INSTITUTE OF ENGINNERING AND TECHNOLOGY LUCKNOW

(An Autonomous Constituent Institute of Dr. A.P.J. Abdul Kalam Technical University, Lucknow)

Evaluation Scheme & Syllabus

For

B. Tech. Fourth Year

(Information Technology)

On

Choice Based Credit System

[Effective from the Session: 2019-20]

B.Tech. (Information Technology)
VII SEMESTER

SI. No.	Subject Code	Subject Name	L-T-P	Th/Lab Marks ESE	Sessional CT	Sessional TA	Total	Credit
1	Open Elective-1	Open Elective Course -1	3--0--0	70	20	10	100	3
2	IT Elective-3	Deptt Elective Course-3	3--0--0	70	20	10	100	3
3	IT Elective-4	Deptt Elective Course-4	3--1--0	70	20	10	100	4
4	RIT701	Cryptography & Network Security	3--1--0	70	20	10	100	4
5	RCS702	Artificial Intelligence	3--0--0	70	20	10	100	3
6	RIT751	Cryptography & Network Security Lab	0--0--2	50		50	100	1
7	RCS752	Artificial Intelligence Lab	0--0--2	50		50	100	1
8	RIT753	Industrial Training	0--0--3			100	100	2
9	RIT754	Project	0--0--6			200	200	3
	TOTAL			450	100	450	1000	24

B.Tech. (Information Technology)
VIII SEMESTER

SI. No.	Subject Code	Subject Name	L-T-P	Th/Lab Marks ESE	Sessional CT	Sessional TA	Total	Credit
1	Open Elective-2	Open Elective Course-2	3--0--0	70	20	10	100	3
2	IT Elective-5	Deptt Elective Course-5	3--1--0	70	20	10	100	4
3	IT Elective-6	Deptt Elective Course-6	3--0--0	70	20	10	100	3
4	RIT851	Seminar	0--0--3			100	100	2
5	RIT852	Project	0--0--12	350		250	600	12
	TOTAL			560	60	380	1000	24

DEPARTMENTAL ELECTIVES

IT-ELECTIVE -3

1. RIT070 Computer Graphics
2. RCS071 Application of Soft Computing
3. RCS072 High Performance Computing
4. RCS073 Human Computer Interface

IT-ELECTIVE-4

1. RCS075 Cloud Computing

2. RCS076 Blockchain Architecture Design

3. RCS077 Agile Software Development

4. RCS078 Augmented & Virtual Reality

IT-ELECTIVE-5

1. RCS080 Machine Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc17_cs17/preview
https://onlinecourses.nptel.ac.in/noc17_cs26/preview)
2. RCS081 Game Programming

3. RCS082 Image Processing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_ee40/preview
https://nptel.ac.in/courses/106105032/
4. RCS083 Parallel and Distributed Computing (Mapping with MOOCS: https://nptel.ac.in/courses/106102114/,
https://nptel.ac.in/courses/106104024/)

IT-ELECTIVE-6

1. RCS085 Speech Natural language processing (Mapping with MOOCS: https://nptel.ac.in/courses/106101007/
https://nptel.ac.in/courses/106105158/)

2. RCS086 Deep Learning (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cs41/preview)

3. RCS087 Data Compression

4. RCS088 Quantum Computing (Mapping with MOOCS: https://onlinecourses.nptel.ac.in/noc18_cy07)

CRYPTOGRAPHY & NETWORK SECURITY		
DETAILED SYLLABUS		**3-1-0**
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 decryptionFermat'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:

1. William Stallings, "Cryptography and Network Security: Principals and Practice", Pearson Education.

2. Behrouz A. Frouzan: Cryptography and Network Security, Tata 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", Tata McGraw Hill

ARTIFICIAL INTELLIGENCE	
DETAILED SYLLABUS	**3-0-0**

Unit	Topic	Proposed Lecture
I	**Introduction:** Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.	**08**
II	**Introduction to Search :** Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning	**08**
III	**Knowledge Representation & Reasoning:** Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	**08**
IV	**Machine Learning :** Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data - EM algorithm, Reinforcement learning,	**08**
V	**Pattern Recognition :** Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.	**08**

Text books:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", McGraw-Hill

3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson Education

4. Dan W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall of India,

CRYPTOGRAPHY & NETWORK SECURITY LAB

The following programs may be developed -

1.Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.

2.Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result

3.Write a Java program to perform encryption and decryption using the following algorithms:

     a) Ceaser Cipher

     b) Substitution Cipher

     c) Hill Cipher

4. Write a Java program to implement the DES algorithm logic

5.Write a C/JAVA program to implement the BlowFish algorithm logic

6.Write a C/JAVA program to implement the Rijndael algorithm logic.

7.Using Java Cryptography, encrypt the text "Hello world" using BlowFish. Create your own key using Java keytool.

8. Write a Java program to implement RSA Algoithm

9.Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).

10.Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

11. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Artificial Intelligence Lab

The following programs may be developed -

1.Study of Prolog.

2 Write simple fact for the statements using PROLOG.

3 Write predicates One converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.

4 Write a program to solve the Monkey Banana problem.

5 WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.

6 WAP to implement factorial, fibonacci of a given number.

7 Write a program to solve 4-Queen problem.

8 Write a program to solve traveling salesman problem.

9 Write a program to solve water jug problem using LISP

COMPUTER GRAPHICS		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	08
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against non rectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping	08
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping.	08
IV	**Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	08
V	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	08

Text books:

Donald Hearn and M Pauline Baker, "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes – "Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill
4. W. M. Newman, R. F. Sproull – "Principles of Interactive computer Graphics" – Tata MCGraw Hill.
5. Amrendra N Sinha and Arun D Udai," Computer Graphics", Tata MCGraw Hill.
6. R.K. Maurya, "Computer Graphics " Wiley Dreamtech Publication.
7. Mukherjee, Fundamentals of Computer graphics & Multimedia, PHI Learning Private Limited.
8. Donald Hearn and M Pauline Baker, "Computer Graphics with OpenGL", Pearson education

APPLICATION OF SOFT COMPUTING		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	**Neural Networks-I (Introduction & Architecture) :** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.	**08**
II	**Neural Networks-II (Back propogation networks):** Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.	**08**
III	**Fuzzy Logic-I (Introduction):** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.	**08**
IV	**Fuzzy Logic –II (Fuzzy Membership, Rules)** : Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications	**08**
V	**Genetic Algorithm(GA):** Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.	**08**

Text books:

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.

2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press. Reference Books:

3. Siman Haykin,"Neural Netowrks"Prentice Hall of India

4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.

5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

	HIGH PERFORMANCE COMPUTING	
	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:

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. lan Foster, et al.,"The Open Grid Services Architecture", Version 1.5 (GFD.80). Open Grid Forum, 2006.

6. RajkumarBuyya. High Performance Cluster Computing: Architectures and Systems. PrenticeHall India, 1999.

HUMAN COMPUTER INTERFACE		
DETAILED SYLLABUS		**3-0-0**
Unit	Topic	Proposed Lecture
I	**Introduction :** Importance of user Interface – definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface	**08**
II	**Design process:** Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions. III Screen Designing : Design goals – Scre	**08**
III	**Screen Designing :** Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	**08**
IV	**Windows :** New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors	**08**
V	**Software tools :** Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.	**08**

Text books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.

2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in HumanComputer Interaction, Wiley, 2010.

3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

CLOUD COMPUTING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**INTRODUCTION** 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 – laaS – 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:

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.

BLOCKCHAIN ARCHITECTURE DESIGN		
DETAILED SYLLABUS		3-1-0
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:

1. Mstering 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

AGILE SOFTWARE DEVELOPMENT		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**AGILE METHODOLOGY** Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values	08
II	**AGILE PROCESSES** Lean Production – SCRUM, Crystal, Feature Driven Development- Adaptive Software Development – Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.	08
III	**AGILITY AND KNOWLEDGE MANAGEMENT** Agile Information Systems – Agile Decision Making – Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).	08
IV	**AGILITY AND REQUIREMENTS ENGINEERING** Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.	08
V	**AGILITY AND QUALITY ASSURANCE** Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.	08

Text books:
1.David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Prentice Hall, 2003.
2.Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.
3.Craig Larman, "Agile and Iterative Development: A Managers Guide", Addison-Wesley, 2004.
4.Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.

AUGMENTED & VIRTUAL REALITY		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**VIRTUAL REALITY AND VIRTUAL ENVIRONMENTS:** The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. HARDWARE TECHNOLOGIES FOR 3D USER INTERFACES: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces.	**08**
II	**3D USER INTERFACE INPUT HARDWARE:** Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.	**08**
III	**SOFTWARE TECHNOLOGIES:** Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market	**08**
IV	**3D INTERACTION TECHNIQUES:** 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry . DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies for Designing and Developing Guidelines and Evaluation. VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	**08**
V	Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	**08**

Text books:

1. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2009.

2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.

3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice",

Addison Wesley, USA, 2005.

4. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.

5. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

6. John Vince, "Virtual Reality Systems", Addison Wesley, 1995.

7. Howard Rheingold, "Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society", Simon and Schuster, 1991.

8. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

9. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.

MACHINE LEARNING		
DETAILED SYLLABUS		**3-1-0**
Unit	Topic	Proposed Lecture
I	INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias	**08**
II	DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation AlgorithmConvergence, Generalization;	**08**
III	Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; **Bayesian Learning:** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;	**08**
IV	**Computational Learning Theory:** Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning	**08**
V	**Genetic Algorithms:** an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.	**08**

Text books:
1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

GAME PROGRAMMING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**3D GRAPHICS FOR GAME PROGRAMMING :** 3D Transformations, Quaternions, 3D Modeling And Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera And Projections, Culling And Clipping, Character Animation, Physics-Based Simulation, Scene Graphs.	**08**
II	**GAME ENGINE DESIGN:** Game Engine Architecture, Engine Support Systems, Resources And File Systems, Game Loop And Real-Time Simulation, Human Interface Devices, Collision And Rigid Body Dynamics, Game Profiling.	**08**
III	**GAME PROGRAMMING** : Application Layer, Game Logic, Game Views, Managing Memory, Controlling The Main Loop, Loading And Caching Game Data, User Interface Management, Game Event Management.	**08**
IV	**GAMING PLATFORMS AND FRAMEWORKS:** 2D And 3D Game Development Using Flash, DirectX, Java, Python, Game Engines – DX Studio, Unity.	**08**
V	**GAME DEVELOPMENT:** Developing 2D And 3D Interactive Games Using DirectX Or Python – Isometric And Tile Based Games, Puzzle Games, Single Player Games, Multi Player Games.	**08**

Text books:

1. Mike Mc Shaffrfy And David Graham, "Game Coding Complete", Fourth Edition, Cengage Learning, PTR, 2012.

2. Jason Gregory, "Game Engine Architecture", CRC Press / A K Peters, 2009.

3. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach To Real-Time Computer Graphics" 2nd Editions, Morgan Kaufmann, 2006.

4. Ernest Adams And Andrew Rollings, "Fundamentals Of Game Design", 2nd Edition Prentice Hall / New Riders, 2009.

5. Eric Lengyel, "Mathematics For 3D Game Programming And Computer Graphics", 3rd Edition, Course Technology PTR, 2011.

6. Jesse Schell, The Art Of Game Design: A Book Of Lenses, 1st Edition, CRC Press, 2008.

IMAGE PROCESSING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**DIGITAL IMAGE FUNDAMENTALS:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	**08**
II	**IMAGE ENHANCEMENT :** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	**08**
III	**IMAGE RESTORATION :** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	**08**
IV	**IMAGE SEGMENTATION:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	**08**
V	**IMAGE COMPRESSION AND RECOGNITION:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	**08**

Text books:
1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition, 2010
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.
3. Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
5. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
6. William K. Pratt,Digital Image Processing John Wiley, New York, 2002
7. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

PARALLEL AND DISTRIBUTED COMPUTING		
DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** Scope , issues, applications and challenges of Parallel and Distributed Computing **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, co-processing. **Principles of Parallel Algorithm Design:** Decomposition Techniques,Characteristics of Tasks and Interactions,Mapping Techniques for Load Balancing.	**08**
II	**CUDA programming model:** Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function.	**08**
III	**Analytical Modeling of Parallel Programs:** Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time	**08**
IV	**Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms **Graph Algorithms:** Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph	**08**
V	**Search Algorithms for Discrete Optimization Problems:** Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms	**08**

Text books:
1. A Grama, A Gupra, G Karypis, V Kumar. Introduction to Parallel Computing (2nd ed.). Addison Wesley, 2003.
2. C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley Publishing Company, 2008.
3. J Jeffers, J Reinders. Intel Xeon Phi Coprocessor High-Performance Programming. Morgan Kaufmann Publishing and Elsevier, 2013.
4. T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley Professional, 2004.

	SPEECH AND NATURAL LANGUAGE PROCESSING	
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. **UNIT III : SPEECH MODELING** : Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-Estimation, Implementation Issues.	**08**
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, OReilly 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. 1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.

7. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.

8. Nitin Indurkhya 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.

DEEP LEARNING		
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	DIMENTIONALITY 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, hyperparameter 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 : Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding-Gathering Image Captions	**08**
Text books:		
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.

DATA COMPRESSION		
DETAILED SYLLABUS		**3-0-0**
Unit	**Topic**	**Proposed Lecture**
I	Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.	**08**
II	The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.	**08**
III	Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Moveto-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.	**08**
IV	Distortion criteria, Models, Scalar Ouantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.	**08**
V	Advantages of Vector Quantization over Scalar Quantization, The Linde-Buzo-Gray Algorithm, Tree structured Vector Quantizers. Structured VectorQuantizers.	**08**

Text books:

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers
2. Elements of Data Compression,Drozdek, Cengage Learning
3. Introduction to Data Compression, Second Edition, Khalid Sayood,The Morgan aufmann Series
4.Data Compression: The Complete Reference 4th Edition byDavid Salomon, Springer
5.Text Compression1st Edition by Timothy C. Bell Prentice Hall

QUANTUM COMPUTING		
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:
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,
3 Oct 2014 3. Computing since Democritus by Scott Aaronson
4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

B.TECH.
VII SEMESTER 2020-21

REVISED OPEN ELECTIVE-I

1.	ROE070	HUMAN VALUES IN SANKHAY YOGA AND VEDANTA DARSAN
2.	ROE071	MODELLING AND SIMULATION OF DYNAMIC SYSTEMS
3.	ROE072	INTRODUCTION TO SMART GRID
4.	ROE073	CLOUD COMPUTING
5.	ROE074	UNDERSTANDING THE HUMAN BEING COMPREHENSIVELY - HUMAN ASPIRATIONS AND ITS FULFILLMENT
6.	ROE075	AUTOMATION AND ROBOTICS
7.	ROE076	COMPUTERIZED PROCESS CONTROL
8.	ROE077	MODELING OF FIELD-EFFECT NANO DEVICES
9.	ROE078	QUALITY MANAGEMENT
10.	ROE079	GIS & REMOTE SENSING
11.	ROE080	HUMAN VALUES IN BUDDHA AND JAIN DARSHAN

| ROE 070 | **Human Values in Sankhya, Yoga and Vedanta Darshan** | **L** | **T** | **P** | **C** |
| | | 3 | 0 | 0 | 3 |

| **Version No.:** | 2.0 (updated as on June 12 '19) |
| **Prerequisite:** | KVE 301/401- Universal Human Values and Professional Ethics |

Objectives:
1. To help students understand the basic principles of Sankhya, Yoga and Vedanta Darshan
2. To help students understand the existential realities including the human existence through Sankhya, Yoga and Vedanta Darshan
3. To help them to see the participation of human beings in the nature/ existential realities (i.e. human values) and therefore the human conduct through each one of them
4. To help students apply this understanding to make their living better at different levels-individual, family, society and nature
5. To facilitate the students in applying this understanding in their profession and lead an ethical life

Course Outcome: On completion of this course, the students will be able to
1. Understand the basic concepts of Sankhya, Yoga and Vedanta Darshan.
2. Understand the human being, the needs and activities of human being through Sankhya, Yoga and Vedanta Darshan.
3. Understand the whole existence
4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct
5. Understand the foundation of human society and human tradition.

Catalogue Description: Sankhya, Yoga and Vedanta Darshan form a part of the philosophy of Indian tradition. This course outlines the basic concepts and principles of these three 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 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.

Module I :Introduction to Sankhya, Yoga and Vedanta Darshan and their Basics
Need to study Sankhya, Yoga and Vedanta Darshan; the origin of the three philosophies, their basic principles and scope for further reading.

Module II: Sankhya Darshan
Sankhya Darshan- the *nature* of *Purush* and *Prakriti*, 8 types of *prakriti (pradhan, mahattatva ahankar and* five *tanmatras*- sound, touch, form, taste and smell) and their 16 evolutes (*vicar), pramana (pratyaksha, anumana and agama),* bondage and salvation (liberation), the principle of *satkaryavad*, sense organs, work organs, *trigunatmak prakriti*

Module III: YogaDarshan
Yoga Darshan- the steps of *Ashtanga yoga (yama, niyama,aasana, pranayama, pratyahara dharana, dhyan* and *samadhi)* and the challenges in following them, afflictions (*klesha)- avidya asmita, raga, dvesha, abhinivesh,* different types of *vritti (pramana, viparyaya, vikalp, nidra, smriti)* the process of *nirodha* of *vritti; maitri, karuna, mudita, upeksha;* description of *yama, niyama aasana* and *pranayaama; kriyayoga –tapa, swadhyaya* and *ishwar-pranidhana,* different steps of *samadhi,* different types of *sanyama, vivekakhyati, pragya.*

Module IV :Vedanta Darshan
Vedanta Darshan- *Nature* of *Brahma* and *Prakriti*, Methods of *Upasana*; a*dhyasa* and s*anskar* n*ature* of Atma, description of existence, principle of *karma-phala*, description of *pancha kosha* different *nature* of *paramatma/brahma, Ishwar, Four qualifications (Sadhan-chatushtay)*.

Module V : Purpose and Program for a Human Being based on the Three Darshan
The purpose and program of a human being living on the basis of the three darshanas, 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.

Text Books:
1. Chattejee, S.G. and Datta, D.M., "*An Introduction to Indian Philosophy*", University of Calcutta Press, 1960.

References:
1. Goendaka, J., "*Shreemad Bhagwat Geeta*", Geeta Press, Gorakhpur, 73rd reprint, 2015.
2. Krishna, I., "*The Sankhya Karika*", Bharatiya Vidya Prakashan, 4th edition, 2010.
3. Madhavacharya, "*Sarva-darshan Samgraha*", Chaukhambha Vidya Bhavan, Varanasi, 1984.
4. Maharaj, O. "*Patanjal Yog Pradeep*", Geeta press, Gorakhpur, 30th reprint, 2009.
5. Muller, F.M. "*The Six Systems of Indian Philosophy*", Longmans Green and Co. Publication, London, 1928.
6. Radhakrishnan, S., "*Indian Philosophy* (*Volume* 1 and 2)", Oxford University Press, 2nd edition, 1996.
7. Shankaracharya, "*Vivek Choodamani*", Geeta Press, Gorakhpur, 48th Reprint, 2018.
8. Sivananda, S., "*Raj Yoga*", The Divine Life Society, Rishikesh, 7th edition, 2016.
9. Vachaspati, M., "*Sankhya Tatva Kaumudi*", Motilal Banarasi Das Publication, Varanasi 1921.

Mode of Evaluation: Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

ROE-071   MODELLING AND SIMULATION OF DYNAMIC SYSTEMS

COURSE OBJECTIVE: *Students undergoing this course are expected to-*
1. Define, describe and apply basic concepts related to modeling and simulation.
2. Use conservation laws and constitutive relationships and other physical relations to model mechanical, electrical and flow systems, and combinations of these.

COURSE OUTCOME: *After completion of the course student will be able to-*
CO1: Define, describe and apply basic concepts related to modeling and simulation.
CO2: Construct bond graphs for the type of systems mentioned above, simplify and analyze the bond graph according to causality conflicts.
CO3: Use conservation laws and constitutive relationships and other physical relations to model mechanical, electrical and flow systems.
CO4: Find dynamic response and transfer function using various tools for system modeling.
CO5: Model and simulate mechanical and electrical systems using the computer tools Simulink.

ROE-071   MODELLING AND SIMULATION OF DYNAMIC SYSTEMS
Unit	Topic	Lectures
1	**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.	**8**
2	**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.	**8**
3	**System models of combined systems:** Linearity and non linearity in systems combined rotary and translatory system, electro mechanical system, hydro-mechanical system.	**8**
4	**Dynamic Response and System Transfer Function:** Dynamic response of 1st order system and 2nd order system, performance measures for 2nd order system, system transfer function, transfer function of 1st and 2nd order system Block diagram algebra, signal flow diagram, state variable formulation, frequency response and bode plots.	**8**
5	**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.	**8**

Text Books and References:
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.

ROE-072 INTRODUCTION TO SMART GRID

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. Present the fundamental concepts associated with Smart Grids.
2. Review renewable energy generation, grid integration energy storage technologies and future developments
3. Introduce advanced management and control concepts of Smart Grids.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Identify the key elements of Smart Grids and visualize the roadmap towards next-Gen electricity networks.

CO2: Evaluate technology options pertaining to renewable energy generation, energy storage, data handling and communications for Smart Grids.

CO3: Justify technological and economical choices in the context of existing commercial Smart Grids projects.

CO4: Determine the relevance of Smart Grids projects, develop ways to evaluate their impacts and implications.

CO5: Analyse the new roles of utilities and consumers in Smart Grids.

	ROE-072 INTRODUCTION TO SMART GRID	
Unit	**Topic**	**Lectures**
1	**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.	8
2	**Smart Grid Technologies:** Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.	8
3	**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.	8
4	**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 flim solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.	8
5	**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.	8

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, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
4. Jean Claude Sabonnadiere, NouredineHadjsaid, "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. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronice and Power Systems)", Springer.
4. R.C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.
5. Phadke, A.G., Thorp, J.S., "Synchronized Phasor Measurements and Their Applications", Springer.
6. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley.

ROE-073   CLOUD COMPUTING

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. Provide students with the fundamentals and essentials of Cloud Computing..
2. Provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO2: Learn the key and enabling technologies that help in the development of cloud.

CO3: Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models..

CO4: Explain the core issues of cloud computing such as resource management and security.

CO5: To appreciate the emergence of cloud as the next generation computing paradigm.

	ROE-073 CLOUD COMPUTING	
Unit	**Topic**	**Lectures**
1	**Introduction :** 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.	**8**
2	**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.	**8**
3	**Cloud Architecture, Services And Storage:** Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – laaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage- as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	**8**
4	**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.	**8**
5	**Cloud Technologies And Advancements:** Hadoop – Map Reduce – 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.	**8**

Text and Reference Books:

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.

ROE- 074 Understanding the Human Being Comprehensively–Human Aspirations and its Fulfillment

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.

2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.

3. To help the students to develop the understanding of human tradition and its various components.

COURSE METHODOLOGY:

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.

2. It is free from any dogma or set of do's and don'ts related to values.

3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.

4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.

5. This self-exploration also enables them to critically evaluate their pre- conditionings and present beliefs.

Unit	Topic	Lectures
ROE- 074 Understanding the Human Being Comprehensively–Human Aspirations and its Fulfillment		
1	**Introduction:** The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	8
2	**Understanding Human being and its expansion:** The domain of right understanding starts from understanding the human being (the knower, the experiencer and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	8
3	**Activities of the Self:** Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	8

4	**Understanding Co-existence with other orders:** The need and the process of inner evolution (through self-exploration, self- awareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence)	8
5	**Expansion of harmony from self to entire existence:** Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behaviour and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence**.**	8

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J.C.Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. IshandiNauUpnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

8. MahasatipatthanSutta , S N Goenka, Vipassana Research Institute, First Edition, 1996
9. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK
10.Slow is Beautiful, Cecile Andrews http://www.newsociety.com/Books/S/Slow- is-Beautiful)
11.Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi
12.Sanchian Sri Guru Granth Sahib Ji ,Shiromani Gurdwara Parbhandhak Committee, 2001
13.SamanSuttam, JinendraVarni ,1974.
14.Vyavaharvadi Samajshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
15. Vyavahatmak Janvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India.

ROE-075   AUTOMATION AND ROBOTICS

COURSE OBJECTIVE: *Students undergoing this course are expected to-*
1. Acquire the knowledge on advanced algebraic tools for the description of motion.
2. Develop the ability to analyze and design the motion for articulated systems.
3. Develop an ability to use software tools for analysis and design of robotic systems

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Use matrix algebra and Lie algebra for computing the kinematics of robot.
CO2: Calculate the forward kinematics and inverse kinematics of serial and parallel robots.
CO3: Calculate the Jacobian for serial and parallel robot.
CO4: Do the path planning for a robotic system.
CO5: Be proficient in the use of Maple or Matlab for the simulation of robots.

ROE-075   AUTOMATION AND ROBOTICS

Unit	Topic	Lectures
1	**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.	8
2	**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.	8
3	**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.	8
4	**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	8

	grippers. Mechanical, vacuum and magnetic grippers. Gripper force analysis and gripper design.	
5	**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.	8

Text Books and References:

1. An Introduction to Robot Technology, by CoifetChirroza, Kogan Page.

2. Robotics for Engineers, by Y. Koren, McGraw Hill.

3. Robotic: Control, Sensing, Vision and Intelligence, by Fu, McGraw Hill.

4. Introduction to Industrial Robotics, by Nagrajan, Pearson India.

5. Robotics, by J.J. Craig, Addison-Wesley.

6. Industrial Robots, by Groover, McGraw Hill.

7. Robotic Engineering - An Integrated Approach : Richard D. Klafter Thomas A.

8. Robots & Manufacturing Automation, by Asfahl, Wiley.

ROE-076 COMPUTERIZED PROCESS CONTROL

COURSE OBJECTIVE: *Students undergoing this course are expected to-*
1. Understand Basics of Computer-Aided Process Control.
2. Analyse Industrial communication System.
3. Design Process Modelling for computerized Process control.
4. Design Advanced Strategies For Computerised Process control.
5. Analyse Computerized Process Control.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Understand the Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer.

CO2: Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system.

CO3: Realize Process model, Physical model, Control Model. Modelling Procedure.

CO4: Formulate of Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.

CO5: Design Electric Oven Temperature Control, Reheat Furnace Temperature control.

ROE-076 COMPUTERIZED PROCESS CONTROL

Unit	Topic	Lectures
1	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.	8
2	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	8
3	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	8
4	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	8

5	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.	8

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", Tata McGraw Hill.

ROE-077   MODELING OF FIELD-EFFECT NANO DEVICES

COURSE OBJECTIVE: *Students undergoing this course are expected to-*
3. Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
4. Introduce the concepts of nanoscale MOS transistor and their performance characteristics.
5. Study the various nano-scaled MOS transistor circuits.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Study the MOS devices used below 10nm and beyond with an eye on the future.

CO2: Understand and study the physics behind the operation of multi-gate systems.

CO3: Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristics.

CO4: Understand and study the physics behind the Radiation effects in SOI MOSFETs.

CO5: Understand the impact of device performance on digital circuits.

	ROE-077 MODELING OF FIELD-EFFECT NANO DEVICES	
Unit	**Topic**	**Lectures**
1	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	**8**
2	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	**8**
3	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.	**8**

4	Radiation effects in SOI MOSFETs, total ionizing dose effects – single-gate SOI – multi-gate devices, single event effect, scaling effects	8
5	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.	8

Text and Reference 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.

ROE-078   QUALITY MANAGEMENT

COURSE OBJECTIVE: *Students undergoing this course are expected to-*
1. Introduce the importance of quality in improving competitiveness.
2. Understand the Implication of Quality on Business.
3. Implement Quality Implementation Programs.
4. Have exposure to challenges in Quality Improvement Programs.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Realize the importance of significance of quality.
CO2: Manage quality improvement teams.
CO3: Identify requirements of quality improvement programs.
CO4: Identify improvement areas based on cost of poor quality.
CO5: Organize for quality and development of quality culture through small group activities.

	ROE-078 QUALITY MANAGEMENT	
Unit	**Topic**	**Lectures**
1	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.	8
2	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.	8
3	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.	8
4	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	8

	results, reliability control, maintainability, zero defects, quality circle.	
5	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	**8**

Text and Reference Books:
1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
   Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

ROE-079 GIS & REMOTE SENSING

COURSE OBJECTIVE: *Students undergoing this course are expected to-*

1. Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

COURSE OUTCOME: *After completion of the course student will be able to-*

CO1: Understand about the principles of Remote Sensing and its advantages and limitations.
CO2: Retrieve the information content of remotely sensed data.
CO3: Apply problem specific remote sensing data for engineering applications.
CO4: Analyze spatial and attribute data for solving spatial problems.
CO5: Create GIS and cartographic outputs for presentation

ROE-079 GIS & REMOTE SENSING

Unit	Topic	Lectures
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	8
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation- interpretation elements;	8
3	photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	8
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	8
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	8

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

ROE 080	Human Values in Bauddha and Jain Darshan	L	T	P	C
		3	0	0	3
Version No.:	2.0 (updated as on June 12th 2019)				
Prerequisite:	RVE 301/401- Universal Human Values and Professional Ethics				
	Desirable- 10 Day Vipassana Meditation course by Shri S. N. Goenka				

Objectives:
1. To help students understand the basic principles of Bauddha and Jain Darshan
2. To help students understand the existential realities including the human existence through Bauddha and Jain Darshan
3. To help them to see the participation of human beings in the nature/ existential realities (i.e. human values) and therefore the human conduct through each one of them
4. To help students apply this understanding to make their living better at different levels- individual, family, society and nature
5. To facilitate the students in applying this understanding in their profession and lead an ethical life.

Course Outcome: On completion of this course, the students will be able to
1. Understand the basic concepts of Bauddha and Jain Darshan
2. Understand the human being, the needs and activities of human being through Bauddha and Jain Darshan
3. Understand the whole existence
4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct
5. Understand the foundation of human society and human tradition.

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 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.

Module I: Introduction to Bauddha and Jain Darshan and their Basics
Need to study Bauddha and Jain Darshan; the origin of the thsee philosophies, their basic principles and scope for further reading.

Module II: Basic Principles of Bauddha Darshan
law of impermanence (changability); four noble truths; eightfold path; law of cause- action (*pratitya-samutpaad*)
Definition of some salient words of Buddha Darshan – *nirvana, dhamma, tri- ratna(Buddha, Dharma and Sangh), pragya, karma, parmi, ashta-kalap, trishna, shad-ayatan, samvedana, vipassana, anitya, maitri, brham-vihaar, tathagata, arahant.*

Module 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, *nirvana*; root of suffering- *vikaar – raga, dvesha* and *moha,* Progam – various steps of meditation for attaining knowledge; *shamath and vipassana; sheel-samadhi-pragya; practice of equanimity (samatva),* eightfold path(Ashtang Marg); combination of understanding and practice.

Module IV: Basic Principles of Jain Darshan

Basic realities – description of nine elements in existence (*jeev, ajeev, bandh, punya, paap, aashrav, samvar, nirjara, moksha*), 6 dravya of lok – *dharma, adhrma, akash, kaal, pudgal, jeev*; tri-lakshan, various types of *pragya*, various stages of realisation; *samyak-gyan, samyak-darshan, samyak-charitra, syadvaad, anekantavaad, naya- nishchaya and vyavahar, karma-phal siddhanta*

Definition of some salient words of Jain Darshan –*arhant, jin, tirthankara, panch-parameshthi, atma, pramaan, kaal, pudgal, paramanu, kashay, leshya.*

Module 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) - *moksha*, Program- following *mahavrat, anuvrat, 10 lakshan dharma; samyak darshan-gyan-charitra.* Commonality with Bauddha Darshan

Text Books:
1. Chattejee, S.G. and Datta, D.M., "*An Introduction to Indian Philosophy*", University of Calcutta Press, 1960.

References:
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=PLPJVlVRVmhc4Z01fD57j bzycm9I6W054x (English)
8. https://www.youtube.com/watch?v=r5bud1ybBDc&list=PLY9hraHvoLQLCkl7Z2DW KMgRAWU77bKFy (Hindi)

Mode of Evaluation: Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

Open Electives for B.Tech 4th year (CBCS)		
Open Electives I (VII Semester)		
Sl. No.	Subject Code	Name of Elective(s)
1	ROE071	Modelling and Simulation of Dynamic Systems
2	ROE072	Introduction to Smart Grid
3	ROE073	Cloud computing
4	ROE074	Understanding the human being Comprehensively Human Aspiration audits fulfilment
Open Electives II (VIII Semester)		
Sl. No.	Subject Code	Name of Elective(s)
1	ROE081	Digital and Social Media Marketing
2	ROE082	Entrepreneurship Development
3	ROE083	Machine Learning
4	ROE084	Micro and Smart Systems
5	ROE085	Operations Research
6	ROE086	Renewable Energy Resources
7	ROE087	*Human Values in Madhyasth Darshan
8	ROE088	*Values, Relationship & Ethical Human Conduct-For a Happy & Harmonious Society

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 two subjects (ROE087 & ROE088) only trained Faculty (who had done the FDP for these courses) will teach the courses.

ROE081   DIGITAL AND SOCIAL MEDIA MARKETING   L T P 3 0 0

UNIT-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.

UNIT-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

UNIT-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).

UNIT-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

UNIT-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,

Text books:

1. Moutsy Maiti: Internet Mareting, 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 Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).

4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).

5. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

ROE082   ENTREPRENEURSHIP DEVELOPMENT   L T P 3 0 0

UNIT-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.
UNIT-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.
UNIT-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.
UNIT-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.
UNIT-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.

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

ROE083   MACHINE LEARNING   L T P 3 0 0

UNIT-I
INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning; THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias

UNIT-II
DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning; ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of backpropagation rule Backpropagation AlgorithmConvergence, Generalization;

UNIT-III
Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm;

UNIT-IV
Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-BASED LEARNING – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning

UNIT-V
Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules-sequential covering algorithms-General to specific beam search-FOIL; REINFORCEMENT LEARNING - The Learning Task, Q Learning.

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and
Machine Learning), The MIT Press 2004.

3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

ROE084 MICRO AND SMART SYSTEMS   L T P 3 0 0

UNIT-I
Introduction, Why miniaturization?, Microsystems versus MEMS, Why micro fabrication?, smart materials, structures and systems, integrated Microsystems, applications of smart materials and Microsystems.

UNIT-II
Micro sensors, actuators, systems and smart materials: Silicon capacitive accelerometer, piezoresistive pressure sensor, conductometric gas sensor, an electrostatic combo-drive, a magnetic microrelay, portable blood analyzer, piezoelectric inkjet print head, micromirror array for video projection, smart materials and systems.

UNIT-III
Micromachining technologies: silicon as a material for micro machining, thin film deposition, lithography, etching, silicon micromachining, specialized materials for Microsystems, advanced processes for micro fabrication.

UNIT-IV
Modeling of solids in Microsystems: Bar, beam, energy methods for elastic bodies, heterogeneous layered beams, bimorph effect, residual stress and stress gradients, poisson effect and the anticlastic curvature of beams, torsion of beams and shear stresses, dealing with large displacements, In-plane stresses, Modelling of coupled electromechanical systems: electrostatics, Coupled Electro-mechanics: statics, stability and pull-in phenomenon, dynamics. Squeezed film effects in electromechanics.

UNIT-V
Integration of micro and smart systems: integration of Microsystems and microelectronics, microsystems packaging, case studies of integrated Microsystems, case study of a smart-structure in vibration control. Scaling effects in Microsystems: scaling in: mechanical domain, electrostatic domain, magnetic domain, diffusion, effects in the optical domain, biochemical phenomena.

Text books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.

ROE085   OPERATIONS RESEARACH   L T P 3 0 0

UNIT-I   Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT-II   Transportation Problems: Types of transportation problems, mathematical models , transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.

UNIT-III Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.

UNIT-IV   Theory of Games : Rectangular games, Minimax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models.

UNIT-V   Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Text books:

1. Wayne L. Winston,"Operations Research" Thomson Learning, 2003.

2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.

3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.

4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

ROE086: RENEWABLE ENERGY RESOURCES   L T P 3 0 0

UNIT-I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

UNIT-III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

UNIT-IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT-V

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle," Renewable Energy Power For A Sustainable Future", Oxford University Press.

ROE 087	Human Values in Madhyasth Darshan	L	T	P	C
		3	0	0	3
Version No.:	2.0 (updated as on June 12th 2019				
Prerequisite:	RVE 301/401- Universal Human Values and Professional Ethics				

Objectives:
1. To help students understand the basic principles of Madhyasth Darshan
2. To help students understand the existential realities including the human existence through Madhyasth Darshan
3. To help them to see the participation of human beings in the nature/ existential realities (i.e. human values) and therefore the human conduct through each one of them
4. To help students apply this understanding to make their living better at different levels- individual, family, society and nature
5. To facilitate the students in applying this understanding in their profession and lead an ethical life

Course Outcome: On completion of this course, the students will be able to
1. Understand the basic concepts of Madhyasth Darshan
2. Understand the human being, the needs and activities of human being through Madhyasth Darshan
3. Understand the whole existence
4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct
5. Understand the foundation of human society and human tradition.

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.
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.

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.

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.

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.

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).

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.
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.

Mode of Evaluation: Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

ROE088 VALUES, RELATIONSHIP & ETHICAL HUMAN CONDUCT–FOR A HAPPY & HARMONIOUS SOCIETY   L T P 3 0 0

Pre-requisites- for this subject only those faculty will teach these courses who had done the FDP for these courses.

Course Objectives:
1. To help the students to understand the importance and types of relationship with expressions.
2. To develop the competence to think about the conceptual framework of undivided society as well as universal human order.
3. To help the students to develop the exposure for transition from current state to the undivided society and universal human order.

Course Methodology:
1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

UNIT-I	Introduction to the course: Basic aspiration of a Human Being and program for its fulfillment, Need for family and relationship for a Human Being, Human-human relationship and role of behavior in its fulfillment, Human-rest of Nature relationship and role of work in its fulfillment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order, an appraisal of the Current State, Appraisal of Efforts in this Direction in Human History.
UNIT-II	Understanding Human-Human Relationship & its fulfillment: Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfillment, Expression of feelings, Types of relationship and their purpose, mutual evaluation in relationship, Meaning of justice in relationship, Justice leading to culture, civilization and Human Conduct.
UNIT-III	Justice from family to world family order: Undivided Society as continuity and expanse of Justice in behavior – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order, Universal Human Order as continuity and expanse of order in living: from family order to world family order, a conceptual framework for universal human order.

UNIT-IV	<u>Program for Ensuring Undivided Society and Universal Human Order:</u> Education – Sanskar, Health – Sanyam, Production-work, Exchange – storage, Justice-preservation.
UNIT-V	<u>Human Tradition:</u> Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

Text books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Asthana, G. P. Bagaria (2010), Excel Books, New Delhi.
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
3. An Appeal by the Dalai Lama to the World: Ethics Are More Important Than Religion , Dalai Lama XIV, 2015.
4. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India.
5. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA.
6. Human Society, Kingsley Davis, 1949.
7. Hind Swaraj or, Indian home rule Mohandas K. Gandhi, 1909.
8. Integral Humanism, Deendayal Upadhyaya, 1965.
9. Lohiya Ke Vichar, Lok Bharti , Rammanohar Lohiya, 2008.
10. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
11. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
12. Samadhanatmak Bhautikvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India
13. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher, 1973, Blond & Briggs, UK.
14. Slow is Beautiful, Cecile Andrews (http://www.newsociety.com/Books/S/Slow-is-Beautiful)
15. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.
16. Samagra kranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
17. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi
18. Vyavaharvadi Samajshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
19. Vyavahatmak Janvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
20. The Communist Manifesto, Karl Marx, 1848.
21. Toward a True Kinship of Faiths: How the World's Religions Can Come Together Dalai Lama XIV, 2011.

Reference Videos.

1. kin school (30 minutes)
2. Technology (Solar City etc.).
3. Natural Farming.
4. Economics of Happiness (1h 8m)