya Prakashan, 1st edition, 1998.
3. Class notes on “Human Values in Madhyasth Darshan” available on www.uhv.org.in
4. PPTs for “Human Values in Madhyasth Darshan” available on www.uhv.org.in
5. Video lectures on “Human Values in Madhyasth Darshan” on AKTU Digital Education (<https://www.youtube.com/watch?v=14x26FPFJYs&t=1558s>)

OPEN ELECTIVE –IV

KOE-090	ELECTRIC VEHICLES
KOE-091	AUTOMATION AND ROBOTICS
KOE-092	COMPUTERIZED PROCESS CONTROL
KOE-093	DATA WAREHOUSING & DATA MINING
KOE-094	DIGITAL AND SOCIAL MEDIA MARKETING
KOE-095	MODELING OF FIELD-EFFECT NANO DEVICES
KOE-096	MODELLING AND SIMULATION OF DYNAMIC SYSTEMS
KOE-097	BIG DATA
KOE-098	**HUMAN VALUES IN BUDDHA AND JAIN DARSHAN
KOE-099	**HUMAN VALUES IN VEDIC DARSANA

** It is mandatory that for these subjects (KOE098 & KOE099) only Trained Faculty (who had done the FDP for these courses) will teach the courses.

KOE090 ELECTRIC VEHICLES		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction of Electric Vehicles: Concept of Electrified transportation, Past, present status of electric vehicles, Recent developments and trends in electric vehicles, Comparison of EVs and IC Engine vehicles, Understanding electric vehicle components, Basic EV components and architecture, Autonomy and vehicle computing needs.	08
II	Electric Motor Drives for EV applications: Concept of EV motors, Classification of EV motors, Comparison of Electric motors for EV applications, Recent EV motors, BLDC and SRM, axial flux motor. Introduction to power electronics converters, DC-DC converter, speed control of dc motor, BLDC motor driving schemes.	08
III	EV Batteries and Battery Management System: EV batteries, Lead Acid batteries – Basics, Characteristics, Lithium batteries- Basics, Characteristics, Selection of battery for EVs, Smart battery pack design, Mechanical and reliability aspects of Li Ion packs, UN38 regulation familiarity, Cell balancing in Li Ion, Battery second life and usage in BESS (energy storage systems). BMS - Global price trends, volumetric and gravimetric efficiency trends	08
IV	Charging system design technology for EV applications: Charging system design considerations, AC & DC Charging, Charging methods, On-board/Off-board chargers, Vehicle to charger communication system, OCPP familiarity cloud and device side, metrology, billing and authentication types, understand the computing needs in a charging system, Understand internal major block diagrams and subsystems of low and high power chargers. IEC61850 and 61851 familiarities, IEC61000, 60950/51, IEC62196 key highlights.	08
V	EV Charging Facility Planning: Identification of EV demand, Impact of EV charging on power grid, Energy generation scheduling, different power sources, centralized charging schemes, Energy storage integration into micro-grid, Overview and applicability of AI for the EV ecosystem, design of V2G aggregator, case studies.	08

Reference:

1. C.C.Chan, K.T.Chau. Modern Electric Vehicle Technology, Oxford University Press, NY 2001
2. M.Ehsani, Y.Gao, S.E.Gay, A.Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles – Fundamentals, Theory and Design, CRC Press, 2004
3. James Larminie, John Lowry. Electric Vehicle Technology Explained. Wiley 2012
4. NPTEL Course on Electric Vehicles – Part 1 by Dr. Amit Jain, IIT Delhi
5. Tests on Lithium-ion batteries. Available at: <https://www.lithium-batterie-service.de/en/un-38.3-test-series>
6. Handbook on Battery Energy Storage Systems- ADB, 2018

Addition Practical Hand (Lab works):

- a. BLDC motor control experiment
- b. E-rickshaw commercial BLDC and driver based live demo
- c. Charge discharge characteristics of Li-Ion batteries and cells
- d. BMS function SoC, SoH and cell balancing demo
- e. PFC demo and waveform capture
- f. LLC (DCDC) demo and waveform capture
- g. CV, CC operation
- h. Tear down analysis of DC fast charger and AC fast charger

KOE091 AUTOMATION AND ROBOTICS		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Automation: Definition, Advantages, goals, types, need, laws and principles of Automation. Elements of Automation. Fluid power and its elements, application of fluid power, Pneumatics vs. Hydraulics, benefit and limitations of pneumatics and hydraulics systems, Role of Robotics in Industrial Automation.	08
II	Manufacturing Automation: Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimode and mixed model production lines. Programmable Manufacturing Automation CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations.	08
III	Robotics: Definition, Classification of Robots - Geometric classification and Control classification, Laws of Robotics, Robot Components, Coordinate Systems, Power Source. Robot anatomy, configuration of robots, joint notation schemes, work volume, manipulator kinematics, position representation, forward and reverse transformations, homogeneous transformations in robot kinematics, D-H notations, kinematics equations, introduction to robot arm dynamics.	08
IV	Robot Drives and Power Transmission Systems: Robot drive mechanisms: Hydraulic/Electric/Pneumatics, servo & stepper motor drives, Mechanical transmission method: Gear transmission, Belt drives, Rollers, chains, Links, Linear to Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearings. Robot end Effectors: Classification of End effectors – active and passive grippers, Tools as end effectors, Drive system for rippers. Mechanical, vacuum and magnetic grippers. Gripper force analysis and gripper design.	08
V	Robot Simulation: Methods of robot programming, Simulation concept, Off-line programming, advantages of offline programming. Robot Applications: Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Limitation of usage of robots in processing operation. Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference.	08

Text Books:

7. An Introduction to Robot Technology, by Coifet Chirroza, Kogan Page.
8. Robotics for Engineers, by Y. Koren, McGraw Hill.
9. Robotic: Control, Sensing, Vision and Intelligence, by Fu, McGraw Hill.
10. Introduction to Industrial Robotics, by Nagarajan, Pearson India.
11. Robotics, by J.J. Craig, Addison-Wesley.
12. Industrial Robots, by Groover, McGraw Hill.
13. Robotic Engineering - An Integrated Approach : Richard D. Klafter Thomas A.
14. Robots & Manufacturing Automation, by Asfahl, Wiley.

KOE092 COMPUTERIZED PROCESS CONTROL		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer–Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces.	08
II	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System.	08
III	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation.	08
IV	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	08
V	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	08

Text Books:

1. S. K. Singh, “Computer Aided Process control”, PHI.

Reference Books:

1. C. L. Smith, “Digital computer Process Control”, Ident Educational Publishers.
2. C. D. Johnson, “Process Control Instrumentation Technology”, PHI.
3. Krishan Kant, “Computer Based Industrial Control”
4. Pradeep B. Deshpande & Raymond H. Ash, “Element of Computer Process Control with Advance Control Applications”, Instrument Society of America, 1981.
5. C. M. Houpis & G. B. Lamond, “Digital Control System Theory”, McGraw Hill.

KOE093: DATA WAREHOUSING & DATA MINING		
	DETAILED SYLLABUS	3-1-0
Unit	Topic	Proposed Lecture
I	Data Warehousing: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept.	08
II	Data Warehouse Process and Technology: Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	08
III	Data Mining: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree	08
IV	Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	08
V	Data Visualization and Overall Perspective: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.	08

Suggested Readings:

1. Alex Berson, Stephen J. Smith “Data Warehousing, Data-Mining & OLAP”, McGrawHil.
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, “Data Warehousing: Architecture and Implementation”, Pearson Education..
3. I. Singh, “Data Mining and Warehousing”, Khanna Publishing House.
4. Margaret H. Dunham, S. Sridhar,”Data Mining:Introductory and Advanced Topics” Pearson Education.

KOE094: DIGITAL AND SOCIAL MEDIA MARKETING		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Digital Marketing: The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. Marketing strategies for the digital world-latest practices.	08
II	Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns.	08
III	Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing. Marketing gamification, Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO).	08
IV	Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies.	08
V	Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation.	08

Text Books:

1. Moutsy Maiti: Internet Marketing, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts
4. Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional.
5. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page.
6. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

KOE095 MODELING OF FIELD-EFFECT NANO DEVICES		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility – threshold voltage – inter subband scattering, multigate technology – mobility – gate stack.	08
II	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics – CMOS Technology – Ultimate limits, double gate MOS system – gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering – mobility.	08
III	Silicon nanowire MOSFETs – Evaluation of I-V characteristics – The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube – Band structure of carbon nanotube – Band structure of graphene – Physical structure of nanotube – Band structure of nanotube – Carbon nanotube FETs – Carbon nanotube MOSFETs – Schottky barrier carbon nanotube FETs – Electronic conduction in molecules – General model for ballistic nano transistors – MOSFETs with 0D, 1D, and 2D channels – Molecular transistors – Single electron charging – Single electron transistors.	08
IV	Radiation effects in SOI MOSFETs, total ionizing dose effects – single-gate SOI – multi-gate devices, single event effect, scaling effects.	08
V	Digital circuits – impact of device performance on digital circuits – leakage performance trade off – multi VT devices and circuits – SRAM design, analog circuit design – transconductance - intrinsic gain – flicker noise – self heating –band gap voltage reference – operational amplifier – comparator designs, mixed signal – successive approximation DAC, RF circuits.	08

Text Books:

1. J P Colinge, "FINFETs and other multi-gate transistors", Springer – Series on integrated circuits and systems, 2008
2. Mark Lundstrom, Jing Guo, "Nanoscale Transistors: Device Physics, Modeling and Simulation", Springer, 2006
3. M S Lundstorm, "Fundamentals of Carrier Transport", 2nd Ed., Cambridge University Press, Cambridge UK, 2000.

KOE096:MODELLING AND SIMULATION OF DYNAMIC SYSTEMS		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to modeling and simulation: Introduction to modeling, Examples of models, modeling of dynamic system, Introduction to simulation, MATLAB as a simulation tool, Bond graph modeling, causality, generation of system equations.	08
II	Bond graph modeling of dynamic system: Methods of drawing bond graph model- Mechanical systems & Electrical systems, some basic system models- Mechanical systems, Thermal systems, hydraulic systems, pneumatic systems and electrical systems.	08
III	System models of combined systems: Linearity and non linearity in systems combined rotary and translatory system, electro mechanical system, hydro- mechanical system.	08
IV	Dynamic Response and System Transfer Function: Dynamic response of 1 st order system and 2 nd order system, performance measures for 2 nd order system, system transfer function, transfer function of 1 st and 2 nd order system Block diagram algebra, signal flow diagram, state variable formulation, frequency response and bode plots.	08
V	Simulation and simulation applications: Simulation using SIMULINK, examples of simulation problems- simple and the compound pendulum, planner mechanisms, validation and verification of the simulation model, parameter estimation methods, system identifications, introduction to optimization.	08

Text Books:

1. Zeigler B.P. Praehofer. H. and Kim I.G. "Theory of modeling and simulation", 2nd Edition. Academic press 2000.
2. Robert L. Woods, Kent L. Lawrence, "Modeling and simulation of dynamic systems", Person, 1997.
3. Brown, Forbes T. "Engineering System Dynamics", New York, NY: CRC, 2001. ISBN: 9780824706166.
4. Pratab.R " Getting started with MATLAB" Oxford university Press 2009.

KOE097: BIG DATA		
	DETAILED SYLLABUS	3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Big Data: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	08
II	Hadoop: History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. Map-Reduce: Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	08
III	HDFS (Hadoop Distributed File System): Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	08
IV	Hadoop Eco System and YARN: Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. NoSQL Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleting documents, querying, introduction to indexing, capped collections Spark: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN SCALA: Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	08
V	Hadoop Eco System Frameworks: Applications on Big Data using Pig, Hive and HBase Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, Hive - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. HBase – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigInsights and Big Sheets, introduction to Big SQL.	08
Suggested Readings:		
<ol style="list-style-type: none"> 1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley. 2. Big-Data Black Book, DT Editorial Services, Wiley. 3. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill. 4. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall. 		

KOE098 HUMAN VALUES IN BAUDDHA AND JAIN DARSHAN

Catalogue Description: Bauddha and Jain Darshan form a part of the philosophy of Indian tradition. This course outlines the basic concepts and principles of these two philosophies and provides scope for further reading of the philosophies, so as to gain clarity about the human being, the existence and human participation i.e. human values expressing itself in human conduct.

It is to be kept in mind that Darshan means realization which calls for developing the capacity to see the reality in oneself directly. So, any study of Darshan shall help develop this capacity in the students through proper steps of practices and shall not just provide the information.

DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Bauddha and Jain Darshan and their Basics Need to study Bauddha and Jain Darshan; the origin of these philosophies, their basic principles and scope for further reading.	08
II	Basic Principles of Bauddha Darshan law of impermanence (changability); four noble truths; eightfold path; law of cause- action (<i>pratitya-samutpaad</i>) Definition of some salient words of Buddha Darshan – <i>nirvana, dhamma, tri- ratna(Buddha, Dharma and Sangh), pragya, karma, parmi, ashta-kalap, trishna, shad-ayatan, samvedana, vipassana, anitya, maitri, brham-vihaar, tathagata, arahant..</i>	08
III	Purpose and Program for a Human Being based on Bauddha Darshan The purpose and program of a human being living on the basis of it, clarity and practice of human values and human conduct, the natural outcome of such a program on society, nature and tradition. Purpose-freedom from suffering, <i>nirvana</i> ; root of suffering- <i>vikaar – raga, dvesha and moha</i> , Program – various steps of meditation for attaining knowledge; <i>shamath and vipassana; sheel- samadhi-pragya; practice of equanimity (samatva), eightfold path(Ashtang Marg); combination of understanding and practice..</i>	08
IV	Basic Principles of Jain Darshan Basic realities – description of nine elements in existence (<i>jeev, ajeev, bandh, punya, paap, aashrav, samvar, nirjara, moksha</i>), 6 dravya of lok – <i>dharma, adhrma, akash, kaal, pudgal, jeev</i> ; tri-lakshan, various types of <i>pragya</i> , various stages of realisation; <i>samyak-gyan, samyak- darshan, samyak-charitra, syadvaad, anekantavaad, naya- nishchaya and vyavahar, karma- phal siddhanta</i> Definition of some salient words of Jain Darshan – <i>arhant, jin, tirthankara, panch- parameshthi, atma, pramaan, kaal, pudgal, paramanu, kashay, leshya..</i>	08
V	Purpose and Program for a Human Being based on Jain Darshan The purpose and program of a human being living on the basis of it, clarity and practice of human values and human conduct, the natural outcome of such a program on society, nature and tradition, possibility of finding solutions to present day problems in the light of it. Purpose (goal) - <i>moksha</i> , Program- following <i>mahavrat, anuvrat, 10 lakshan dharma; samyak darshan-gyan-charitra</i> . Commonality with Bauddha Darshan	08

Text Books:

1. Chattejee, S.G. and Datta, D.M., “*An Introduction to Indian Philosophy*”, University of Calcutta Press, 1960..

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1. “*Dhammapad*”, Vipassana Research Institute, 2001.
2. Drukpa, G., “*Musings from the Heart*”, Drukpa Publications Private Ltd, 2018.
3. Jyot, “*Ek cheez milegi Wonderful*”, A Film Directed by Jyot Foundation, 2013.
4. Goenka, S.N., “*The Discourse Summaries*”, Vipassana Research Institute, 1987.
5. Madhavacharya, “*Sarva-darshan Samgraha*”, Chaukhambha Vidya Bhavan, Varanasi, 1984.
6. Varni, J., “*Samansuttam*”, Sarva Seva Sangh Prakashan, Varanasi, 7th Edition, 2010.
7. <https://www.youtube.com/watch?v=cz7QHNvNFfA&list=PLPJVIVRVmhc4Z01fD57jbzycm9I6W054x> (English)
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KOE099: HUMAN VALUES IN VEDIC DARŚANA		
DETAILED SYLLABUS		3-1-0
Unit	Topic	Proposed Lecture
I	Introduction to Vedic Darśana and Nyāya Darśana (Philosophy of Indian Logic and Reasoning) Introduction to Vedic literature, need to study Vedic Darśana; its origin and subject matter. Introduction to Nyāya Darśana, 16 padārthas (pramāṇa, prameya, saṁśaya, prayojana, dṛṣṭānta, siddhānta, avayava, tarka, nirṇaya, vāda, jalpa, vitanḍā, hetuābhāsa, chala, jāti, nigrasthāna) pañcāvayava prakriyā (pratijñā, hetu, udāharana, upanaya, nigamana).	09
II	Vaiśeṣika Darśana (Philosophy of Matter) Introduction to Vaiśeṣika Darśana, definition of Dharma, abhyudaya, niḥśreyasa; 6 padārthas (dravya, guṇa, karma, sāmānya, viśeṣa, samavāya) – their definition, characteristics and relationship; nitya-anitya; cause-effect relationships; dṛṣṭa-adṛṣṭa karma phala; mindful dāna; śucitā-aśucitā; reasons of rāga-dveṣa, avidyā, sukha-duḥkha, etc. and how to get rid of them.	07
III	Sāṁkhya-Yoga Darśana (Philosophy of Spirituality) Sāṁkhya Darśana- Puruṣārtha, the nature of Puruṣa and Prakṛti, 24 elements of Prakṛti, bondage and salvation (liberation), the principle of satkāryavāda, triguṇātma prakṛti. Yoga Darśana- the steps of Aṣṭāṅga yoga (yama, niyama, āsana, prāṇāyāma, pratyāhāra, dhāraṇā, dhyāna and samādhi) and the challenges in following them, afflictions (kleṣa)- avidyā, asmitā, rāga, dveṣa, abhiniveśa, different types of vṛttis (pramāṇa, viparyaya, vikalpa, nidrā, smṛti), the process of nirodha of vṛttis; maitri, karuṇā, muditā, upekṣā; description of yama, niyama, āsana and prāṇāyāma; kriyāyoga– tapa, svādhyāya and Īśvara-praṇidhāna; different steps of samādhi, different types of saṁyama, vivekakhyāti, prajñā. Vedanta Darshan Vedanta Darshan- <i>Nature of Brahma and Prakṛti, Methods of Upasana; adhyasaand sanskar; nature of Atma, description of existence, principle of karma-phala, description of pancha kosha, different nature of paramatma/brahma, Ishwar, Four qualifications (Sadhan chatushtay).</i>	12
IV	Upaniṣad and Vedanta Darśana (Philosophy of God) Introduction to Upaniṣads and Vedanta Darśana; Īsopaniṣad – Idea of renouncement, Karma Yoga, balance of Vidyā-Avidyā and Prakṛti-Vikṛti; Tattirīyopaniṣad – Different names of the God and their meaning, parting message of Guru to the graduating student (Śikṣāvallī), Nature of Brahma and Prakṛti, Methods of Upāsanā; Nature of Ātmā, Description of existence, principle of karma-phala, description of pañca kośa, nature of mukti , process and way to achieve it, antaḥkaraṇa-śuddhi, different characteristics of paramātmā/brahma, Īśvara, Four qualifications (Sādhana-catuṣṭaya)	08
V	<i>Purpose and Program for a Human Being based on the Vedic Darśana</i> <i>The purpose and program of a human being living on the basis of the Vedic Darśana, clarity and practice of human values and human conduct, the natural outcome of such a program on society, nature and tradition. Vedic system of living in a society - the idea of vratas and varaṇa (freedom of choice with commitment), Varṇa System, Āśrama System, Pañca Mahāyajña, 16 Saṁskāras, etc.</i>	06

Reference Books:

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2. Acharya Rajveer Shastri, Patanjali Yog Darśana Bhashyam, Arsha Sahitya Prachar Trust.
3. Acharya Udayveer Shastri, Brahma Sutra (Vedanta Darshanam), Govindram Hasanand.
4. Krishna, I. (2010) The SāṃkhyaKarika, Bharatiya VidyaPrakashan, 4th edition
5. Madhavacharya, Sarva-DarshanaSamgrah Chaukhambha Vidyabhavan, Varanasi.
6. Muller, F.M. (1928) The Six Systems of Indian Philosophy, London: Longmans Green and Co. Publication.
7. Maharaj O. () Patanjali Yogpradeep, Geeta press Gorakhpur
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9. Shreemad Bhagwat geeta
10. Shankaracharya, VivekChoodamani
11. Rajyoga, Swami Shivananda
12. The Nyāya Sutras of Gotama, Sinha, N. (Ed.). Motilal Banarsidass Publ. (1990).
13. Pandit Madanmohan Vidyasagar. Sanskar Samuchaya, Vijaykumar Govindram Hasanand. 1998
14. Vedic Vision: Ancient Insights Into Modern Life, Satyavrata Siddhantalankar, Vijay Krishn Lakhanpal, 1999
15. Sanskar Chandrika (Hindi), Dayananda Saraswati, and Satyavrata Siddhantalankar. Vijay Krishn Lakhanpal, (1990).
16. THE TAITTIRIYA Upanishad, Achari, Sri Rama Ramanuja. (2013).
17. Vedic religion: The Taittiriya-Upanishad with the commentaries of Sankaracharya Suresvaracharya and Sayana (Vidyarana). Sastri, A. Mahadeva.(2016).
18. Taittiriyanopanishad Sankara Bhashya With Hindi Translation Gita Press 1936.
19. Gautama's Nyāyasūtras: With Vātsyāyana-Bhāṣya. Jha, Ganganatha, ed. Oriental Book Agency, 1939.
20. NyayaDarshnam, Acharya Udayveer Shastri, Vijaykumar Govindram Hasanand (2018)
21. VaisheeshikaDarshanam, Acharya Udayveer Shastri, Vijaykumar Govindram Hasanand (2017)
22. Chattejee, S.G. and Datta, D.M. (1960) An Introduction to Indian Philosophy, Calcutta: University of Calcutta Press.
23. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Asthana, G. P. Bagaria (2019 Second Revised Edition), Excel Books, New Delhi [ISBN 978-93-87034-47-1].
24. Class notes on "Human Values in Vedic Darśana" available on www.uhv.org.in
25. PPTs for "Human Values in Vedic Darśana" available on www.uhv.org.in