

# **INSTITUTE OF ENGINEERING 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**

**(Civil Engineering)**

**On**

**Choice Based Credit System**

**[Effective from the Session: 2019-20]**

## SEVENTH SEMESTER

## CIVIL ENGINEERING

## SESSION 2019-20

S. No.	Subject Code	Subject Name	Department	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		Open Elective Course-1	Other Deptt.	3---0---0	70	20	10	100	3
2	RCE071	<b>Elective -3</b> Geology and Soil Mechanics	Core Deptt.	3---0---0	70	20	10	100	3
	RCE072	Rural Development Engineering							
	RCE073	Structural Health Monitoring & Rehabilitation							
	RCE074	River Engineering							
3	RCE075	<b>Elective -4</b> Computational Fluid Dynamics	Core Deptt.	3---1---0	70	20	10	100	4
	RCE076	Railways, Airport & Water Ways							
	RCE077	Air & Noise Pollution Control							
	RCE078	Ground Improvement Techniques							
4	RCE701	Design of Structure-III	Core Deptt.	3---1---0	70	20	10	100	4
5	RCE702	Water Resources	Core Deptt.	3---0---0	70	20	10	100	3
6	RCE751	Non Destructive Testing Laboratory	Core Deptt.	0---0---2	50		50	100	1
7	RCE752	Mini Project	Core Deptt.	0---0---2	50		50	100	1
8	RCE753	Industrial Training	Core Deptt.	0---0---3			100	100	2
9	RCE754	Project-1	Core Deptt.	0---0---6			200	200	3
	<b>TOTAL</b>				<b>450</b>	<b>100</b>		<b>1000</b>	<b>24</b>

**Industrial Training:** Industrial Training 1 (completed after IVth sem) & 2 (completed after VIth sem) is to be evaluated in VII semester.

**Project-1:** Students will initiate Project work in VII semester as Project -1 and the same will be completed in VIII semester as Project-2.

**Evaluation of Project-1 should be based on the progress reported by the student and certified by the supervisor.**

## **RCE701 Design of Structure-III**

**(L-T-P 3-1-0)**

**Credit – 4**

**NOTE: All design are to be carried as per IS:800-2007**

**UNIT - I** Introduction to steel structures. Advantages and Disadvantages of Steel as a Structural Material. Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements. Introduction to Limit State Design Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design. **[8]**

**UNIT - II** Introduction to Riveted, Bolted and Pinned Connections, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Design of eccentric bolted connections . Simple Welded Connections, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections. **[8]**

**UNIT – III** Introduction to Tension Members, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio ( $\lambda$ ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate. **[8]**

**UNIT – IV** Introduction to Compression Members, Effective Length, Slenderness Ratio ( $\lambda$ ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases. **[8]**

**UNIT – V** Introduction to Beams, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder , Introduction to Gantry Girder. **[8]**

### **Text Books**

1. Design of Steel Structures by N. Subramanian, Oxford University Press
2. Limit State Design of Steel Structures by S. K. Duggal, Tata Mcgraw Hill.
3. Design of Steel Structures by K S Sairam, Pearson Education
4. Design of Steel Structures by S Ramamurtham, DhanpatRai Publishing Company.

Reference Books

1. Steel Structures by Robert Englekirk. Hohn Wiley & sons inc.
2. Structural Steel Design by Lambert tall (Ronald Press Comp. Newyork.
3. Design of steel structures by Willam T Segui , CENGAGE Learning
4. Structural Steel Design By D MacLaughlin, CENGAGE Learning

## **RCE702 Water Resources**

**(L-T-P 3-0-0) Credit - 3**

**UNIT – I** Hydrology: Hydrological Cycle and its components; Water Budget Equation, Precipitation: Types, measurements and analysis, Evaporation and consumptive use: estimation and measurement techniques.

Irrigation: Necessity and types, Advantages & disadvantages of irrigation; Functions of water in plant growth, Methods of Irrigation, Water requirement of crops, Duty and Delta relationship; Irrigation frequency; Irrigation efficiencies; Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Command area, curves in channels, channel losses.

Introduction to Sediment Transportation: Suspended and Bed load and its estimation **[8]**

**UNIT – II** Irrigation channels and Design: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area statistics and channel dimensions, cross sections of an Irrigation channel,

Lining of Irrigation Canals: Advantages and types; factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging and Drainage Design: effects, causes and anti-water logging measures, Drainage of water logged land. **[8]**

**UNIT – III** Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects

Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion

River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge.

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification; Introduction to design principle of falls, Design of Sarda type and straight glacis fall.

Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars [8]

**UNIT – IV** Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types; Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. [8]

**UNIT – V** Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure, Phreatic line, and its determination Introduction to stability analysis

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential in reference to India, classification of power plants, important terms, types of turbines and their suitability; Power House layout and important structures of a powerhouse. [8]

### **Text Books**

1. Water Resources Engg. By Larry W Mays, John Wiley India
2. Water resources Engg. By Wurbs and James, John wiley India
3. Water Resources Engg. By R.K. Linsley, McGraw Hill
4. Irrigation and Water Resources Engg. By G L Asawa, New age International Publishers
5. Irrigation Engg. and Hydraulic Structures by S.K. Garg, Khanna Publishers.

### **References**

1. Fundamental of Hydraulic Engineering System by Houghalen, Pearson Publication.
2. Irrigation and water Power engineering by B.C. Punmia, Laxmi Publications.
3. Engineering Hydrology by K. Subramanya, TMH.
4. Irrigation Water Power and Water Resource Engg. by K.R. Arrora.
5. Water resource engineering by Ralph A. Wurbs & Wesley P. James, Pearson Publication.

## **RCE071 Geology and Soil Mechanics**

**(L-T-P 3-0-0) Credit - 3**

**UNIT- I** Minerals : Their physical and detailed study of certain rock forming minerals.

Rocks structure of earth and formation of rocks. Texture and classification of rocks. Engineering properties, weathering and suitability of rocks as Engg. materials. **[8]**

**UNIT- II** Stratification and Lamination bedding of rocks. Dip and strike of bed.

Rock deformation : Folds, Faults, joints unconformity and their classification, causes and relation to engg. behaviour of rock masses. **[8]**

**UNIT- III** Earthquake, its causes, classification, seismic zones of India and geological consideration for construction of building, projects in seismic areas.

Landslides: Causes, classification and preventive measures. **[8]**

**UNIT –IV** Geological investigations for site selection of dams, reservoirs tunnels, bridges and highways.

Principles of geophysical explorations methods for subsurface structures. **[8]**

**UNIT- V** Clay Mineralogy, index properties of soil, IS classification of soil, shear strength of soil, Effective stresses in soil, stress in soil (Boussiensq, Westergaard theories) & Earth pressure theories and their application. **[8]**

### **REFERENCES:**

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, “Soil Mechanics & Foundation Engineering”, John Wiley & Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.
4. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
5. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
6. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics.
7. J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.
8. Prabin Singh : Engg. and General Geology, Katson Publishing House
9. F G Bell : Funamentals of Engineering Geology , B S Publication
10. P.K. Mukerjee : A text Book of Geology, Calcutta Word Publishers.

## **RCE072 Rural Development Engineering**

**(L-T-P 3-0-0) Credit - 3**

**UNIT- I** Rural Development Planning and Concept of Appropriate Technology: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development programme/ projects. **[8]**

**UNIT- II** Rural Housing: Low cost construction materials for housing; Architectural considerations for individual and group housing; Composite material - ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction of: non-erodable mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units, Earthquake resistant measures for low cost houses. **[8]**

**UNIT- III** Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment-low cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, low cost waste disposal systems; septic tank ; Biogas technology; low cost community & individual Garbage disposal systems, Ferro-cement water storage tanks. **[8]**

**UNIT- IV** Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Flyash and Cement Treated Course. Crusher-run-Macadam. Use of local materials. Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing for Rural Road. **[8]**

**UNIT- V** Low Cost Irrigation: Consideration of low cost irrigation techniques , drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures **[8]**

### **Reference Books:**

1. A.G.Madhov Rao, D.S.Ramachandra Murthy, Appropriate Technologies for low cost Housing Oxfordand IBH Publishing Co. Pvt .Ltd.
2. CBRI, Roorkee, Advances in Building Mat erials and Construction.
3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures. Wiley Eastern Ltd.,
4. Document on Rural Road Development in India Volume1& 2; Central Road Research Institute, New Delhi.
5. Water supply and sanitary engineering by Rangwala, .Charotar publication
6. Rural Infrastructure by P.Nair, SBS Publication
7. Rural Infrastructure by Samalia Bihari Verma, Gyaneshwar Prasad & Sahib Kumari Singh, Sarup & Sons.
8. Rural Development by Katar Singh, SAGE Publication

9. Information and Communication Technology for Agriculture and rural development by R. Saravanan, New India Publishing agency

### **RCE073 Structural Health Monitoring & Rehabilitation (L-T-P 3-0-0) Credit - 3**

**UNIT - I Maintenance:** Repair and rehabilitation, facts of maintenance, importance of maintenance various aspects of inspection, assessment procedure for evaluating damaged structure, causes of deterioration.

**Repair Strategies:** Causes of distress in concrete structures, construction and design failures, condition assessment and distress-diagnostic techniques, assessment procedure for inspection and evaluating a damaged structure. [8]

**UNIT - II Serviceability and Durability of Concrete:** Quality assurance for concrete construction, concrete properties – strength, permeability, thermal properties and cracking. effects due to climate, temperature, chemicals, corrosion. [8]

**UNIT - III Materials and Techniques for Repair:** Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fibre reinforced concrete, bacterial concrete, rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. [8]

**UNIT - IV Repair, Rehabilitation and Retrofitting Techniques:** Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

**Repair of structure:** Common types of repairs, repair in concrete structures, repairs in under water structures.

**Strengthening of Structures:** Strengthening Methods, retrofitting, jacketing. [8]

**UNIT – V Health Monitoring and Demolition Techniques:** Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, use of sensors for building instrumentation. [8]

#### **Suggested Reading:**

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildings, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.



5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B .
- 7 .Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.,
8. Jackson, N., Civil Engineering Materials, ELBS, 1983.

## **RCE074 RIVER ENGINEERING**

**(L-T-P 3-0-0) Credit - 3**

**UNIT– I** Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes. **[8]**

**UNIT –II** Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control. **[8]**

**UNIT-III** Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration. **[8]**

**UNIT-IV** Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. **[8]**

**UNIT-V** River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works. **[8]**

### **Text book:**

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson
4. Principles of River Engineering by ( the non tidel alluvial) PH Jameen

## **RCE075 Computational Fluid Dynamics**

**(L-T-P 3-1-0) Credit - 4**

**UNIT-I** Introduction to Computational Fluid Dynamics, Basic concepts of CFD: Finite difference approximations, Consistency, stability and convergence. **[8]**

**UNIT-II** Derivation of equations governing fluid flow, Equations for incompressible flow and boundary conditions. **[8]**

**UNIT - III** Fundamentals of discretization, finite Volume approach and discretization of unsteady-state problems. Classification calculation of flow in a rectangular duct ,Calculation of fully developed flow in a triangular duct. **[8]**

**UNIT- IV** Solution of Navier Stokes equations for compressible flows and incompressible flows, solution of linear algebraic equations: basic methods and advanced methods. **[8]**

**UNIT-V** Basics of finite volume method including grid generation, Turbulent flows and turbulence modelling. **[8]**

**REFERENCES:**

- 1.Ferziger J.H. & Peric M. (1999) Computational Methods for Fluid Dynamics, Springer, Berlin, Germany.
- 2.Hirsch C. (1988) Numerical Computation of Internal and External Flows, John Wiley & Sons, New York, USA.
- 3.Patankar S.V. (1980) Numerical Heat Transfer and Fluid Flow, Hemisphere, Washington D.C., USA.
- 4.Versteeg H.K. & Malalsekera W. (1995) An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Longman Scientific & Technical, Harlow, Essex, UK.
- 5.Anderson J.D. (1995) Computational Fluid Dynamics: The Basics with Applications,McGraw-Hill, Inc.
- 6.John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor &Francis.
7. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press.

**RCE076 Railways, Airport & Water Ways**

**(L-T-P 3-1-0) Credit - 4**

**UNIT –I** Introduction to Permanent Way and its Components: History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications. **[8]**

**UNIT-II** Track Geometrics, Turnouts and Crossings, Stations and Yards: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning.

**[8]**

**UNIT –III** Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas. **[8]**

**UNIT – IV** Introduction to Airport Engineering Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment. **[8]**

**UNIT – V** Water Transport Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses. Inland waterways: advantages and disadvantages; Development in India. Inland water operation. **[8]**

#### **Text Books**

1. A Text Book of Railway Engineering by S. P. Arora & S. C. Saxena
2. Railway Engineering by M. M. Aggrawal.

#### **References**

1. Railway Engineering by Rangwala (Charotar Publishing House).
2. Airport Engineering by Rangwala (Charotar Publishing House).
3. Airport Planning & Design by Khanna , Arora & Jain Nem Chand & Brothers).
4. Docs & Harbour Engineering by Bindra (Dhanpat Rai Publishing Company).
5. Docs & Harbour Engineering by Rangwala (Charotar Publishing House).
6. Docs & Harbour Engineering by Oza (Charotar Publishing House).

### **RCE077 Air & Noise Pollution Control**

**(L-T-P 3-1-0) Credit - 4**

**UNIT- I** Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants. **[8]**

**UNIT - II** Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. **[8]**

**UNIT - III** Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). **[8]**

**UNIT - IV** Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications. [8]

**UNIT - V** Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods. [8]

**References:**

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.
- Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control
8. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung Ise Hung.
9. Noise Pollution and Control by S. P.Singhal , Narosa Pub House
10. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition

**RCE078 Ground Improvement Techniques**

**(L-T-P 3-1-0) Credit - 4**

**UNIT -I** Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes. [8]

**UNIT -II** In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement.

[8]

**UNIT -III** In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method. [8]

**UNIT – IV** Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test. **[8]**

**UNIT -V** Underpinning of foundations: importance and situations for underpinning, methodology, typical examples. Geotextiles: types, functions, specifications, precautions in transportation and storage. **[8]**

**Recommended:**

1. S. K. Garg – Soil Mechanics & Foundation Engineering.
2. Purshotham Raju – Ground Improvement.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. N. Mandal – Geosynthetics World
5. Bergado et. al. – Soft Ground Improvement
6. Koerner, R. M. - Designing with geosynthetics
7. Ground Improvement Techniques by Dr. P Purushothama Raj

**RCE751 Non Destructive Testing Laboratory**

**(L-T-P 0-0-2) Credit - 1**

**NOTE: Student will have to perform minimum 3 test on concrete & two test on structural steel**

1. Non Destructive Testing of reinforced cement concrete
  - (a) Strength assessment using rebound hammer
  - (b) Quality assessment using ultrasonic puls velocity test
  - (c) Strength assessment using pull out method
  - (d) Assessment of corrosion of reinforcing bars using half cell potentiometer
  - (e) To determine thickness of concrete cover, diameter & spacing of reinforcing bars using rebar scanner.
2. Testing of structural steel
  - (a) Testing for corrosion of structural steel
  - (b) Assessment of thickness of pipes/tubes/structural steel
  - (c) Test for welding performance with Di-penetration test, ultrasonic test & magnetic particle test

## **RCE752 Mini Project**

**(L-T-P 0-0-2) Credit - 1**

- **Students will be asked to work upon minimum four of the following topics during the semester.**
  - **They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.**
1. Work related to preparation of bill of quantity & tender document.
  2. Work related to design & drawing of flat slab using IS code method.
  3. Work related to cost estimation of (including market survey of rates by students) building/earth work for a highway.
  4. Work related to scheduling of activities of a project using relevant software
  5. Work related to preparation of layout plan of a building and its marking on ground.
  6. Design & analysis of a G+5 residential building using structural design and analysis software like STAAD Pro/STRUDS/SAP/ETAB/STRAP.
  7. Work related to design of a small sewage treatment plant (STP) unit for a residential society.
  8. Work related to computation of surface runoff & design of rain water harvesting system for given area (relevant software may be used for runoff computation).

**EIGHTH SEMESTER**

**CIVIL ENGINEERING**

**SESSION 2019-20**

S No.	Subject Code	Subject Name	Teaching Deptt.	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		Open Elective Course -2	Other Deptt.	3---0---0	70	20	10	100	3
2	RCE081 RCE082 RCE083 RCE084	<b>Elective -5</b> Finite Element Method Structural Dynamics Advanced Concrete Design Solid Waste Management	Core Deptt.	3---1---0	70	20	10	100	4
3	RCE085 RCE086 RCE087 RCE088	<b>Elective -6</b> Engineering Hydrology and Ground Water Management Urban Transportation System & Planning Probability Methods in Civil Engineering Earthquake Resistant Design of Structure	Core Deptt.	3---0---0	70	20	10	100	3
4	RCE851	Seminar	Core Deptt.	0 ---0---3			100	100	2
5	RCE852	Project-2	Core Deptt.	0---0---12	350		250	600	12
	<b>TOTAL</b>				<b>560</b>	<b>60</b>	<b>380</b>	<b>1000</b>	<b>24</b>

The required identification and distribution of electives through NPTEL has been made as given below.

Sem	Departmental Elective	Name of Elective through NPTEL
VIII	5	RCE082 Structural Dynamics
	6	RCE087 Probability Methods in Civil Engineering

## **RCE081 Finite Element Methods**

**(L-T-P 3-1-0) Credit – 4**

**UNIT - I** Calculus of variation, Introduction to calculus of variations, Introduction to equilibrium equations in elasticity, Euler's Lagrange's equations, Principle of virtual work, virtual displacements, Principles of minimum potential energy, boundary value, initial value problems, Flexibility approach, Displacement approach, Different problems in structural analysis. **[8]**

**UNIT - II** FEM Procedure, Derivation of FEM equations by variation principle polynomials, Concept of shape functions, Derivation for linear simplex element, Need for integral forms, Interpolation polynomials in global and local coordinates. Weighted residual Methods: Concept of weighted residual method, Derivation of FEM equations by Galerkin's method, Solving cantilever beam problem by Galerkin's approach, Derivation of shape functions for CST triangular elements, Shape functions for rectangular elements, Shape functions for quadrilateral elements. **[8]**

**UNIT - III** Higher order Elements: Concept of iso-parametric elements, Concept of sub-parametric and super - parametric elements, Concept of Jacobin matrix. Numerical Integration: Numerical Integration, one point formula and two point formula for 2D formula, Different problems of numerical integration evaluation of element stiffness matrix, Automatic mesh generation schemes, **[8]**

**UNIT - IV** Pascal's triangle law for 2D shape functions polynomial, Pascal's triangle law for 3D shape function polynomials, Shape function for beam elements, Hermitian shape functions. Convergence: Convergence criteria, Compatibility requirements, Geometric isotropy invariance, Shape functions for iso-parametric elements, Special characteristics of stiffness matrix, Direct method for deriving shape functions using Lagrange's formula, Plane stress problems. **[8]**

**UNIT - V** Analysis of structures: Truss elements, Analysis of truss problems by direct stiffness method. Analysis of frames and different problems, Different axi-symmetric truss problems. **[8]**

### **Text Book:**

1. The Finite Element method -ZIENKIEWICZ.O.C.Tata McGraw Hill Pub. New Delhi, 2000
2. Finite Element Methods by C R Alaval , PHI
3. Finite Elements in Engineering:- Chandrupatta, et. Al. Prentice Hall of India Pvt. Ltd.,
4. Finite element method with application in engineering by Chandrupatla & Belegundu, Pearson Publication.
5. Finite Element Method Basics concept & Applications by Alawala
6. Fundamental of Finite element Analysis by Devid V. hutton
7. Finite element Methods is fundamentals an application in engineering by Chen Z

### **Reference:**

1. Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E. Michel, John wiley & sons 3rd Edn. New York, 2000



2. Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi,
3. Introduction to the Finite Element method -Desai / ABEL-C.B.S. Publishers & Distributors, New Delhi.

## **RCE082 Structural Dynamics**

**(L-T-P 3-1-0) Credit - 4**

**UNIT- I** Introduction of Structural Dynamics, differential equations in civil engineering, types of analysis/static and dynamic load, degree of freedom ,generation of stiffness matrix), dynamic equilibrium equation, solution of equilibrium equation, Undamped free vibration solution, natural period/frequency ,energy in free vibration, damped free vibration, types of damping, logarithmic decrement equation. **[8]**

**UNIT - II** Undamped forced vibration , amplitude & phase angle , dynamic amplification factor for deflection( $R_d$ ), damped forced vibration, relationship between  $R_d$ ,  $R_v$ , &  $R_a$  , Resonant frequency and half power band width, force transmission and Isolation, Introduction of vibration measuring Instruments. **[8]**

**UNIT – III** Response to Unit Impulse , response to arbitrary force ( duhamel's Integral), response to step and ramp forces, response to rectangular pulse, half sinusoidal wave, time stepping methods, central difference method, Newmark's Method , Concept of response spectrum, uses of response spectrum, response of structure in frequency domain. **[8]**

**UNIT – IV** Equation of Motion for MDOF System , Solution of equation, natural frequencies and mode shapes, modal orthogonality, approximate method for finding natural frequency , Time History Analysis, Response spectrum Analysis, 3 D dynamic Analysis , Vibration of continuous systems, shear behavior and bending behavior, generalized SDOF. **[8]**

**UNIT – V** Dynamics of rigid blocks, Non structural elements, floor response spectrum, Introduction to vibration control, active control, passive control, design of tuned mass damper by displacement and energy perspectives. **[8]**

### **References Books:**

1. “Dynamics of structures” by Anil K Chopra, Pearson Education Limited.
2. “Structural Dynamics” by Clough & Penzin, McGraw-Hill Education .
3. “Theory of Vibrations” by Thompson, Pearson Education Limited.

4. "Elements of vibration analysis" by Leonard Mirovitch , McGraw-Hill Education .
5. "Structural dynamics" by Madhujit Mukhopadyay ,Ane Books India.

## **RCE083 Advanced Concrete Design**

**(L-T-P 3-1-0) Credit - 4**

**UNIT - I** Introduction to liquid retaining structures, design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground and underground. **[8]**

**UNIT - II** Design of over-head tanks: design of RC domes and beams curved in plan, design of cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects. **[8]**

**UNIT - III** Introduction to prestressing, assumptions, general principles ,advantages of prestressing, Axially placed tendons, bent tendons, parabolic tendons, load balancing concept, pressure line , systems of prestressing, pretensioning and post tensioning, Hoyer system, Freyssinet system ,Le-Mccall system, Magnel-Blaton system, Gifford-Udall system, C.C.L standard system. **[8]**

**UNIT - IV** Losses in prestress, IS 1343 recommendations for prestressed concrete, stages of loading to be considered in design, handling and transportation of precast prestressed concrete beams , analysis and design of simple prestressed beams, Lever arm conception, kern distance. **[8]**

**UNIT - V** Introduction to deep beams, minimum thickness, design of deep beams by IS 456, check for local failures, detailing of deep beams, Introduction to Corbels, Shear friction, Corbel dimensions, design of a corbel. **[8]**

### **Text Books & References**

- 1)IS : 456 – 2000, " Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.
- 2)IS 3370-2009, "Indian Standard concrete structures for storage of liquids - code of practice", Bureau of Indian Standards, New Delhi
- 3)IS 1343-2012, "Indian Standard prestressed concrete - code of practice", Bureau of Indian Standards, New Delhi
- 4)Shah. H.J., "Reinforced Concrete Vol : 2", Charotar publishing house pvt. Ltd.
- 5)Varghese P.C. " Advanced Reinforced concrete design", PHI learning pvt. Ltd.
- 6)Ramamrutham S. and Narayan R. ,"Design of Reinforced Concrete Structures", Dhanpat Rai Publishing company pvt. Ltd.
- 7)Jain, A.K., "Reinforced Concrete: Limit State Design", Nem Chand & Bros., Roorkee.
- 8)Punmia B.C. ,Jain A.K., " Limit State Design of Reinforced Concrete", Laxmi Publications pvt. Ltd.

## **RCE 084 Solid Waste Management**

**(L-T-P 3-1-0) Credit - 4**

**UNIT-I** Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system. **[8]**

**UNIT-II** Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments. **[8]**

**UNIT-III** Landfilling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction to engineered landfills. **[8]**

**UNIT-IV** Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practices in India. **[8]**

**UNIT-V** Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste.

Introduction to Electronic waste and Biomedical waste and their disposal. **[8]**

### **References:**

1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill, New York
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Land fills, Narosa Publishers, Delhi.
7. Waste Management “Asian and Pacific Center for Transfer of Technology (N.D.) India”, September 1993.

8. Solid and Hazardous Waste Management: Science and Engineering by M.N. Rao, Razia Sultana & Sri Harsha Kota
9. E-Waste Management: From Waste to Resource by Ramzy Kahhat, Klaus Hieronymi, Eric Williams.
10. Biomedical Waste Management by R. Radhakrishnan
11. Electronic Waste Management (Issues in Environmental Science and Technology) by R. E. Hester , R. M. Harrison & Martin T. Goosey

## **RCE085 Engineering Hydrology & Groundwater Management**

**(L-T-P 3-0-0) Credit - 3**

**UNIT – I** Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement & estimation. **[8]**

**UNIT – II** Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. **[8]**

**UNIT – III** Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. **[8]**

**UNIT – IV** Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology & aquifers, Ground water movement. Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. **[8]**

**UNIT – V** Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells. Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, Artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. **[8]**

### **Text Books:**

- ‘Groundwater Hydrology’ by Todd D. K., Wiley
- ‘Groundwater Resource Evaluation’ by Walton W. C. , McGraw Hill
- ‘Groundwater’ by Raghunath H. M., New Age Publisher
- ‘Engineering Hydrology’ by K. Subramanya, Mc Graw Hill Education
- ‘Hydrology: Principles. Analysis. Design’ by Raghunath H. M., New Age Publisher
- ‘Handbook of Applied Hydrology’ by Chow V. T. , Mc Graw Hill Education

**Reference:**

- ‘Irrigation: Theory & Practice’ by Michael A. M., Vikas Publication House
- ‘Groundwater’ by S.Ramakrishnan, Scitech Publications
- ‘Irrigation: Theory & Practice’ by Michael A. M., Vikas Publication House
- ‘Engineering Hydrology’ by Ojha, Oxford University Press.
- ‘Introduction to Hydrology’ by Viessman & Lewis by Pearson Publication.
- ‘Applied Hydrology’ by Fetter, by Pearson Publication

**RCE086 Urban Transportation System & Planning (L-T-P 3-0-0) Credit - 3**

**UNIT-I** Introduction to transportation planning, the planning concept, Goals, objective and Importance of transportation planning. Nature of traffic problems in cities. Present Scenario of road transport and rail transport assets. Role of transportation: Social, Political, Environmental. Transport and Socioeconomic Activities, Historical Development of Transport, Transportation in the Cities, Freight Transportation, Future Developments. **[8]**

**UNIT- II** Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Types of transport systems, evolution of transport modes, transport problems and mobility issues. Public Transport: Intermediate Public Transport (IPT) Rapid and mass transport system like MRTS & bus rapid transit. Transport Planning Process, Problem Definition, Solution Generation. **[8]**

**UNIT- III** Travel demand: Estimation and fore casting, trip classification, trip generation: factor and methods, multiple regression analysis. Trip distribution methods, modal split, trip assignment. **[8]**

**UNIT- IV** Studying travel behavior. Analyzing urban travel markets. Traffic and transportation surveys and studies, traffic and travel characteristics, urban transport planning process – stages, study area, zoning, database, **[8]**

**UNIT-V** Evaluation of transport planning proposals: Land Use Transport Planning, Economic Evaluation methods like Net present Value methods, Benefit Cost method. Transport system management: Long term and short term planning. **[8]**

**Text Book:**

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. “Highway Engineering”, Nem Chand and Bros., Roorkee- 247 667.
2. Kadiyali L. R., & Lal, N.B. “Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)”, Khanna Publications, Delhi – 110 006

**References:**

1. Introduction to Transportation Engineering: William W. Hay.
2. Introduction to Transportation Engineering planning- E.K.Mortak.
3. Metropolitan Transportation planning-J.W.Dickey.
4. Traffic Engineering, L.R. Kadiyali
5. Hutchinson,B.G.(1974).Principles of Urban Transport Systems Planning. Mc Graw Hill Book Company, New York.
6. John W.Dickey.(1975). Metropolitan Transportation Planning. Mc Graw Hill Book Company, New York.

**RCE087 Probability Methods in Civil Engineering (L-T-P 3-0-0) Credit - 3**

**UNIT -I** Introduction: Role of Probability in Civil Engineering Problems, Random Events: Definition of basic random events; Application of set theory in definition of composite event operations; Probability of events and definition of probability axioms; Solution of real life examples from civil engineering. **[8]**

**UNIT- II** Random Variables: Definition of random variables – discrete and continuous; Probability definitions – PMF, PDF, CDF; Moments and expectations.  
Functions of Random Variables: Definition of probability distributions of functions of single random variables – exact methods and approximate methods; Moments and expectations of functions – direct and indirect methods. **[8]**

**UNIT- III** Multiple Random Variables: Definition of joint, marginal, and conditional probability distributions; Definitions of moments and expectations, including the definition of correlation coefficient; Functions of multiple random variables. **[8]**

**UNIT -IV** Common Probability Models: Discrete random variables – binomial distribution, Poisson’s distribution; Continuous random variables – exponential distribution, gamma distribution; Central limit theorem; Normal and lognormal distributions **[8]**

**UNIT -V** Statistics and sampling: Goodness of fit tests; regression and correlation analyses; estimation of distribution parameters from statistics; hypothesis testing and significance; Bayesian updating of distributions. **[8]**

**References:**

1. Papoulis, A, and S. U. Pillai (2002), Probability, Random Variables and Stochastic Processes, McGraw-Hill, New York.
2. Richard A. Jonson and C. B. Gupta (2005), Miller and Freund's Probability and Statistics for Engineers, Pearson Education, Inc., United States.
3. West M. and J. Harrison (1997), Bayesian Forecasting and Dynamic Models, Springer-Verlag, New York.
4. Ang, A. H-S., and Tang, W., H. "Probability concepts in engineering: Emphasis on applications in civil and environmental engineering." Wiley.
5. Kottegoda, N. T., and Rosso, R. "Applied Statistics for Civil and Environmental Engineers." Wiley.
6. Ross, S. "A first course on probability." Prentice Hall.

**RCE088 Earthquake Resistant Design of Structure (L-T-P 3-0-0) Credit – 3**

**UNIT-I** Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes, [8]

**UNIT-II** Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system, [8]

**UNIT-III** Dynamics of multi degree of freedom system, Idealization of structures, seismic response, [8]

**UNIT-IV** Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Introduction to earthquake resistant brick and masonry buildings. [8]

**UNIT-V** Reinforced Concrete framed buildings, Code provisions. Introduction to machine foundation & its design. Degrees of freedom of a block foundation. [8]

**References:**

1. Introduction to Structural Dynamics - J.M. Biggs
2. Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran
3. IS: 1983 - 1984 Criterion for Earthquake Resistant Design.
4. Structural Dynamics - Theory & computation - Mario Paz.
5. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.
6. Earthquake Resistant of Design of structures, Agarwal and Srihande.
7. Earthquake Resistant of Design of structures, S.K.Duggal

**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	<b>Human Values in Sankhya, Yoga and Vedanta Darshan</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3
<b>Version No.:</b>	2.0 (updated as on June 12 '19)				
<b>Prerequisite:</b>	KVE 301/401- Universal Human Values and Professional Ethics				
<b>Objectives:</b>	<ol style="list-style-type: none"> <li>1. To help students understand the basic principles of Sankhya, Yoga and Vedanta Darshan</li> <li>2. To help students understand the existential realities including the human existence through Sankhya, Yoga and Vedanta Darshan</li> <li>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</li> <li>4. To help students apply this understanding to make their living better at different levels- individual, family, society and nature</li> <li>5. To facilitate the students in applying this understanding in their profession and lead an ethical life</li> </ol>				
<b>Course Outcome:</b>	<p>On completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the basic concepts of Sankhya, Yoga and Vedanta Darshan.</li> <li>2. Understand the human being, the needs and activities of human being through Sankhya, Yoga and Vedanta Darshan.</li> <li>3. Understand the whole existence</li> <li>4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct</li> <li>5. Understand the foundation of human society and human tradition.</li> </ol>				
<b>Catalogue Description:</b>	<p>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.</p>				
<b>Module I :Introduction to Sankhya, Yoga and Vedanta Darshan and their Basics</b>	<p>Need to study Sankhya, Yoga and Vedanta Darshan; the origin of the three philosophies, their basic principles and scope for further reading.</p>				
<b>Module II: Sankhya Darshan</b>	<p>Sankhya Darshan- the <i>nature</i> of <i>Purush</i> and <i>Prakriti</i>, 8 types of <i>prakriti</i> (<i>pradhan, mahattatva, ahankar</i> and five <i>tanmatras</i>- sound, touch, form, taste and smell) and their 16 evolutes (<i>vicar</i>), <i>pramana</i> (<i>pratyaksha, anumana and agama</i>), bondage and salvation (liberation), the principle of <i>satkaryavad</i>, sense organs, work organs, <i>trigunatmak prakriti</i></p>				
<b>Module III: Yoga Darshan</b>	<p>Yoga Darshan- the steps of <i>Ashtanga yoga</i> (<i>yama, niyama, aasana, pranayama, pratyahara, dharana, dhyana</i> and <i>samadhi</i>) and the challenges in following them, afflictions (<i>klesha</i>)- <i>avidya, asmita, raga, dvesha, abhinivesh</i>, different types of <i>vritti</i> (<i>pramana, viparyaya, vikalp, nidra, smriti</i>) the process of <i>nirodha</i> of <i>vritti</i>; <i>maitri, karuna, mudita, upeksha</i>; description of <i>yama, niyama, aasana</i> and <i>pranayama</i>; <i>kriyayoga –tapa, swadhyaya</i> and <i>ishwar-pranidhana</i>, different steps of <i>samadhi</i>, different types of <i>sanyama, vivekakhyaati, pragya</i>.</p>				

**Module IV :Vedanta Darshan**

Vedanta Darshan- *Nature of Brahma and Prakriti*, Methods of *Upasana*; *adhyasa* and *sanskar* nature of Atma, description of existence, principle of *karma-phala*, description of *pancha kosha* different nature of *paramatma/brahma*, *Ishwar*, *Four qualifications (Sadhan-chatushtay)*.

**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	<b>Introduction to modeling and simulation:</b> 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	<b>Bond graph modeling of dynamic system:</b> 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	<b>System models of combined systems:</b> Linearity and non linearity in systems combined rotary and translatory system, electro mechanical system, hydro-mechanical system.	8
4	<b>Dynamic Response and System Transfer Function:</b> Dynamic response of 1 <sup>st</sup> order system and 2 <sup>nd</sup> order system, performance measures for 2 <sup>nd</sup> order system, system transfer function, transfer function of 1 <sup>st</sup> and 2 <sup>nd</sup> order system Block diagram algebra, signal flow diagram, state variable formulation, frequency response and bode plots.	8
5	<b>Simulation and simulation applications:</b> 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.

<b>ROE-072 INTRODUCTION TO SMART GRID</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Introduction: Introduction to Smart Grid:</b> 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
<b>2</b>	<b>Smart Grid Technologies:</b> Introduction to Smart Meters, Real Time Pricing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.	8
<b>3</b>	<b>Smart Grid Technologies:</b> 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
<b>4</b>	<b>Microgrids and Distributed Energy Resources:</b> Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin film solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.	8
<b>5</b>	<b>Power Quality Management in Smart Grid:</b> 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", 2<sup>nd</sup> 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.

<b>ROE-073 CLOUD COMPUTING</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Introduction :</b> 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.	<b>8</b>
<b>2</b>	<b>Cloud Enabling Technologies:</b> 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.	<b>8</b>
<b>3</b>	<b>Cloud Architecture, Services And Storage:</b> Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage- as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.	<b>8</b>
<b>4</b>	<b>Resource Management And Security In Cloud:</b> 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.	<b>8</b>
<b>5</b>	<b>Cloud Technologies And Advancements:</b> 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.	<b>8</b>

**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.

<b>ROE- 074 Understanding the Human Being Comprehensively–Human Aspirations and its Fulfillment</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Introduction:</b> 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
<b>2</b>	<b>Understanding Human being and its expansion:</b> 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
<b>3</b>	<b>Activities of the Self:</b> 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	<b>Understanding Co-existence with other orders:</b> 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	<b>Expansion of harmony from self to entire existence:</b> 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.

<b>ROE-075 AUTOMATION AND ROBOTICS</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	<b>Automation:</b> 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.	<b>8</b>
<b>2</b>	<b>Manufacturing Automation:</b> 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.	<b>8</b>
<b>3</b>	<b>Robotics:</b> 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.	<b>8</b>
<b>4</b>	<b>Robot Drives and Power Transmission Systems:</b> 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	<b>8</b>

	grippers. Mechanical, vacuum and magnetic grippers. Gripper force analysis and gripper design.	
5	<b>Robot Simulation:</b> 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.

<b>ROE-076 COMPUTERIZED PROCESS CONTROL</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	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.	<b>8</b>
<b>2</b>	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	<b>8</b>
<b>3</b>	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	<b>8</b>
<b>4</b>	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	<b>8</b>

<b>5</b>	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.	<b>8</b>
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**Text Books:**

1. S. K. Singh, "Computer Aided Process control", PHI.

**Reference Books:**

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

## ROE-077 MODELING OF FIELD-EFFECT NANO DEVICES

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

3. Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
4. Introduce the concepts of nanoscale MOS transistor and their performance characteristics.
5. Study the various nano-scaled MOS transistor circuits.

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

- CO1: Study the MOS devices used below 10nm and beyond with an eye on the future.  
CO2: Understand and study the physics behind the operation of multi-gate systems.  
CO3: Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristics.  
CO4: Understand and study the physics behind the Radiation effects in SOI MOSFETs.  
CO5: Understand the impact of device performance on digital circuits.

ROE-077 MODELING OF FIELD-EFFECT NANO DEVICES		
Unit	Topic	Lectures
1	MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility – threshold voltage – inter subband scattering, multigate technology – mobility – gate stack	8
2	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics – CMOS Technology – Ultimate limits, double gate MOS system – gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering – mobility	8
3	Silicon nanowire MOSFETs – Evaluation of I-V characteristics – The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube – Band structure of carbon nanotube – Band structure of graphene – Physical structure of nanotube – Band structure of nanotube – Carbon nanotube FETs – Carbon nanotube MOSFETs – Schottky barrier carbon nanotube FETs – Electronic conduction in molecules – General model for ballistic nano transistors – MOSFETs with 0D, 1D, and 2D channels – Molecular transistors – Single electron charging – Single electron transistors.	8

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

**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.	
<b>5</b>	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	<b>8</b>

**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

<b>ROE-079 GIS &amp; REMOTE SENSING</b>		
<b>Unit</b>	<b>Topic</b>	<b>Lectures</b>
<b>1</b>	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.	<b>8</b>
<b>2</b>	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;	<b>8</b>
<b>3</b>	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.	<b>8</b>
<b>4</b>	Microwave remote sensing. GIS and basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	<b>8</b>
<b>5</b>	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.	<b>8</b>

**Text & Reference Books:**

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

ROE 080	Human Values in Bauddha and Jain Darshan	L	T	P	C
<b>Version No.:</b>	2.0 (updated as on June 12th 2019)				
<b>Prerequisite:</b>	RVE 301/401 - Universal Human Values and Professional Ethics Desirable- 10 Day Vipassana Meditation course by Shri S. N. Goenka				
<b>Objectives:</b>	<ol style="list-style-type: none"> <li>1. To help students understand the basic principles of Bauddha and Jain Darshan</li> <li>2. To help students understand the existential realities including the human existence through Bauddha and Jain Darshan</li> <li>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</li> <li>4. To help students apply this understanding to make their living better at different levels- individual, family, society and nature</li> <li>5. To facilitate the students in applying this understanding in their profession and lead an ethical life.</li> </ol>				
<b>Course Outcome:</b>	<p>On completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the basic concepts of Bauddha and Jain Darshan</li> <li>2. Understand the human being, the needs and activities of human being through Bauddha and Jain Darshan</li> <li>3. Understand the whole existence</li> <li>4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct</li> <li>5. Understand the foundation of human society and human tradition.</li> </ol>				
<b>Catalogue Description:</b>	<p>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.</p>				
<b>Module I: Introduction to Bauddha and Jain Darshan and their Basics</b>	Need to study Bauddha and Jain Darshan; the origin of the thsee philosophies, their basic principles and scope for further reading.				
<b>Module II: Basic Principles of Bauddha Darshan</b>	<p>law of impermanence (changability); four noble truths; eightfold path; law of cause- action (<i>pratitya-samutpaad</i>)</p> <p>Definition of some salient words of Buddha Darshan – <i>nirvana, dhamma, tri- ratna(Buddha, Dharma and Sangh), pragya, karma, parmi, ashta-kalap, trishna, shad-ayatan, samvedana, vipassana, anitya, maitri, brham-vihaar, tathagata, arahant.</i></p>				
<b>Module III: Purpose and Program for a Human Being based on Bauddha Darshan</b>	<p>The purpose and program of a human being living on the basis of it, clarity and practice of human values and human conduct, the natural outcome of such a program on society, nature and tradition. Purpose-freedom from suffering, <i>nirvana</i>; root of suffering- <i>vikaar – raga, dvesha</i> and <i>moha</i>, Progam – various steps of meditation for attaining knowledge; <i>shamath and vipassana; sheel-samadhi-pragya; practice of equanimity (samatva)</i>, eightfold path(Ashtang Marg); combination of understanding and practice.</p>				

**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=PLPJVIVRVmhc4Z01fD57jbzycm9I6W054x> (English)
8. <https://www.youtube.com/watch?v=r5bud1ybBDc&list=PLY9hraHvoLQLCkI7Z2DWKMgRAWU77bKFy> (Hindi)

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

Open Electives for B.Tech 4 <sup>th</sup> 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.

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. Mouty Maiti: Internet Marketing, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts 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)

- 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



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 Algorithm Convergence, 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.

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.

- Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study.
- UNIT-I 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  $2 \times n$  or  $m \times 2$  games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queuing 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.

- 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 geothermal 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 et al, "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.

<b>ROE 087</b>	<b>Human Values in Madhyasth Darshan</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3
<b>Version No.:</b>	2.0 (updated as on June 12 <sup>th</sup> 2019)				
<b>Prerequisite:</b>	RVE 301/401- Universal Human Values and Professional Ethics				
<b>Objectives:</b>	<ol style="list-style-type: none"> <li>1. To help students understand the basic principles of Madhyasth Darshan</li> <li>2. To help students understand the existential realities including the human existence through Madhyasth Darshan</li> <li>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</li> <li>4. To help students apply this understanding to make their living better at different levels- individual, family, society and nature</li> <li>5. To facilitate the students in applying this understanding in their profession and lead an ethical life</li> </ol>				
<b>Course Outcome:</b>	<p>On completion of this course, the students will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the basic concepts of Madhyasth Darshan</li> <li>2. Understand the human being, the needs and activities of human being through Madhyasth Darshan</li> <li>3. Understand the whole existence</li> <li>4. Understand the role of human being in the entire existence, thus getting clarity about values at all levels of living and human conduct</li> <li>5. Understand the foundation of human society and human tradition.</li> </ol>				
<b>Catalogue Description:</b>	<p>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.</p>				
<b>Module I: Introduction to Madhyasth Darshan and its Basics</b>	<p>Need to study Madhyasth Darshan; introduction, basic formulations of the darshan; the complete expanse of study and the natural outcome of living according to the darshan.</p>				
<b>Module II: Submergence of Nature in Space</b>	<p>The ever-present existence in the form of nature submerged in space; nature classified into two categories – material and consciousness, and four orders; the form, property, natural characteristic and self-organization of the four orders, General direction and process of evolution in the nature/ existence.</p>				
<b>Module III: Human Being as an indivisible part of Nature</b>	<p>Human being as an indivisible part of nature; various types (five classes) of human beings; human being in the combination of self and body; purpose of self as realization, prosperity for the body; need of behavior and work for attaining the goals of realization and prosperity.</p>				
<b>Module IV: Fulfillment of human goal of realization and prosperity</b>	<p>Following natural, social and psychological principles for actualizing the human goal; form of conducive society and order for such practices, study process- achieving realization through self-study and practice while living in such a society (social order).</p>				

**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

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.



Program for Ensuring Undivided Society and Universal Human Order:  
UNIT-IV Education – Sanskar, Health – Sanyam, Production-work, Exchange – storage, Justice-preservation.

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

## Reference Videos.

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