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

(Electronics and Instrumentation Engineering)

On

Choice Based Credit System

[Effective from the Session: 2019-20]

EVALUATION SCHEME

B.Tech Electronics & Instrumentation Engineering, B.Tech Instrumentation & Control Engineering, B.Tech Applied Electronics & Instrumentation, B.Tech Instrumentation Engineering

YEAR 4th, SEMESTER VII

Sr. No.	Sub Code	Subject Name	Dept.	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		Open Elective-I	Other Dept.	3--0--0	70	20	10	100	3
2		Departmental Elective-III	Core Deptt.	3--0--0	70	20	10	100	3
3		Departmental Elective-IV	Core Deptt.	3--1--0	70	20	10	100	4
4	RIC701	Control System II	Core Deptt.	3--1--0	70	20	10	100	4
5	RIC702	Telemetry Principles	Core Deptt.	3--0--0	70	20	10	100	3
6	RIC751	Control System Lab - II	Core Deptt.	0--0--2	50	-	50	100	1
7	RIC752	Telemetry Lab	Core Deptt.	0--0—2	50	-	50	100	1
8	RIC753	Industrial Training Viva-Voce	Core Deptt.	0--0—3	-	-	100	100	2
9	RIC754	Mini Project	Core Deptt.	0--0--6	-	-	200	200	3
	TOTAL				450	100	450	1000	24

LIST OF DEPT. ELECTIVES:

Elective – III Departmental Elective III

1. RIC070 Optical Instrumentation
2. RIC071 Power Plant Instrumentation
3. RIC072 Voice Over IP
4. REC073 Advance Programming in Engineering

Elective – IV Departmental Elective IV

1. REC078 Computerized Process Control
2. REC076 Filter Design
3. REC077 Applied Fuzzy Electronic Systems
4. REC075 Optical Communication

EVALUATION SCHEME

B.Tech Electronics & Instrumentation Engineering, B.Tech Instrumentation & Control Engineering, B.Tech Applied Electronics & Instrumentation, B.Tech Instrumentation Engineering

YEAR 4TH , SEMESTER VIII

Sr. No	Sub Code	Subject Name	Dept.	L-T-P	Th/LAB Marks	Sessional		Subject Total	Credit
					ESE	CT	TA		
1		Open Elective-II	Other Dept.	3-0-0	70	20	10	100	3
2		Departmental Elective-V	Core Deptt.	3-1-0	70	20	10	100	4
3		Departmental Elective-VI	Core Deptt.	3-0-0	70	20	10	100	3
4	RIC851	GD & Seminar	Core Deptt.	0-0-3			100	100	2
5	RIC852	Project	Core Deptt.	0-0-12	350	-	250	600	12
	TOTAL				560	60	380	1000	24

LIST OF DEPT. ELECTIVES:

Elective –V Departmental Elective V

1. RIC080 Biomedical Signal Processing (NPTEL : https://nptel.ac.in/courses/108105101/3)
2. REC081 Analytical Instrumentation
3. REC080 Electronic Switching
4. REC082 Advance Display Technologies & Systems

Elective – VI Departmental Elective VI

1. RIC085 Biomedical Instrumentation
2. RIC086 Optimal Control Systems (NPTEL https://nptel.ac.in/courses/108105019/ & https://nptel.ac.in/courses/108107098/)
3. REC088 Micro and Smart Systems (NPTEL: https://nptel.ac.in/courses/112108092/)
4. REC087 Speech Processing

CONTROL SYSTEM II

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand the concept of sampling & signal conversion and basics of Z-Transform.
2. Analyse transfer function of system and PID controller.
3. Design state space analysis of sampled data systems.
4. Design digital controls using state space analysis.
5. Mechanize control algorithms using microprocessors.

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

CO1	Understand the concept of sampling & signal Conversion and basics of Z-Transform, and frequency–domain characteristic.
CO2	Calculate Transfer Functions, Block Diagrams, and Signal flow Graphs, Pulse Transfer Function and the Z-Transfer Function.
CO3	Realize Pulse Transfer function, State Equations for sampled Data Systems, Concepts of Controllability and Observability.
CO4	Formulate the optimal control Problem Optimal State Regulator and optimal state estimation.
CO5	Formulate Digital quantization, Microprocessor based Position Control System.

CONTROL SYSTEM II		**3 1 0**
Unit	**Topic**	**Lectures**
I	**Sampling and Signal Conversion:** Sampled-Data Control Systems, Digital to Analog Conversion, Sample and Hold operations, Sample and Hold Devices, frequency–Domain Characteristic of Zero order Hold. **The Z-Transform:** Linear Difference equations, The Pulse Response, The Definition of the Z transform, Relationship between the Laplace transform and the Z transform, Relationship between S -plane and the Z-plane, The constant Damping Loci, The constant Frequency Loci, The constant-Damping Ratio Loci, The Inverse Z-Transform, Theorems of the Z-transform, Limitations of the Z-transform, Application of the Z-transform ,Stability Analysis, Systems with Dead-Time.	**10**
II	Transfer Functions, Block Diagrams, and Signal flow Graphs The Pulse Transfer Function and The Z-Transfer Function, The Pulse Transfer Function of the Zero-Order Hold and the Relation Between G(s) and G(z), Closed loop systems, The Sampled Signal flow Graph, The Modified Z-transfer function, Multirate Discrete Data System. Transform Design of Digital Controls Design of position Servo Design Specifications, Design on the W- plane, Design of the W-plane, the Digital PID Controllers.	**10**

III	State Space Analysis of Sampled Data Systems Discrete time state equations. Similarity Transformations, The Cayley-Hamilton Theorem, Realization of Pulse Transfer function, State Equations for sampled Data Systems, Concepts of Controllability and Observability, Liapunov Stability Analysis Systems with Dead time.	**7**
IV	Design of digital controls using State Space analysis Formulation of the optimal control Problem Optimal State Regulator, Use of State Regulator results, Eigen value Assignment by State feedback, State observers Stochastic optimal State Estimation.	**6**
V	Mechanization of Control algorithms Using Micro Processors General Description of Microcontrollers, Digital quantization, Microprocessor based Position Control System.	**7**

Text Books:

1. M. Gopal, "Digital Control Engineering", New Age International Publishers.
2. B.C. Kuo,"Digital Control Systems", Oxford University Press.

Reference Books:

1. Venkatesh & Rao, "Control Systems", Cengage

TELEMETRY PRINCIPLES

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems.
2. Analyze Frequency Division Multiplex System- FDM, IRIG Standards, FM circuits, Phase Modulation Circuits.
3. Design Modems.
4. Design Transmitter and Receiver.
5. Analyse Filters.

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

CO1	Understand the concept of Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems, Frequency Telemetering, Power line carrier communication.
CO2	Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system.
CO3	Realize Modems & modem protocol.
CO4	Formulate Transmission Techniques, Inter stage Coupling, Receiver Antennas: The Ideal structure, dipoles.
CO5	Design Active RC Filters, Universal Filter Circuits, Switched Capacitor Filters, Digital Filters Basics of Satellite and Fiber Optic.

TELEMETRY PRINCIPLES		**3 0 0**
Unit	**Topic**	**Lectures**
I	Introduction to Telemetry Principles: Basic System, Classification, Non electrical telemetry systems, Voltage and current Telemetry systems, Frequency Telemetering, Power line carrier Communication.	**4**
II	Multiplexed System: Frequency Division Multiplex System- FDM, IRIG Standards, FM circuits, Phase Modulation Circuits, Receiving end, Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system, PAM/ PM systems, TDM-PCM System, Digital Multiplexer, PCM Reception, Coding for varying level, DPCM, Standards.	**10**
III	Modems: Modems Introduction, QAM, modem protocol.	**4**
IV	Transmitter and Receiver: Transmitters, Transmission Techniques, Inter stage Coupling, Receiver Antennas: The Ideal structure, dipoles, arrays, current distribution and design consideration, Microwave Antennas.	**10**
V	Filters: Polynomial, Filters, Active RC Filters, Universal Filter Circuits, Switched Capacitor Filters, Digital Filters Basics of Satellite and Fiber Optic Telemetry Data Acquisition Systems (DAS), µP based DAS, Remote Control	**12**

Text Books:

1. D Patranabis, Telemetry Principle; TMH Ed 1 1999.

CONTROL SYSTEM LAB II

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand Discrete Time LTI model.
2. Evaluate digital DC motor speed control with PID controller.
3. Design Lead & Lag Compensators and Kalman Filter design.
4. Write a Matlab Program to find
    a. LTI characteristics
    b. PID control response
5. Write a program to check for controllability and observability for the second order system.

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

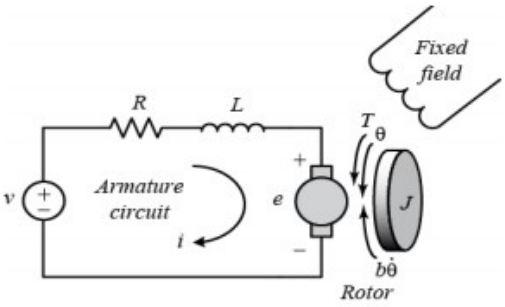
CO1	Understand the Discrete Time LTI model.
CO2	Design Discrete pole locations & transients response.
CO3	Evaluate Digital DC motor Speed control with PID controller.
CO4	Design Lead & Lag Compensators, and Kalman Filter design.
CO5	Perform State space design for the Inverted pendulum and Consider modelling of DC Motor.

CONTROL SYSTEM LAB II

1. Discrete Time LTI model.
2. Discrete pole locations & transients response

   Small damping ($\varepsilon = 0.1\ W_n = 4\pi/5T$) Medium damping ($\varepsilon = 0.4\ W_n = 11\ \pi\ /5T$)

   Large damping ($\varepsilon = 0.8\ W_n = \pi\ /4T$)
3. Digital DC motor Speed control with PID controller.
4. Designing Lead & Lag Compensators.
5. Kalman Filter design.
6. State space design for the Inverted pendulum.
7. Consider modelling of DC Motor shown in figure.



The motor Physical Parameters are

(J)	Moment of inertia of the rotor	0.01 $kg.m^2$
(b)	Motor viscous friction constant	0.1 N.m.s
(Ke)	Electromotive force constant	0.01 V/rad/sec
(Kt)	Motor torque constant	0.01 N.m/Amp
(R)	Electric resistance	1 Ohm
(L)	Electric inductance	0.5 H

and the design requirements are

i. Settling time less than 2 seconds
ii. Overshoot less than 5%
iii. Steady-state error less than 1%

Write a Matlab Program to find

a) LTI characteristics
b) PID control response

8. Write a program to check for controllability and observability for the second order system.
9. Write a MATLAB program to compute and display the poles and zeros, to compute and display the factored form, and to generate the pole-zero plot of a z-transform that is a ratio of two polynomials in z^{-1} . Using this program, Find and plot the poles and zeroes of G(z) .Also Find the radius of the resulting poles.
10. To design feedback and feedforward compensators to regulate the temperature of a chemical reactor through a heat exchanger.

TELEMETRY LAB

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Measure Temperature Using RTD/ Thermister and amplification to an appropriate level suitable for Tele transmission.
2. Realize PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems.
3. Understand Manchester coding & decoding (Biphase L) of NRZ-L Data AND Coding and decoding NRZ-L into URL-L (Unipolar return to Zero coding.)
4. Analyze ASK FSK PSK– Modulation and Detection.
5. Analyze Error, Detect Error & Correct it using Hamming Code.

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

CO1	Understand Measurement of Temperature Using RTD/ Thermister and amplification to an appropriate level suitable for Tele transmission
CO2	Realize PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems
CO3	Analyse Manchester coding & decoding (Biphase L) of NRZ-L Data AND Coding and decoding NRZ-L into URL-L (Unipolar return to Zero coding
CO4	Learn ASK FSK PSK– Modulation and Detection
CO5	Analyze Error introduction, Error Detection & Correction using Hamming Code

TELEMETRY LAB

Minimum of 10 experiments to be performed.

1. Measurement of Temperature Using RTD/ Thermister and amplification to an appropriate level suitable for Tele transmission.
2. Sampling through a S/H Circuit and reconstruction of the sampled signal. Observe the effect of sampling rate & the width of the sampling pulses.
3. Realization of PCM signal using ADC and reconstruction using DAC using 4-bit/8 bit systems. Observe the Quantization noise in each case.
4. Fabricate and test a PRBS Generator.
5. Realization of data in different formats such as NRZ-L, NRZ-M and NRZ-S.
6. Clock recovery circuit from NRZ-L data using PLL.
7. Manchester coding & decoding (Biphase L) of NRZ-L Data.

8. Coding and decoding NRZ-L into URL-L (Unipolar return to Zero coding).
9. ASK – Modulation and Detection.
10. FSK – Modulation and Detection.
11. PSK - Modulation and Detection.
12. Error introduction, Error Detection & Correction using Hamming Code.
13. Amplitude modulation and Detection of signal obtained from experiment no.1

DEPARTMENT ELECTIVES - III

OPTICAL INSTRUMENTATION

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand Light Sources, Transmitting and Receiving .
2. Analyse Opto –Electronic devices and Optical Components
3. Design Interferometry
4. Learn Holography.
5. Analyse Fiber optic fundamentals and Measurements.

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

CO1	Understand the Concept of Light, Classification of different phenomenon based on theories of light, Basic light sources and its Characterization, Polarization Computer.
CO2	Design Photo diode, PIN, Photo-Conductors, Solar cells, ,Phototransistors, Materials used to fabricate LEDs and Lasers
CO3	Realize Interference effect, Radio-metry, types of interference phenomenon and its Application, Michelson's Interferometer and its application
CO4	Aware of Principle of Holography, On-axis and Off axis Holography, Application of Holography, Optical data storage. Optical Fiber Sensors
CO5	Understand Fundamental of Fibers, Fiber Optic Communication system, Optical Time domain Reflectometer (OTDR)

OPTICAL INSTRUMENTATION		**3 0 0**
Unit	**Topic**	**Lectures**
I	Light Sourcing, Transmitting and Receiving Concept of Light, Classification of different phenomenon based on theories of light, Basic light sources and its Characterization, Polarization , Coherent and Incoherent sources, Grating theory, Application of diffraction grating, Electro - optic effect, Acousto-optic effect and Magneto-optic effect	**8**
II	Opto –Electronic devices and Optical Components Photo diode, PIN, Photo-Conductors, Solar cells, ,Phototransistors, Materials used to fabricate LEDs and Lasers Design of LED for Optical communication, Response times of LEDs ,LED drive circuitry, Lasers Classification :Ruby lasers, Neodymium Lasers, He- Ne Lasers, CO2 Lasers, Dye Lasers, Semiconductors Lasers, Lasers Application	**8**

III	Interferometry Interference effect, Radio-metry, types of interference phenomenon and its Application, Michelson's Interferometer and its application Fabry-perot interferometer, Refractometer, Rayleigh's interferometers, Spectrographs and Monochromators, Spectrophotometers, Calorimeters, Medical Optical Instrument	**8**
IV	Holography: Principle of Holography, On-axis and Off axis Holography, Application of Holography, Optical data storage. Optical Fiber Sensors: Active and passive optical fiber sensor, Intensity modulated, displacement type sensors, Multimode active optical fiber sensor (Micro bend sensor)Single Mode fiber sensor -Phase Modulates and polarization sensors	**8**
V	Fiber optic fundamentals and Measurements: Fundamental of Fibers, Fiber Optic Communication system, Optical Time domain Reflectometer (OTDR), Time domain dispersion measurement, Frequency Domain dispersion measurement, Laser Doppler velocity meter.	**8**

Text Books:

1. J. Wilson & J. F. B. Hawkes, "Optoelectronics: An Introduction" PHI/ Pearson
2. Rajpal S. Sirohi "Wave Optics and its Application", Hyderabad, Orient longman Ltd.
3. A. Yariv, "Optical Electronics", C. B. S. Collage Publishing, New York, 1985.

Reference Books:

1. G. Hebbar, "Optical Fiber Communication", Cengage

POWER PLANT INSTRUMENTATION

COURSE OBJECTIVE:

1. To create awareness of energy resources and its scenario in India.
2. To study the concept of power generation using various resources.
3. To study the role of Instrumentation in power plants.
4. To study and compare various power plants for optimal performance.

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

CO1	Understand the renewable and Non-renewable energy resources
CO2	Known Method of power generation, layout and energy conversion process, Types of Turbines & control.
CO3	Understand Hydroelectric Power Plant- Site selection, Hydrology, Estimation electric power to be developed, classification of Hydropower plants
CO4	Be aware of Wind Energy and Solar Energy
CO5	Understand Nuclear power generation, control station and reactor control. Comparison of various plants

POWER PLANT INSTRUMENTATION		**3 0 0**
Unit	**Topic**	**Lectures**
I	Energy sources, their availability, worldwide energy production, energy scenario of India. Introduction to Power generation- Classification: Renewable and non-renewable energy generation resources. Renewable: small hydro; modern biomass; wind power; solar; geothermal and bio-fuels. Non-renewable: fossil fuels (coal, oil and natural gas) and nuclear power. Boiler: Types of boilers, boiler safety standards. Boiler instrumentation, control and optimization, combustion control, air to fuel ratio control, three element drum level control, steam temperature and pressure control, boiler interlocks, sequence event recorder, data acquisition systems	**8**
II	Thermal Power Plant- Method of power generation, layout and energy conversion process, Types of Turbines & control, Types of Generators, condensers. Types of pumps and Fans, variable speed pumps and Fans, Material handling system, study of all loops-water, steam, fuel etc.	**8**

III	Hydroelectric Power Plant- Site selection, Hydrology, Estimation electric power to be developed, classification of Hydropower plants, Types of Turbines for hydroelectric power plant, pumped storage plants, storage reservoir plants	**8**
IV	Wind Energy: Power in wind, Conversion of wind power, Aerodynamics of wind turbine, types of wind turbine, and modes of operation, power control of wind turbines, Betz limit, Pitch & Yaw control, wind mill, wind pumps, wind farms, different generator protections, data recording, trend analysis, troubleshooting & safety. Solar Energy: solar resource, solar energy conversion systems: Solar PV technology: Block diagram of PV system, advantages and limitations. Solar thermal energy system: Principle, solar collector and its types, solar concentrator and its types, safety	**8**
V	Nuclear Power Plant: Nuclear power generation, control station and reactor control. Comparison of various plants: Comparison of thermal power plant, hydroelectric power plant, wind, solar, nuclear power plant on the basis of: Performance, efficiency, site selection, Economics-capital and running, safety standards, pollution, effluent management and handling. Power plant safety, Pollution monitoring, control Sound, Air, smoke, dust, study of Electrostatic precipitator	**8**

Text Books:

1. G.F. Gilman, "Boiler Control Systems Engineering", ISA Publication.
2. P. K. Nag, "Power Plant Engineering", McGraw Hill.

Reference Books:

1. B. H. Khan, "Non-conventional Energy Resources", McGraw Hill.
2. Chetan Singh Solanki, "Renewable Energy Technology", Prentice Hall Publication.
3. S. P. Sukhatme, "Solar Energy", Tata McGraw Hill.
4. G. D. Rai, "Nonconventional Energy Sources", Khanna Publication.

VOICE OVER IP

COURSE OBJECTIVE: Students undergoing this course are expected to :

1. Understand the basic principle of VoIP.
2. Understand the different signaling protocols.
3. Learn about how to improve the quality of service (VoIP).

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

CO1	Understand the characteristics of the Call signaling systems.
CO2	Design SIP Architecture.
CO3	Model and estimate media gateways.
CO4	Understand the network synchronization and management.
CO5	Evaluate the quality of service the need for QoS.

VOICE OVER IP		**3 0 0**
Unit	**Topic**	**Lectures**
I	**Introduction:** Carrier-Grade, VoIP, VoIP Challenges, Overview of the IP Protocol Suite, The Internet Protocol, IP Version 6, IP Multicast, The Transmission Control Protocol, The User Datagram Protocol, The Stream Control Transmission Protocol, The Real-Time Transport Protocol, The RTP Control Protocol, Security and Performance Optimization. **Speech-Coding Techniques** A Little about Speech, Audio, and Music, Voice Sampling, Voice Quality, Types of Speech Coders, Waveform Coders, Analysis-by-Synthesis Codecs, G.722–Wideband Audio	**8**
II	**Signalling Protocols:** H.323: Multimedia Conferencing over IP The H.323 Architecture, RAS Signalling, Call Signalling, Call Scenarios, H.245 Control Signalling, Conference Calls, Securing an H.323 Network. **The Session Initiation Protocol** The SIP Architecture, Overview of SIP Messaging Syntax, Examples of SIP Message Sequences, Redirect and Proxy Servers, The Session Description Protocol, Usage of SDP with SIP, SIP Extensions and Enhancements, Usage of SIP for Features and Services, Interworking.	**8**
III	**Distributed Gateways and the Softswitch Architecture** Separation of Media and Call Control, Softswitch Architecture, Protocol Requirements for Controlling Media Gateways, Protocols for Controlling Media Gateways, MGCP, MEGACOP/H.248.1.	**8**

IV	**VoIP and SS7** The SS7 Protocol Suite, SS7 Network Architecture, ISUP, Performance Requirements for SS7, SIGTRAN, Interworking SS7 and VoIP Architectures	**8**
V	**Quality of Service** The Need for QoS, Overview of QoS Solutions, The Resource Reservation Protocol, DiffServ, Multiprotocol Label Switching, Combining QoS Solutions.	**8**

Text Books:

1. Richard Swale, Daniel Collins," Carrier-Grade VoIP", McGraw-Hill Education 3rd Edition,2014.
2. Olivier Hersent, Jean Pierre Petit, David Gurle, "IP Telephony – Deploying Voice Over IP Protocols", John Wiley & Sons Ltd, 2005

ADVANCE PROGRAMMING IN ENGINEERING

COURSE OBJECTIVE: Students undergoing this course are expected:

1. To understand interactive computation techniques and learn algorithm development in Matlab.
2. To apply Matlab programming skills in communication engineering applications.
3. To apply Matlab programming skills in control system applications.
4. To apply Matlab application in neural networks and fuzzy logic.
5. To apply Matlab programming skills in digital signal processing applications.

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

CO1	Understand the fundamentals of Matlab programming as well as understand and apply advance level programming techniques for solving problems using numerical methods.
CO2	Learn, apply, and investigate Matlab applications in advance communication systems.
CO3	Apply and investigate stability of systems and processes using time domain and frequency domain stability criterions like Routh-Hurwitz, State-space representation, Bode plots and Root Locus techniques.
CO4	Learn, apply, and investigate Matlab applications in neural networks and fuzzy logic.
CO5	Learn, apply, and investigate Matlab applications in digital signal processing including multi-rate DSP algorithms.

ADVANCE PROGRAMMING IN ENGINEERING		**3 0 0**
Unit	**Topics**	**Lectures**
I	Introduction of MATLAB, MATLAB fundamental, Interactive Computation: Logical vectors, logical operations, logical functions, Matrix and Arrays, matrices, matrix operations, MATLAB Graphics: Basics 2-D plots, 3-D plots, handle graphics, Saving and printing graphs, Linear equations. Loops, Error and Pitfalls. Program design and algorithm development, MATLAB scripts and functions and data import-export utilities.	8
II	MATLAB Applications in Communication Systems: Introduction, Generation and detection of AM, FM, and PM signals, Sampling of signals, Pulse modulation techniques (PAM, PWM, PPM), PCM, Digital modulation techniques (ASK, PSK, FSK, M-ary), OFDM, Spread-spectrum techniques	8
III	MATLAB Applications in control system: Introduction, Laplace and Inverse Laplace Transform, Transfer function, Zero, Poles and Pole – Zero map of a transfer function, State-Space representation, series/cascade, parallel and feedback Connections, Time response of control systems Routh Hurwitz Criteria. Root Locus, Frequency response Representation: Bode plots, Gain	8

	Margin, Phase Margin, Polar Plot, Nyquist Plot.	
IV	MATLAB Application in Neural Networks: Introduction, salient features of artificial neural networks, ANN Architectures, Application using multilayer perceptron, ANN based control. MATLAB Application in Fuzzy Logic Systems: Introduction, Linguistic variables and membership functions, fuzzy operations, rule matrix, fuzzy inference systems, washing machine problem, fuzzy controller example (Water Bath).	8
V	MATLAB Application in Digital Signal Processing: Introduction, signal and systems classification, operations on discrete-time signals, Multirate signal processing functions, convolution, Z- Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete Cosine Transform, Digital Filtrer Design.	8

Text Books:

1. Raj Kumar Bansal, Ashok Kumar Goel and Manoj Kumar Sharma, "MATLAB and its Applications in Engineering ", Pearson 14th impression,2014.
2. Brian H. Hahn and Daniel T. Valentine, "Essential MATLAB for Engineering and Scientists", Academic Press, Elsevier, 5th edition, 2013.
3. Rudra Pratap, "MATLAB- A quick introduction for Scientists and Engineers", Oxford University Press, 2013.
4. www.mathworks.com

DEPARTMENT ELECTIVES - IV

COMPUTERISED 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.

COMPUTERISED PROCESS CONTROL		**3 1 0**
Unit	**Topic**	**Lectures**
I	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer –Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces.	**8**
II	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System	**8**
III	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation	**8**
IV	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	**8**

V	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	**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.

FILTER DESIGN

COURSE OBJECTIVE: Students undergoing this course are expected to :

1. Understand about the characteristics of different filters.
2. Understand the concept of Approximation Theory.
3. Learn about the switched capacitor filter.

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

CO1	Choose an appropriate transform for the given signal.
CO2	Choose appropriate decimation and interpolation factors for high performance filters.
CO3	Model and design an AR system.
CO4	Implement filter algorithms on a given DSP processor platform.

FILTER DESIGN		**3 1 0**
Unit	**Topic**	**Lectures**
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulation and modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	8
II	First order filter: Bilinear transfer functions and frequency response – Bilinear transfer function and its parts, realization of passive elements, Bode plots, Active realization, The effect of A(s), cascade design.	8
III	Second order low pass and band pass filters: Design parameters, Second order circuit, frequency response of low pass and band pass circuits, Integrators and others biquads.	8
IV	Second order filters with arbitrary transmission zeros: By using summing, By voltage feed forward, cascade design revisited. Low pass filters with maximally flat magnitude: the ideal low pass filter, Butterworth response, Butterworth pole locations, low pass filter specifications, arbitrary transmission zeros.	8
V	Low pass filter with equal ripple (Chebyshev) magnitude response: The chebyshev polynomial ,The chebyshev magnitude response, Location of chebyshev poles, Comparison of maximally flat & equal–ripple responses, Chebyshev filter design Inverse chebyshev and cauer filters: Inverse chebyshev response, From specifications to pole and zero locations, Cauer magnitude response, Chebyshev rational functions, Cauer filter design	8

Text Books:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, “Analog Filter Design”, 2nd Indian Edition, Oxford University Press.

Reference Books:

1. J. Michael Jacob ,”Applications and Design with Analog Integrated Circuits”, Second edition, PHI learning.

2. T. Deliyannis, Yichuang Sun, J.K. Fidler, “Continuous-Time Active Filter Design”, CRC Press.

APPLIED FUZZY ELECTRONIC SYSTEMS

COURSE OBJECTIVE : Students undergoing this course are expected to:

1. Understand Fuzzy Sets, Possibility Distributions.
2. Analyse Fuzzy Rule.
3. Be aware of uncertainty in information.
4. To learn Approximate method of Extension.
5. Analysis Fuzzy Logic in Control Engineering.

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

CO1	Understand the Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory.
CO2	Design Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models.
CO3	Realize Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties.
CO4	Be aware of Principle of Vertex Method, DSW Algorithm, and Restricted DSW Algorithm and their comparison, Classical Predicate Logic; Fuzzy Logic.
CO5	Understand Fundamental Issues in Control Engineering, Control Design Process, Semiformal Aspects of Design Process, Mamdani Architecture of Fuzzy Control, The Sugeno-Takagi Architecture.

APPLIED FUZZY ELECTRONIC SYSTEMS		**3 1 0**
Unit	**Topic**	**Lectures**
I	History of Fuzzy Logic, Fuzzy Sets, Possibility Distributions, Fuzzy Rules, Fuzzy Sets, Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory, Fuzzy Relations and their Compositions, Fuzzy Graphs, Fuzzy Numbers, Functions with Fuzzy Arguments, Arithmetic Operations of Fuzzy Numbers.	**8**
II	Fuzzy Rules: Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models: Mamdani Model, TSK Model, Standard Additive Model, Fuzzy Implications and Approximate Reasoning: Propositional Logic, First Order Predicate Calculus, Fuzzy Implications Approximate Reasoning, Criteria and Family of Fuzzy Implications, Possibility vs. Probability, Probability of Fuzzy Event, Probabilistic Interpretations of Fuzzy Sets, Fuzzy Measure.	**8**

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** 3	**T** 0	**P** 0	**C** 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 1^{st} order system and 2^{nd} order system, performance measures for 2^{nd} order system, system transfer function, transfer function of 1^{st} and 2^{nd} order system Block diagram algebra, signal flow diagram, state variable formulation, frequency response and bode plots.	**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.

ROE- 074 Understanding the Human Being Comprehensively–Human Aspirations and its Fulfillment		
Unit	**Topic**	**Lectures**
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 – Evaluvation 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** 3	**T** 0	**P** 0	**C** 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=PLPJVlVRVmhc4Z01fD57jbzycm9I6W054x (English)
8. https://www.youtube.com/watch?v=r5bud1ybBDc&list=PLY9hraHvoLQLCkl7Z2DWKMgRAWU77bKFy (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	Program for Ensuring Undivided Society and Universal Human Order: Education – Sanskar, Health – Sanyam, Production-work, Exchange – storage, Justice-preservation.
UNIT-V	Human Tradition: 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.
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1. kin school (30 minutes)
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