BIJUPATNAIKUNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

Curriculum and Syllabus

B. Tech (*Electrical Engineering)* for the Batch

2018-19

Semester (5th)

5th Semester

Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC 11		Electric Power Transmission and Distribution	3-0-0	3
2	PC 12		Control System	3-0-0	3
3	PC 13		Electrical Machines-II	3-0-0	3
4	PE 2 (Any One)		Electrical Machine Design	3-0-0	3
			Electrical Energy Conservation and Auditing	3-0-0	
			Industrial Process Control and Dynamics	3-0-0	
5	PE 3 (Any One)		Electric Drives	3-0-0	3
			Renewable Power Generating System	3-0-0	
			Sensors and Transducers	3-0-0	
6	MC 5		Universal Human Values		0
Total Credit (Theory)					**15**
Practical					
1	PC 14		Electric Power Transmission and Distribution Lab	0-0-3	2
2	PC 15		Control and Instrumentation Lab	0-0-3	2
3	PC 16		Electrical Machines Lab-II	0-0-3	2
4	PSI 2		Evaluation of Summer Internship	0-0-3	1
Total Credit (Practical)					**7**
Total Semester Credit					**22**

5Th Semester

Electric Power Transmission and Distribution

Module I: **(4 hours)**

Evolution of Power Systems and Present-Day Scenario. Structure of power system. Conventional sources of Electrical Energy, Hydroelectric Power Generation, Thermal Power Generation and Nuclear Power Generation.

Module II: **(10 hours)**

Inductance of a Conductor due to Internal Flux, Flux Linkages between Two Points External to an Isolated Conductor, Inductance of a Single Phase Two Wire Line, Flux Linkages of one Conductor in a Group, Inductance of Composite-Conductors, Concept of GMD, Transposition of lines, Inductance of a Three Phase Line with symmetrical and Unsymmetrical Spacing, Inductance Calculations for Bundled Conductors, Skin effect and Proximity effect. Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with symmetrical and Unsymmetrical Spacing, Effect of Earth on the Capacitance of a Three Phase Line, Capacitance Calculations for Bundled Conductors, Parallel- Circuit Three Phase Lines. Corona.

Module III: **(12 hours)**

Representation of Short, medium and long Transmission Line, Equivalent Circuit, Calculation and analysis of performance of transmission lines, Voltage Profile of transmission lines, Ferranti Effect, Power Flow Through Transmission Line, Power Flow capability and Surge Impedance Loading, Series and Shunt Compensation of Transmission Line.

Overhead Line Insulators: Insulator Materials, Types of Insulators, Voltage Distribution over Insulator String, Methods of Equalizing the potential.

Mechanical Design of Overhead Transmission Lines: The catenary curve, Sag TensionCalculation, supports at different levels, Stringing chart, sag Template, Equivalent span, Stringing of Conductors, Vibration and Vibration Dampers

Module IV: **(6 hours)**

Method of Symmetrical Components (positive, negative and zero sequences). Balanced andUnbalanced Faults. Representation of generators, lines and transformers in sequencenetworks. Computation of Fault Currents. Neutral Grounding.

Module V: **(10 hours)**

Classification of Distribution Systems, Primary and secondary distribution network, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin's Law, Limitations of Kelvin's Law, Application of Capacitors to Distribution Systems.

Underground Cables: Type and construction, Classification of Cables, Parameters of Single Core Cables, Grading of Cables, Capacitance of Three Core Cable, Comparison of overhead lines with underground Cables, XLPE, PVC Cables.

Power System Earthing: Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages. Single-wire Earth Return Concept in distribution system.

Books:

[1] J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.

[2] O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.

[3] D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 4th Edition, 2011.

[4] B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, “Electric Power Systems”, Wiley, 5th Edition, 2012.

[5] C.L. Wadhwa, “Electrical Power Systems”, New Age International Publishers, 6th Edition.

[6] A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc, 1999.

Digital Learning Resources:

Course Name:	Power System Generation Transmission and Distribution
Course Link:	https://nptel.ac.in/courses/108/102/108102047/
Course Instructor:	Prof. D P Kothari, IIT Delhi

Course Name:	Power System Engineering
Course Link:	https://nptel.ac.in/courses/108/105/108105104/
Course Instructor:	Prof. D Das, IIT Kharagpur

5Th Semester

Control System

Module I: **(5 hours)**

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of NegativeFeedback. Block diagram algebra. Signal Flow Graph and Mason'sGain formula.

Module II: **(10 hours)**

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-ordersystems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Module III: **(7 hours)**

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stabilitycriterion. Relative stability using Nyquist stability criterion – gain and phase margins. Closed-loop frequency response: Constant M Circle, Constant N Circle, Nichols Chart.

Module IV: **(10 hours)**

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Tuning of PID controllers, Lead and Lag and Lag-Lead compensator design.

Module V: **(10 hours)**

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Text Books:

[1] I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

[2] K. Ogata, "Modern Control Engineering", Prentice Hall, 1991

Reference Books:

[1] M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

[2] B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

Digital Learning Resources:

Course Name:	Control System Engineering
Course Link:	https://nptel.ac.in/courses/108/102/108102043/
Course Instructor:	Prof. M Gopal, IIT Delhi

5Th Semester

Electrical Machines - II

Module I: **(8 Hours)**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; singleturn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

Module II: **(4 Hours)**

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Module III: **(12 Hours)**

Three Phase Induction Motor

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Module IV: **(6 Hours)**

Single Phase Induction Motor

Constructional features, double revolving field theory, equivalent circuit, determination ofparameters. Split-phase starting methods and applications

Module V: **(10 Hours)**

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Text Books:

[1] Stephen J. Chapman-‘Electric Machinery and Fundamentals’- Mc Graw Hill International Edition, (Fourth Edition), 2015.

[2] M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

Reference Books:

[1] A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, McGraw Hill Education, 2013.

[2] P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.

[3] I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

[4] A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.

[5] P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley &

Sons, 2007

Digital Learning Resources:

Course Name:	Electrical Machine-II
Course Link:	https://nptel.ac.in/courses/108/105/108105131/
Course Instructor:	Prof. T K Bhattacharya, IIT Kharagpur

5Th Semester

Electrical Machine Design

Module-I: **(12 hours)**

Design of Transformers: Classification of transformer, transformer core, yoke, transformer winding, cooling of transformers, method of cooling of transformers, transformer tank, cooling ducts, transformer insulation, conservator and breather, output of transformer, output equation, ratio of iron loss to copper loss, relation between core area and weight of iron and copper, optimum design, variation of output and lossless in transformers with linear dimensions, design of core, selection of core area and type of core, choice of flux density, design of windings, Design of insulation, surge phenomenon, surge protection widow space factor, window dimension, width of window for optimum output, design of yoke, overall dimensions, simplified steps for transformer design, operating characteristics, resistance of winding, leakage reactance of winding, regulation.

Module-II: **(12 hours)**

D C Machines; Output equations, choice of average gap density, choice of ampere conductor per meter, selection of number of poles, core length, Armature diameter, pole proportions, number of ventilating ducts, estimation of air gap length, Armature reaction;flux distribution at load, effect of armature reaction, brush shift and its effect, reduction of effects of armature reaction **Armature design;** choice of armature winding, numbers of armature conductors, numbers of armature slots, cross section of armature conductors, insulation of armature winding, slot dimension, armature voltage drop, depth of armature core, **Design of field system;** pole design, design of field winding, design of yoke, magnetic circuit, magnetization curve, design of field winding, commutation phenomenon, forms of current in coil undergoing commutation, **Design of commutator and brushes;** number of segments, commutator diameter, length of commutator, dimension of brushes, losses at commutator surface, loss and efficiency. Design of interpoles; time of commutation, width of commutation zone, width of interpole shoe, calculation of reactance voltage, length of interpole, flux density under interpole shoe, design of interpole winding.

Module-III: **(8 hours)**

Three Phase Induction Motors; output equation, choice of average flux density in air gap, choice of armature conductors, efficiency and power factor, main dimensions, stator winding, Shape of stator slots, number of stator slots, area of stator slots, length of mean turn, stator teeth, stator core, **Rotor design;** length of air gap, number of rotor slots, effects of harmonics, reduction of harmonic torques, design of rotor bars and slots, design of end rings, full load slip, design of wound rotor, rotor teeth, rotor core, operating characteristics; no load current, short circuit current, leakage reactance.

Module-IV: **(12 hours)**

Design of synchronous Machines; output equation, design of salient pole machines-main dimensions, short circuit ratio, length of air gap, shape of pole face, armature design, armature winding, coils and their insulation, slot dimension, length of mean turn, stator pole, elimination of harmonics, armature parameters, estimation of air gap length, design of rotor, magnetic circuits, Open circuit characteristics, determination of full load field mmf, design of field winding, design of turbo-Alternator- main dimension, length of air gap, stator design,

rotor design. Determination of direct and quadrature axis synchronous reactances, short circuit characteristics, losses, temperature rise,

Text Books:

[1] A.K. Sawhney and Dr. A. Chakrabarti,“A course in Electrical Machine Design”,Dhanpat Rai & Company Pvt. Ltd International Edition, (Fourth Edition), 2015.

Reference Books:

[1] Clayton A E & Hancock N N, “The Performance and Design of Direct Current Machines”, CBS Publishers and Distributors.
[2] M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
[3] Sen S K, “ Principles of Electrical Machine Design with Computer Programs:, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
[4] A.Shanmugasundaram, G.Gangadharan, R.Palani, “'Electrical Machine Design Data Book”, New Age Intenational Pvt. Ltd

5Th Semester

Electrical Energy Conservation and Auditing

Module I: **(12 Hours)**

Electrical energy conservation: Energy economics- discount rate, payback period, internal rate of return, net present value, and life cycle cost. Energy generation, energy distribution, energy usage by processes, technical and economic evaluation, understanding energy costs, classification of energy conservation measures, plant energy performance, benchmarking and energy performance, matching energy usage to requirement, maximizing energy system efficiency, optimizing the input energy requirements, fuel and energy substitution, and energy balancing.

EB billing- HT and LT supply, transformers, electric motors- motor efficiency computation, energy efficient motors, pumps, fans, blowers, compressed air systems, refrigeration and air conditioning systems, cooling towers, electric heaters (space and liquid), DG-sets, illuminating devices, power factor improvement, and harmonics.

Module II: **(12 Hours)**

Electrical energy audit: Energy consumption pattern and scenario of any region; Energy auditing: Need, types, methodology and approaches; Preliminary energy audit methodology (initial site visit and preparation required for detailed auditing, detailed energy audit activities, information and data collection, process flow diagram and process steps); Procedure and techniques: Data gathering, evaluation of saving opportunities, and energy audit reporting; and Energy audit instruments.

Module III: **(06 Hours)**

Illumination: Illumination, luminous flux, lumen, luminous intensity, candela power, brightness, glare, types of lighting (incandescent, CFL, and LED), requirements of lux for various purposes, determine the method of lighting, select the lighting equipments, and calculate the lighting parameters.

Text Books:

[1] Callaghn, P. W." Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.

[2] Dryden. I. G. C.," The Efficient Use of Energy", Butterworths, London, 1982.

[3] Energy Economics -A. V. Desai (Wiley Eastern).

[4] Handbook of Energy Efficiency - CRC Press

Reference Books:

[1] Energy Technology, OP Gupta, Khanna Book Publishing

[2] Handbook of Energy Audits Albert Thumann, William J. Younger, Terry Niehus, 2009.

[3] Handbook on Energy Audit and Environment Management, Y P Abbi and Shashank Jain, TERI, 2006.

5Th Semester

Industrial Process Control and Dynamics

Module-I: **(10 Hours)**

Introduction, control systems, process control block diagram, control system evaluation, analog and digital processing. **Analog Signal Conditioning:** Introduction, principles of analog signal conditioning, passive circuits, operation, amplifiers, op-amp circuits in instrumentation

Module-II: **(10 Hours)**

Digital Signal Conditioning: Introduction, Review of digital fundamentals, converters, Data Acquisition system.

Thermal Sensors: Introduction, Definition of temperature, Metal resistance versus Temperature devices, Thermistors, Thermocouples.

Mechanical Sensors: Introduction, Displacement, Location or Position sensors, Strain sensors, Motion sensors Pressure sensors, Flow sensors

Module-III: **(10 Hours)**

Optical Sensors: Introduction, Photo detectors, Pyrometry, Optical Sources application. **Final Control:** Introduction, Final control operation, signal conversions, Industrial Electronics, Actuators, Control Elements. **Discrete State Process Control:** Introduction, Definition of Discrete State Process control, Characteristics of the system, Relay controllers and ladder diagram, PLCs. Control Loop.

Module IV **(10 Hours)**

Controller Principles: Introduction, Process characteristics, Control system parameters, Discontinuous controller modes, continuous controller modes, composite control modes. **Analog Controllers:** Electronics Controller, Pneumatic controller. **3. Digital Controllers:** Digital electronics methods, Computers in process control, Characteristics of digital data

Text Books:

[1] Curtis D. Johnson, "Process Control Instrumentation Technology", PHI Publication.

[2] D. R. Coughanowr, Steven LeBlanc, "Process System Analysis and Control", McGraw Hill, 3rd Edition, 2013

Reference Books:

[1] Surekha Bhanot, "Process Control: Principle and Application", Oxford

5Th Semester

Electric Drives

MODULE I **(10 HOURS)**

Requirements, AC and DC drives, Advantages of Electrical Drives, Fundamentals ofTorque Equations, Speed Torque Conventions and Multi-quadrant Operation, Equivalent Valuesof Drive Parameters, Components of Load Torques, Calculation of Time and Energy Loss inTransient Operations, Steady State Stability, Load Equalization, Control of Electrical Drives,

Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

MODULE II **(10 HOURS)**

Steady State Performance of DC/AC Drives:DC Motors and their Performances, Starting,Braking, Transient Analysis, Speed Control, Methods of Armature Voltage Control, ControlledRectifier Fed DC Drives,Induction Motor Drives: Speed Control, Pole Changing, PoleAmplitude Modulation, Stator Voltage Control, Variable Frequency Control from VoltageSource, Voltage Source Inverter Control, Variable Frequency Control from Current Source,Current Source Inverter Control, Current Regulated Voltage Source Inverter Control, RotorResistance Control, Slip Power Recovery.

.

MODULE III **(10 HOURS)**

Synchronous Motor Drives: Synchronous Motor Variable Speed Drives, VariableFrequency Control of Multiple Synchronous Motors. Electric Traction: System of electrictraction Mechanics of Train Movement: Speed- time, distance- time and simplified speed-timecurves, Attractive effort for acceleration and propulsion, effective weight, train resistance,adhesive weight, specific energy output and consumption. Traction Motors: Review of characteristics of different types of DC and AC motors usedin traction and their suitability

MODULE IV **(10 HOURS)**

Drives for specific application like Textile Mills, Steel Rolling Mills, Cranes and HoistDrives, Cement Mills, Sugar Mills, Machine Tools, Paper Mills, Coal Mines, Centrifugal Pumps.Application Areas and Functions of Microprocessors in Drive Technology.

Text Books:

[1] G. K. Dubey," Fundamentals of Electrical Drives", CRC Press, 2002.
[2] V.Subrahmanyam, "Electric Drives",TMH

Reference Books:

[1] W. Leonhard," Control of Electric Drives", Springer Science & Business Media, 2001.
[2] R. Krishnan," Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall 2001.

Digital Learning Resources:

Course Name:	Fundamentals of Electric Drives
Course Link:	https://nptel.ac.in/courses/108/104/108104140/
Course Instructor:	Prof. Shyama Prasad Das, IIT Kanpur

5Th Semester

Renewable Power Generation Systems

Module I: **(15 Hours)**

Introduction: Conventional energy Sources and its Impacts, Non conventional energy– seasonalvariations and availability, Renewable energy – sources and features, Distributed energy systemsand dispersed generation (DG). Solar Energy: Solar processes and spectral composition of solar radiation. Solar Thermal system-Solar collectors, Types and performance characteristics, Applications-Solar water heating systems(active & passive) , Solar space heating & cooling systems , Solar desalination systems, Solar cooker.Solar photovoltaic system-Operating principle, Photovoltaic cell concepts, Cell, module, array,Losses in Solar Cell, Effects of Shadowing-Partial and Complete Shadowing, Series and parallelconnections, Cell mismatching, Maximum power point tracking, Applications-Battery charging,Pumping, Lighting, Peltier cooling. Modelling of PV cell.

Module II: **(10 Hours)**

Wind Energy: Wind energy, Wind energy conversion; Wind power density, efficiency limit for windenergy conversion, types of converters, aerodynamics of wind rotors, power ~ speed and torque speed characteristics of wind turbines, wind turbine control systems; conversion to electricalpower: induction and synchronous generators, grid connected and self excited induction generatoroperation, constant voltage and constant frequency generation with power electronic controlsingle and double output systems, reactive power compensation, Characteristics of wind powerplant, Concept of DFIG.

Module III: **(9 Hours)**

Biomass Power: Principles of biomass conversion, Combustion and fermentation, Anaerobic digestion, Types of biogas digester, Wood gassifier, Pyrolysis, Applications. Bio gas, Wood stoves,Bio diesel, Combustion engine, Application.

Module IV: **(6 Hours)**

Hybrid Systems: Need for Hybrid Systems, Range and type of Hybrid systems, Case studies ofDiesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles.

Text Books:

[1] Godfrey Boyle“Renewable Energy- Power for a Sustainable Future”,Oxford University Press.

[2] B.H.Khan, “Non-Conventional Energy Resources”,Tata McGrawHill, 2009.

[3] S. N. Bhadra, D. Kastha, S. Banerjee, “Wind Electrical Systems”,Oxford University Press, 2005.

Reference Books:

[1] S. A. Abbasi, N. Abbasi, “Renewable Energy Sources and Their Environmental Impact”, Prentice Hall of India, New Delhi, 2006

.

Digital Learning Resources:

Course Name:	Energy Resources and Technology
Course Link:	https://nptel.ac.in/courses/108/105/108105058/
Course Instructor:	Prof. S Banerjee, IIT Kharagpur

5Th Semester

Sensors and Transducers

Module-I **(9 Hours)**

Elements of a general measurement system: Static Characteristics: systematiccharacteristics, statistical characteristics, calibration; Dynamic characteristics ofmeasurement systems: transfer functions of typical sensing elements, step and frequencyresponse of first and second order elements, and dynamic error in measurement systems.

Module-II **(8 Hours)**

Sensing elements: Resistive sensing elements: potentiometers, Resistance TemperatureDetector (RTD), thermistors, strain gages. Capacitive sensing elements: variableseparation, area and dielectric; Inductive sensing elements: variable reluctance and LVDTdisplacement sensors; Electromagnetic sensing elements: velocity sensors.

Module-III **(8 Hours)**

Thermoelectric sensing elements: laws, thermocouple characteristics, installationproblems, cold junction compensation. IC temperature sensor Elastic sensing elements:Bourdon tube, bellows, and diaphragms for pressure sensing, force and torquemeasurement.

.

Module-IV **(9 Hours)**

Signal Conditioning Elements: Deflection bridges: design of resistive and reactive bridges,push-pull configuration for improvement of linearity and sensitivity. Amplifiers:Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting anddifferential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phasesensitive demodulators and its applications in instrumentation.

Text Books:

[1] J.P. Bentley, “Principles of Measurement Systems”,Pearson Education, New Delhi,3rdEdition, 2007.

[2] A.K. Ghosh, “Introduction to Measurement and Instrumentation”,PHI, 3rdEdition, 2009.

Reference Books:

[1] E.O. Doeblin, “Measurement Systems Application and Design”, McGraw-Hill, International, 4thEdition.

[2] J.W. Dally, W.F. Riley and K.G.McConnel, “Instrumentation for Engineering Measurements”, John Wiley, NY, 2nd Edition 2003.

[3] T.R. Padmanabhan, “Industrial Instrumentation”, Springer, London, 2000.

Digital Learning Resources:

Course Name:	Industrial Instrumentation
Course Link:	https://nptel.ac.in/courses/108/105/108105064/
Course Instructor:	Prof. A Barua, IIT Kharagpur

5Th Semester

Universal HumanValues

(Self, Society and Nature)

Pre-requisites: Universal Human Values: Self & Family (desirable); 4-day Harmony-2 Workshop (co-requisite). Please refer to AICTE Model Curriculum-Vol-II.

1. Objective:

The objective of the course is four-fold:

A. Sensitization of student towards issues in society and nature.
B. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
C. Strengthening of self reflection.
D. Development of commitment and courage to act.

(For elaboration on some of the above, consult course description for Universal Human Values 1: Self and Family, AICTE Model Curriculum-VOL-II).

2. Course Topics :

In this Universal Human Values course, the focus is more on understanding society and nature on the basis of self and human relationships.

i) Purpose and motivation for the course.
ii) Recapitulation (from the previous course) on ideas of self, pre-conditioning, and natural acceptance.
iii) Harmony in the self. Understanding human being as co-existence of self and body. Identifying needs and satisfying needs of self and body. Self-observations. Handling peer pressure.
iv) Recapitulation on relationships. Nine universal values in relationships. Reflecting on relationships in family. Hostel and institute as extended family. Real life examples.
v) Teacher-student relationship. Shraddha. Guidance. Goal of education.
vi) Harmony in nature. Four orders of nature – material order, plant order, animal order and human order. Salient features of each. Human being as cause of imbalance in nature. (Film **"Home"** can be used.)
vii) Human being as cause of imbalance in nature. Depletion of resources – water, food, mineral resources. Pollution. Role of technology. Mutual enrichment not just recycling.
viii) Prosperity arising out of material goods and understanding of self. Separation of needs of the self and needs of the body. Right utilization of resources. lkekU; vkdka{kk ,oa egRokdka{kk, Understanding the purpose they try to fulfil.

ix) Recapitulation on society. Five major dimensions of human society. Fulfilment of the individual as major goal. Justice in society. Equality in human relationships as naturally acceptable. Establishment of society with abhaya (absence of fear).

x) Ethical human conduct. Values, character and netikataa.

xi) Professional ethics. Conduct as an engineer or scientist.

Electric Power Transmission and Distribution Laboratory

List of Experiments

(Perform any 08 Experiments)

1. Study and of Ferranti Effect
2. Determination of ABCD Parameter.
3. Determination of string efficiency
4. Earth resistance measurement.
5. Series and shunt capacitance computation in transmission line
6. Transformer oil test.
7. Study of various lightning arresters.
8. Distribution system power factor improvement using switched capacitor.
9. Study of corona discharge

Digital Learning Resources:

Virtual Lab Link: http://vp-dei.vlabs.ac.in/Dreamweaver/list.html

Control and Instrumentation Laboratory

List of Experiments

(Perform any 10 Experiments)

Group-A (Control)

1. Study of a dc motor driven position control system
2. Study of speed torque characteristics of two phase ac servomotor and determination of its transfer function
3. Obtain the frequency response of a lag and lead compensator.
4. To observe the time response of a second order process with P, PI and PID control and apply PID control to servomotor
5. To determine the transfer function of a system (network) using transfer function analyser.
6. To study and validate the controllers for a temperature control system
7. To study the position control system using Synchroscope.

Group-B (Instrumentation)

1. To measure strain developed in a cantilever beam using strain gauges.
2. Study of temperature voltage characteristic of J type thermocouple
3. Measurement of linear displacement using LVDT
4. To measure unknown resistance, inductance and capacitance using different bridges.
5. Calibration of Single phase Energy meter

Digital Learning Resources:

Virtual Lab Link: http://202.3.77.143/virtuallab/login.php

Electrical Machine-II Laboratory

List of Experiments

(Perform any 08 Experiments)

1. Determination of the voltage regulation of an alternator by synchronous impedance method and zero power factor (zpf) method
2. Determination of the V and inverted V curves of a synchronous motor
3. Speed control of a three phase induction motor using variable frequency drives.
4. Determination of parameters of synchronous machine
    (a) Positive sequence reactance
    (b) Negative sequence reactance
    (c) Zero sequence reactance
5. Determination of power angle characteristics of an alternator
6. Determination of parameter of a Capacitor start single phase induction motor.
7. Study of parallel operation of two alternators
8. Measurement of direct and quadrature axis reactance of a salient pole synchronous machine by Slip test.
9. Measurement of transient and sub transient reactance of a salient pole alternator
10. Performance of grid connected induction generator.
11. Determination of parameters of three phase induction motor from No Load Test and Blocked Rotor Test.
12. Determination of Efficiency, Plotting of Torque-Slip Characteristics of Three Phase Induction motor by Brake Test.

Digital Learning Resources:

Virtual Lab Link http://vem-iitg.vlabs.ac.in/

http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering