DR. K N MODI UNIVERSITY, NEWAI
STUDENT EVALUATION SYSTEM

Continuous Assessment

All courses undertaken by students are evaluated during the semester using internal system of continuous assessment. The students are evaluated on class /tutorial participation, assignment work, lab work, class tests, mid-term tests, quizzes and end semester examinations, which contribute to the final grade awarded for the subject. Students will be notified at the commencement of each courses about the evaluation methods being used for the courses and weightages given to the different assignments and evaluated activities.

In order to make the evaluation system as similar and transparent with any of the globally reputed educational institutions like N.I.Ts, I.I.Ts etc. the Dr. K. N. Modi University Academic Council has adopted the grading practices. Here marks obtained in the continuous assessment and end semester examination are added together and a 10-point grading system will be used to award the student with on overall letter grade for the course (subject).

Distribution of Marks

(i)Courses without Practical Components

Continuous Assessment	- 25
Mid –Term Examination	- 15
End –Term Examination	- 60
Total :	**100**

(ii)Courses with Practical Components only

Continuous Assessment	- 30
Mid –Term Examination (Practical)	- 20
End –Term Examination (Practical)	- 50
Total :	**100**

Letter Grading system

Final evaluation of course is carried out on a TEN POINT grading system. Performance Grade and Grade Points are as shown below:

Table 1

Marks	Grade Value	Grade	Description
91 to 100	10	A+	Out Standing
81 to 90	9	A	Excellent
71 to 80	8	B	Very Good
61 to 70	7	C	Good

51 to 60	6	E	Average
41 to 50	5	E	Fair
Less than 41	0	F	Fail
Absent in the University Final Examination	0	I	Incomplete

*However, within the above grading system the student has to earn a minimum of 24markseach in Continuous Assessment and End Term Examination, thatis a total of (24) + (24) =48 marks have to be secured forgetting declared pass in the *"Fair" category.*

Note: In order to convert the GPA and CGPA into percentile, multiply the same with the Conversion factor of 9.10.

A student who earns a minimum of 5 grade Point (E grade) in a course (subject) is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course. A course successfully completed cannot be repeated.

A student should have appeared for the end semester examination of the prescribed course of study (mere appearance in the continuous assessment test is not sufficient) to be eligible for the award of the degree in the course.

If a student is eligible for but-fails to appeared in the end semester examination, he/she will be awarded an 'I grade (in complete) on the grade sheet. For all practical purposes an 'I'Grade is treated as an 'F'.

If a student is not eligible to appear in the end semester examination owing to his/her not fulfilling the minimum attendance requirements, he may be permitted to re-register for those courses in which he/she had attendance shortage, at the next available opportunity.

Grade Point Average (GPA) &Cumulative Grade Point Average (CGPA)

Each course grade will be converted into a specific number of points associated with the grade as mentioned in above Table 1. Here points are weighted with the number of credits assigned to a course. The Grade Point Average (GPA) is the weighted average of grade points awarded to a student. The Grade Point Average for each semester will be calculated only for those students who have passed all the courses of that semester. The weighted average of GPA's of all semester that the student has completed at any point of time is the Cumulative Grade Point Average (CGPA) at that point of time.

CGPA upto any semester will be calculated only for those students who have passed all the courses upto that semester.

Calculation of GPA and CGPA :

Example:
Table 2

Courses	Credits	Letter Grade	Grade Value	Credit Value	Grade Points
Mathematics	3	C	7	3x7	21
Chemistry	3	B	8	3x8	24
Physics	3	A	9	3x9	27
Language Lab	2	B	8	2x8	16
TOTAL	11			TOTAL	88

In this case GPA = $\frac{\text{Total Grade Points}}{\text{Credits}} = \frac{88}{11} = 8.0$

Suppose the GPAS in two successive semesters are 7.0 and 8.0 with 26 and 24 respective course credits, then the

CGPA = $\frac{7x26+8x24}{26+24} = \frac{374}{50} = 7.48$

After the results are declared, grade cards will be issued to each student which will contain the list of courses for that semester and the grades obtained by the student, as well as GPA of that semester. However, a conversion factor of "9.1", will be included, enabling students and future employers for transforming CGPA into percentage of marks at par with the existing practices of I.I.Ts, N.I.Ts and A.I.C.T.E.

Minimum Eligibility Requirements in Dr. K. N. Modi University for proceeding to the next academic year of study.

A First year Student of Dr. K. N. Modi University satisfying the below mentioned requirements is eligible to study in the 3rd Semester of next academic year.

"Pass with Minimum E Grade in Four Theory Papers & Pass in Four Laboratory Papers in the I & II Semester (Combined)"

A Second year Student of Dr. K. N. Modi University satisfying the below mentioned requirements is eligible to study in the Vth Semester of the next academic year.

"Pass with Minimum E Grade in Four Theory Papers & Pass in Four Laboratory Papers in the IIIrd& IV Semester (Combined)"

A Third year Student of Dr. K. N. Modi University satisfying the below mentioned requirements is eligible to study in the VIIth Semester of the next academic year.

"Pass with Minimum E Grade in Four Theory Papers & Pass in Four Laboratory Papers in the Vth& VI Semester (Combined)"

ELECTRICAL & ELECTRONICS ENGINEERING

DR. K. N. MODI UNIVERSITY

Study and Evaluation Scheme
B.Tech(Electrical & Electronics Engg.) Effective from session 2013-14
Year-II Semester-IVth

S.NO.	Sub Code	Subject Name	Period			Evaluation Scheme			Credit
						Continuous Assessment	Final Exam	Total	
			L	T	P				
1	02BTAS401	Mathematics-IV	3	1	0	40	60	100	4
2	02BTEE402	Control System	3	1	0	40	60	100	4
3	02BTEE403	Electromagnetic field theory	3	1	0	40	60	100	4
4	02BTEC404	Electronics Electrical Measuring Instruments	3	1	0	40	60	100	4
5	02BTEE405	Electrical Machines-I	3	1	0	40	60	100	4
6	02BTEE406	Circuit Analysis	3	1	0	40	60	100	4
LAB									
1	02BPEE402	Control System Lab	0	0	2	50	50	100	1
2	02BPEC404	Electronic Electrical Measuring Instruments Lab	0	0	2	50	50	100	1
3	02BPEE405	Electrical Machines-I Lab	0	0	2	50	50	100	1
4	02BPEE406	Circuit Analysis Lab	0	0	2	50	50	100	1
5	02BP4010	Seamless Learning	0	0	4	100		100	1
6	02BP4011	Co-Curricular Activities	0	0	4	100		100	1
		Total	**18**	**6**	**16**				**30**

DR. K. N. MODI UNIVERSITY

Study and Evaluation Scheme
B.Tech(Electrical & Electronics Engg.) Effective from session 2013-14
Year-III Semester-Vth

S.NO.	Sub Code	Subject Name	Period			Evaluation Scheme			Credit
						Continuous Assessment	Final Exam	Total	
			L	T	P				
1	03BTEE501	Power Electronics -I	3	1	0	40	60	100	4
2	03BTEC502	Microprocessor	3	1	0	40	60	100	4
3	03BTEC503	Principle of Communication System	3	1	0	40	60	100	4
4	03BTEE504	Generation of Electrical Power	3	1	0	40	60	100	4
5	03BTEE505	Electrical Machines-II	3	1	0	40	60	100	4
6	03BTME506	Industrial Engineering	3	1	0	40	60	100	4
LAB									
1	03BPEE501	Power Electronics I-Lab	0	0	2	50	50	100	1
2	03BPEC502	Microprocessor Lab	0	0	2	50	50	100	1
3	03BPEC503	Communication System Lab	0	0	2	50	50	100	1
4	03BPEE505	Electrical Machines-II Lab	0	0	2	50	50	100	1
5	03BP5010	Seamless Learning	0	0	4	100		100	1
6	03BP5011	Co-Curricular Activities	0	0	4	100		100	1
		Total	**18**	**6**	**16**				**30**

DR. K. N. MODI UNIVERSITY

Study and Evaluation Scheme

B.Tech(Electrical & Electronics Engg.) Effective from session 2013-14

Year-III Semester-VIth

S.NO.	Sub Code	Subject Name	Period			Evaluation Scheme			Credit
						Continuous Assessment	Final Exam	Total	
			L	T	P				
1	03BTEC601	Digital Communication	3	1	0	40	60	100	4
2	03BTEE602	Power Electronics-II	3	1	0	40	60	100	4
3	03BTEE603	Modern Control Theory	3	1	0	40	60	100	4
4	03BTEE604	Transmission and Distribution of Electrical Power	3	1	0	40	60	100	4
5	03BTEE605	Scada and Energy Management System	3	1	0	40	60	100	4
6	03BTEE606	High Voltage Engineering	3	1	0	40	60	100	4
LAB									
1	03BPEC601	Communication Lab-II	0	0	2	50	50	100	1
2	03BTEE602	Power Electronics II-Lab	0	0	2	50	50	100	1
3	03BPEE603	MATLAB Programming Lab	0	0	2	50	50	100	1
4	03BPEE606	High voltage engineering lab	0	0	2	50	50	100	1
5	03BP6010	Seamless Learning	0	0	4	100		100	1
6	03BP6011	Co-Curricular Activities	0	0	4	100		100	1
		Total	**18**	**6**	**16**				**30**

DR. K. N. MODI UNIVERSITY

Study and Evaluation Scheme
B.Tech(Electrical & Electronics Engg.) Effective from session 2013-14
Year-IV Semester-VIIth

S.NO.	Sub Code	Subject Name	Period			Evaluation Scheme			Credit
						Continuous Assessment	Final Exam	Total	
			L	T	P				
1	04BTEE701	AC/DC Transmission	3	1	0	40	60	100	4
2	04BTEE702	Power system analysis	3	1	0	40	60	100	4
3	04BTEE703	Economic operation of power system	3	1	0	40	60	100	4
4	04BTEE704	Switch Gear & Protection	3	1	0	40	60	100	4
5	04BTEE705	Computer aided design of electrical machine	3	1	0	40	60	100	4
6	04BTEE706	Power system Engineering	3	1	0	40	60	100	4
LAB									
1	04BPEE706	Power system Design lab	0	0	2	50	50	100	1
2	04BPEE702	Power system modelling & simulation lab	0	0	2	50	50	100	1
3	04BPEE704	Switch Gear & Protection	0	0	2	50	50	100	1
4	04BPEE709	Industrial Training	0	0	2	50	50	100	1
5	04BP7010	Seamless Learning	0	0	4	100		100	1
6	04BP7011	Co-Curricular Activities	0	0	4	100		100	1
		Total	**18**	**6**	**16**				**30**

DR. K. N. MODI UNIVERSITY

Study and Evaluation Scheme
B.Tech(Electrical & Electronics Engg.) Effective from session 2013-14
Year-IV Semester-VIIIth

S.NO.	Sub Code	Subject Name	Period			Evaluation Scheme			Credit
						Continuous Assessment	Final Exam	Total	
			L	T	P				
1	04BTEE801	Non Conventional Energy Source	3	1	0	40	60	100	4
2	04BTEE802	Electric Drives and their Control	3	1	0	40	60	100	4
3	04BTEE803	Protection of Power System	3	1	0	40	60	100	4
4	04BTEE804	Facts Device and their Application	3	1	0	40	60	100	4
5	04BTEE805	Utilization of Electrical Energy & Traction	3	1	0	40	60	100	4
LAB									
1	04BPEE802	Electrical drives and control labs	0	0	2	50	50	100	1
2	04BPEE803	Computer based Power System Lab	0	0	2	50	50	100	1
3	04BPEE809	Major Project	0	0	2	50	50	100	5
4	04BPEE808	Seminar	0	0	2	50	50	100	1
5	04BP8010	Seamless Learning	0	0	4	100		100	1
6	04BP8011	Co-Curricular Activities	0	0	4	100		100	1
		Total	**15**	**5**	**16**				**30**

Year-II Semester-IVth

MATHEMATICS IV
CODE:02BTAS401

Course objective: The main objectives of this course are to train the students to read and write mathematical proofs; to develop the students' mathematical problem solving skills; and to familiarize the students with standard concepts in discrete mathematics.

Unit 1: Differential Calculus:
Asymptotes and Curvature (Cartesian Coordinates Only) Concavity, Convexity and Point of Inflexion (Cartesian Coordinates Only) Curve Tracing (Cartesian and Standard Polar Curves – Cardioids, Lemniscates of Bernoulli, Limacon, And Equiangular Spiral

Unit 2: Statistics-I
Statistics and its Role in Scientific Description of data sets by Graphs and Tables, Summerizing Data sets using Measures of Central Tendency and Variation, Elements of Probability, Properties of Probability Counting Techniques, Conditional Probability/Bayes' Formula, Independent Events/Random Variables/Types of Random Variables.

Unit 3: Statistics-II
Cumulative Distribution Function, Expected values and its properties, Bernoulli, Binomial, Poisson, Geometric, Hypergeometric random variables, Normal Random Variables, Exponential, Gamma, chi-square , t and F distributions, The normal approximation to the Binomial distribution/Random Sampling/Statistical Sampling Distributions, Distribution of the Sample Mean and the Central Limit, Theorem of Normal Population Sampling Distribution from a Normal Population/Sampling from a Finite Population.

Unit 4: Curve fitting and Regression analysis
Methods of least square and curve fitting of straight lines and parabola, solutions of cubic and bi quadratic equations.

Unit 5: Calculus of variations
Functional, strong and weak variations simple variation problems, the Euler's equation.

Reference Books:
1) Higher Engineering Mathematics , B. S. Grewal, Khanna Publications
2) Engineering Mathematics Vol. 3, H.K. Dass, S. Chand Publishers

CONTROL SYSTEM
CODE - 02BTEE402

Course objective

This course deals with the fundamental principles for analysis and design of control systems. Topics include dynamic modeling, dynamic response, basic properties of feedback, root-locus design method, frequency-response design method, and state-space design.

Unit 1: Control System and Components:

Examples and application of open loop and close loop systems. Brief idea of multivariable control system, Brief idea of Z-transform and digital control systems. Differential equations. Determination of transfer function by block diagram reduction technique & signal flow graph method.

Unit 2: Time Response Analysis of First Order and Second Order System

Transient response analysis. Steady state error & error constants. Dynamic error and dynamic error coefficient, Performance Indices.

Unit 3: Frequency Domain Methods and Networks

Bode plot, Design specification in frequency domain and their co-relation with time domain, Lag, lead and log lead networks, brief idea of proportional, derivative and integral controllers.

Unit 4: Stability of the System:

Absolute stability and relative stability. Routh's stability criterion, Hurwitz criterion. Root locus method of analysis. Polar plots, Nyquist stability criterion. M and N loci.

Unit 5: State Variable Analysis:

Concepts of state, state variable and state model. State models for linear continuous time systems. Brief idea of state variable analysis in discrete time domain. Transfer functions, Solution of state equation. Concepts of controllability & observability.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley IndiaLtd, 2008.
4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

1. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
2. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
3. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
4. N.C. Jagan, " Control Systems", B.S. Publications,2007.

02BTEE403 -ELECTROMAGNETIC FIELD THEORY

Course Objective: The purpose of this course is to provide students with an introduction to the fundamentals of electrostatics, magnetostatics, and electromagnetics. The bridge between electric circuits and electromagnetics is done through the study of transmission lines and their lumped element model, transmission line input impedance, and power flow on lossless transmission line. This course also emphasizes the physical understanding and practical applications of electromagnetic in electronics.

Unit-1

Concept of distributed elements, Voltage and current equations, Characteristic impedance, Reflection coefficient, impedance transformation, Voltage and current standing wave, Power transfer in transmission lines, Transmission lines examples

Unit-2

Maxwell's Equations, Maxwell's Equations examples, Estimation of transmission line parameters, Boundary Conditions, Boundary Conditions- Examples, Wave equation, Unifrom Plane Waves, Power flow and Poynting Vector, Poynting vector- examples

UNIT-3

Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's theorem, Stoke's theorem.

UNIT-4

Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. Gauss's law. Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation.

UNIT -5

Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance, Energy stored in magnetic field, Analogy between electric and magnetic field.

Reference Books

1. Principals of Electromagnetics- Sadiku
2. Mayt, W.H. and Buck, J.A., "Engineering Electromagnetic" Tata Mc.Graw Hill Publishing
3. Jordan E.C. and Balmain K.G., "Electromagnetic Wave and radiating Systems" Prentice Hall International , 2nd Edition
4. Kraus, F. "Electromagnetic" Tata Mc. Graw Hill 5th Edition.
5. Elements of Engineering Electromagnetics – NN Rao
6. Field and Wave Electromagnetics – David. K. Cheng
7. Electromagnetic Waves - Shevgaonkar

ELECTRONICS ELECTRICAL MEASURING INSTRUMENTS
CODE : 02BTEC404

Course objective To provide a basic understanding of electrical measurement systems. To alert the students to the many varieties of meters, 'scopes and transducers available, their operating principles, strengths and weaknesses. To give students enough applications information that they can select optimum meters, transducer, amplifier, recording and readout devices to assemble a system for routine measurements of electrical phenomena.

Unit 1: Theory of Errors:

Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.

Unit 2: Electronic Instrument for Measuring basic Parameter:

Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, Component Measuring Instruments, Q meter, Vector Impedance meter, RF Power & Voltage Measurements, Measurement of frequency, Introduction to shielding & grounding.

Unit 3: Oscilloscope:

CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes. Curve tracers.

Unit 4: Signal Generation:

Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators, Instrumentation amplifiers, frequency to voltage converters, temperature to current converters, function generators, timers, sample and hold, Signal Analysis - Measurement Technique, Wave Analyzers, Frequency - selective wave analyser, Heterodyne wave analyser, Harmonic distortion analyser, Spectrum analyser,.

Unit 5: Transducers:

Classification, Selection Criteria, Characteristics, Construction, Working Principles, Application of following Transducers- RTD, Thermocouples, Thermistors, LVDT, RVDT, Strain Gauges, Bourdon Tubes, Bellows, Diaphragms, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.

Text Books:

1. A.K.Sawhney, “Advanced Measurements & Instrumentation”, Dhanpat Rai & Sons
2. B.C. Nakra & K.Chaudhry, “Instrumentation, Measurement and Analysis”, Tata Mc Graw Hill 2nd Edition.
3. Curtis Johns, “Process Control Instrumentation Technology”, Prentice Hall

Reference Books:

4. E.O. Decblin, “Measurement System – Application & design”, Mc Graw Hill.
5. W.D. Cooper and A.P. Beltried, “Electronics Instrumentation and Measurement Techniques” Prentice Hall International
6. Rajendra Prasad,”Electronic Measurement and Instrumentation Khanna Publisher
7. M.M.S. Anand, “Electronic Instruments and Instrumentation Technology” PHI Learning.

02BTEE405 ELECTRICAL MACHINES-I

Course objective

To clearly understand the basic concepts of the electrical machines working in the modern power system. Furthermore, modeling and analysis of various types of generators and motors is also carried out.

Unit-1:Electromechanical Energy Conversion: Basic principles of electromechanical energy conversion. Basic aspects and physical phenomena involved in energy conversion. Energy balance.

Unit-2:DC generators: Construction, Types of DC generators, emf equation, lap & wave windings, equalizing connections, armature reaction, commutation, methods of improving commutations, demagnetizing and cross magnetizing mmf, interpoles, characteristics, parallel operation. Rosenberg generator.

Unit-3:DC Motors: Principle, back emf, types, production of torque, armature reaction & interpoles, characteristics of shunt, series & compound motor, DC motor starting. Speed Control of DC Motor: Armature voltage and field current control methods, single-phase series motor.

Unit-4:Transformers: Construction, types, emf equation. No load and load conditions. Equivalent circuits, Vector diagrams, OC and SC tests, Sumpner's back-to-back test, efficiency. Voltage regulation, effect of frequency, parallel operation, autotransformers, switching currents in transformers, separation of losses.

Unit-5:Polyphase Transformers: Single unit or bank of single-phase units, polyphase connections, Open delta and V connections, Phase conversion: 3 to 6 phase and 3 to 2 phase conversions, Effect of 3-phase winding connections on harmonics, 3-phase winding transformers, tertiarywinding.

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.
2. P.C. Sen "Principles of Electrical Machines and Power Electronics" John willey & Sons, 2001
3. G.K.Dubey "Fundamentals of Electric Drives" Narosa Publishing House, 2001

Reference Books:

1. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987
2. M.G. Say "Alternating current Machines"Pitman & Sons

02BTEE406 CIRCUIT ANALYSIS

Course objective

To provide principles of analog integrated circuit analysis and design knowledge, which are required in analog IC design industry and research. Contents of the class include large and small signal behavior of MOS transistors, single-stage amplifiers, differential amplifiers, current mirrors, amplifier basics, input offset voltage and feedback.

Unit-1 Introduction: Network Analysis: Kirchhoff's laws, current division, Kirchhoff's voltage law(KVL), Mesh and Nodal Analysis of Electric circuits,

Unit-2 Network Theorems: Thevenis's, Norton's, Superposition, Reciprocity, Compensation, Millman's, Tellegen's, Maximum power transfer and Miller`s theorems.

Unit-3 Time Domain and Frequency Domain Analysis: Response of networks to step, ramp, impulse, pulse and sinusoidal inputs .Time domain and frequency domain analysis of circuits. Shifting theorem, initial and final value theorems.

Unit-4 Polyphase Circuits: Introduction, Advantage of Three phase system, Relationship between line and phase voltages and currents in Star Connection, Relationship between line and phase voltages and currents in delta connection, Measurement of power and power factor of balanced Three phase load, Variation in wattmeter readings. Unbalance loads.

Unit-5 Synthesis of passive networks: Concept of stability of a system (polynomial Ratio) from pole zero concept, Necessary Condition of stability of a network function [F(s)] ,Hurwitz polynomials, Properties of Hurwitz polynomials. Procedure of testing of a given polynomial for Hurwitz character.

Text Books:

1 M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2 A.Chakrabarti, "Circuit Theory" Dhanpat Rai & Co.
3 C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007.
4 D.Roy Choudhary, "Networks and Systems" Wiley Eastern Ltd.
5 Donald E. Scott: "An Introduction to Circuit analysis: A System Approach" McGraw Hill

Reference Books:

1.M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis",Wiley Eastern Ltd.
2.N.C. Jagan and C. Lakshminarayana, "Newwork Analysis" B.S. Publications, 2008.
3.K.S. Suresh Kumar, "Electric Circuits and Networks" Pearson Education, 2009.
4.A Ramakalyan, "Linear Circuits: Analysis and Synthesis" Oxford University Press, 2005.

02BPEE402- Control System Lab

1. Introduction to MATLAB Computing Control Software.
2. Defining Systems in TF, ZPK form.
3. For a given 2nd order system plot step response and obtain time response specification.
4. To design 1st order R-C circuits and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse
5. To design 2nd order electrical network and study its transient response for step input and following cases. (a) Under damped system (b) Over damped System. (c) Critically damped system.
6. To Study the frequency response of following compensating Networks, plot the graph andfinal out corner frequencies. (a) Lag Network (b) Lead Network (c) Lag-lead Network.
7. To draw characteristics of a.c servomotor
8. To perform experiment on Potentiometer error detector.
9. PID CONTROLLER
   (a) To observe open loop performance of building block and calibration of PID Controls.
   (b) To study P, PI and PID controller with type 0 system with delay.
   (c) To study P, PI and PID controller with type 1 system.
10. Plot bode plot for a 2nd order system and find GM and PM.

02BPEC404 - Electronic Electrical Measuring Instruments Lab

1. Measure earth resistance using fall of potential method.
2. Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
3. Measure unknown inductance capacitance resistance using following bridges
   (a) Anderson Bridge (b) Maxwell Bridge
4. To measure unknown frequency & capacitance using Wein's bridge.
5. Measurement of the distance with the help of ultrasonic transmitter & receiver.
6. Measurement of displacement with the help of LVDT.
7. Draw the characteristics of the following temperature transducers:
   (a) RTD (Pt-100) (b) Thermistors (c) Thermocouple

8	Draw the characteristics between temperature & voltage of a K type thermocouple.
9	Measure the speed of a Table Fan using stroboscope.
10	Measurement of strain/ force with the help of strain gauge load cell.
11	Study the working of Q-meter and measure Q of coils.
12	To study the working of Spectrum analyzer and determine the bandwidth of different signals.

02BPEE405 – Electrical Machines-I Lab

1	Speed control of D.C. shunt motor by (a) Field current control method & plot the curve for speed vs field current. (b) Armature voltage control method & plot the curve for speed vs armature voltage.
2	2 Speed control of a D.C. Motor by Ward Leonard method and to plot the curve for speed vs applied armature voltage.
3	3 To determine the efficiency of D.C. Shunt motor by loss summation (Swinburne's) method.
4	4 To determine the efficiency of two identical D.C. Machine by Hopkinson's regenerative test.
5	To perform O.C. and S.C. test on a 1-phase transformer and to determine the parameters of its equivalent circuit its voltage regulation and efficiency.
6	To perform back-to-back test on two identical 1-phase transformers and find their efficiency & parameters of the equivalent circuit.
7	To perform parallel operation of two 1-phase transformers and determine their load sharing.
8	To determine the efficiency and voltage regulation of a single-phase transformer by direct loading.
9	To perform OC & SC test on a 3-phase transformer & find its efficiency and parameters of its equivalent circuit.
10	To perform parallel operation of two 3-phase transformers and determine their load sharing.
11	To study the performance of 3-phase transformer for its various connections, i.e. star/star star/delta delta/star and delta/delta and find the magnitude of 3rd harmonic current.

02BPEE406 –Circuit Analysis Lab

1. Draw the circuit symbols.
2. Verify theorems for A. C. & D. C. circuits.

PSPICE Programs For Circuit Analysis:

3 DC-analyze resistor networks to determine node voltages, components voltages, and component currents.
4 Analyze resistor networks that have several voltage and current sources and variable load resistors.
5 Transient –analyze RC & RL circuits to produce tables of component voltage & current levels for a given set of time instants & to produce graphs of voltages & currents versus time.
6 AC-analyze impedance networks to determine the magnitude & phase of node voltages, components voltages and component currents.
7 Determine the magnitude & phase and component voltages and currents in resonant circuits & produce voltage and current v/s frequency graphs.

Programs For Circuit Analysis:

8 Calculate the resistance of a conductor, given its dimensions & resistivity or determine the change in conductor resistance when the temp changes.
9 D.C.-analyze resistor networks to determine all junction voltages, component voltages, and component currents.
10 Transient –analyze RC & RL circuits to produce tables of component voltage & current levels for a given set of time instants.
11 Convert Y-connected resistor networks to delta-connected circuits.

Year-III Semester-Vth

03BTEE501 –POWER ELECTRONICS-I

Course objective

The scope and objective of the course is to develop an understanding of state of the art in power electronics devices and circuits: their operation, performance, protection and applications.

Unit-1:PN Junction Diodes: Open-circuited p-n junction and space charge region. The biased p-n junction, volt-ampere characteristics, cutting voltage and effect of temperature on V-I characteristics. Minority carrier density distribution in (i) a forward biased junction and (ii) a reverse biased junction, diode capacitances, junction diode switching times and characteristics.

Other Diodes: Avalanche breakdown and zener breakdown, working principles of zener diodes, photo-diodes, light emitting diodes, solar cell and varactor diodes.

Unit-2:Analysis of Diode Circuits: Diode as a circuit element, load line, small signal diode model and large signal diode model, analysis of half wave and full wave single-phase rectifiers, peak inverse voltage, various types of filters, their analysis and applications, voltage multipliers, clipping and clamping circuits.

Unit-3:Bipolar Junction Transistors (BJT): P-N-P and N-P-N transistors, transistor current components, common base (CB) and common emitter (CE) configurations: input & output characteristics, current Gains: alpha & beta, transistor operating regions: active region, saturation region and cutoff region, common collector configuration, BJT biasing and DC models, thermal stability and stabilization Techniques, small signal models: h-parameters and hybrid pie models, BJT as a switch, minority carrier concentration in the base for cutoff, active and saturation conditions, transistor switching times and characteristics, transistor ratings.

Unit-4:Field Effect Transistors: Construction, working, V-I characteristics and transfer characteristics of JFET. MOSFET: Enhancement type and depletion type: construction, working, V-I characteristics, and transfer characteristics. DC analysis of FETs. FET as a voltage variable resistor. FET small signal models. FET as a switch. CMOS.

Unit-5Small Signal Amplifiers: Analysis of BJT and JFET amplifiers at low frequency: input and out resistances, voltage and current gains, frequency response of common emitter transistor amplifier at high frequency. Miller's theorem and its dual. Cascaded BJT amplifiers. Darlington pair and Bootstrapped Darlington circuit.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rdEdition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics"Tata MC Graw Hill, 2005
3. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press,2007.

Reference Books:

4. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
5. Chakrabarti & Rai, "Fundamentals of Power Electronics &Drives"Dhanpat Rai & Sons.
6. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India Ltd,2008.
7. S.N.Singh, "A Text Book of Power Electronics" Dhanpat Rai & Sons

03BTEC502 - MICROPROCESSORS

Course objective

At the end of the course the student should:
(a) know basics of microprocessor-based Systems
(b) know basics of assembly language
(c) know the process of compilation from high level language to assembly language to machine language.
(d) know interaction between hardware and software, i.e. `interfacing'

UNIT I: Introduction:
Introduction to Microprocessors, 8085 Microprocessor, Architecture, pin description, Bus concept and organization; concept of multiplexing and demultiplexing of buses. Input/output devices, buffers, encoders, latches. Brief introduction to comparison of different features in 8085and 8086 microprocessors.

UNIT II:
Software architecture registers and signals, Classification of instruction, Instruction set, addressing modes, Assembly Language Programming and Debugging, Programming Technique, instruction Format and timing.

UNIT III:
Advance Assembly Language Programming, Counter and time delay; types of Interrupt and their uses, RST instructions and their uses, 8259 programmable interrupt controller; subroutine; Stack implementation and uses with examples; Memory interfacing.

UNIT IV:
8085 Microprocessor interfacing, 8255 Programmable Peripheral Interface, 8254, programmable interval timer, interfacing of Input/output device, 8279 Key board/Display interface.

UNIT V: Computer Architecture: Central Processing Unit, memory and input/output interfacing. Memory Classification: Volatile and non-volatile memory, Primary and secondary memory, Static and Dynamic memory, Logical, Virtual and Physical memory. Types of memory: Magnetic core memory, binary cell, Rom architecture and different types of ROM, RAM architecture, PROM, PAL, PLA, Flash and Cache memory, SDRAM, RDRAM and DDRAM. Memory latency, memory bandwidth, memory seek time.

Text Books:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.
2. Uffenbeck, John, "Microcomputers and Microprocessors" PHI/ 3rd Edition.
3. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing" Tata Mc. Graw Hill.
4. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.

Reference Books:

1. Brey, Barry B. "INTEL Microprocessors" Prentice Hall (India)
2. ADitya P Mathur, "Introduction to Microprocessor" Tata Mc Graw Hill
3. M. Rafiquzzaman, "Microprocessors- Theory and applications" PHI
4. B. Ram, "Advanced Microprocessor & Interfacing" Tata McGraw Hill

03BTEC503-PRINCIPLE OF COMMUNICATION SYSTEMS

Course objective

This course provides an introduction to analog and digital communications systems. The band pass transmission of analog data is motivated and typical systems are analyzed with respect to bandwidth considerations and implementation techniques. Baseband and passband digital transmission systems are introduced. Pulse shaping and intersymbol interference criteria are developed in relation to the pulse rate transmission limits of bandlimited channels

Unit-1:Noise Effects in Communication Systems: Resistor noise, Networks with reactive elements, Noise temperature, Noise bandwidth, effective input noise temperature, Noise figure. Noise figure & equivalent noise temperature in cascaded circuits.

Unit-2:Amplitude Modulation: Frequency translation, Recovery of base band signal, Spectrum & power relations in AM systems. Methods of generation & demodulation of AM-DSB, AMDSB/ SC and AM-SSB signals. Modulation & detector circuits for AM systems. AM transmitters & receivers.

Unit-3:Frequency Modulation: Phase & freq. modulation & their relationship, Spectrum & bandwidth of a sinusoidally modulated FM signal, phasor diagram, Narrow band & wide band FM. Generation & demodulation of FM signals. FM transmitters & receivers, Comparison of AM, FM & PM. Pre emphasis & de-emphasis. Threshold in FM, PLL demodulator.

Unit-4: **Noise in AM and FM:** Calculation of signal-to-noise ratio in SSB-SC, DSB-SC, DSB with carrier, Noise calculation of square law demodulator & envelope detector. Calculation of S/N ratio in FM demodulators, Super-heterodyne receivers.

Unit-5:Pulse Modulation Systems: Sampling theorem, Generation and demodulation methods of PAM, PWM, PPM

Text Books:

1. G. Kennedy and B. Davis , "Electronic Communication Systems" Tata McGraw Hill
2. Simon Haykin, " Communication Systems" John Wiley & Sons

Reference Books:

3. Roy Blake, " Wireless Communication Technology" Thomson Asia Pvt. Ltd. Singapore
4. B. P. Lathi, "Modern Analog and Digital Communication Systems" Oxford University Press.
5. Taub & Schilling, "Principles of Communication Systems" McGraw Hill.

03BTEE504-GENERATION OF ELECTRICAL POWER

Course objective

Provide students with a broad understanding of electricity generation. The corresponding Course Outcomes are

(1) Students will have a basic understanding of conversion of coal, oil, gas,nuclear, hydro, solar, geothermal, etc. energy to electrical energy.
(2) Students will understand the operation and major components of electric generating plants.

Unit-1:Conventional Energy Generation Methods: **(i) Thermal Power plants:** Basic schemes and working principle. **(ii) Gas Power Plants:** open cycle and closed cycle gas turbine plants, combined gas & steam plants – basic schemes. **(iii) Hydro Power Plants:** Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. **(iv) NuclearPower Plants:** Nuclear fission and Nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.

Unit-2:New Energy Sources: Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming). Renewable and non-renewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.

Unit-3:(i) Loads and Load curves: Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization. **(ii) Power factor improvement**: Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers.

Unit-4:Power Plant Economics: (i) Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. **(ii)** Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. **(iii) Energy cost reduction:** off peak energy utilization, co-generation, and energy conservation.

Unit-5:(i) Tariffs: Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three-part tariff. Spot (time differentiated) pricing. **(ii) Selection of Power Plants:** Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.

Text Books:

1. B.R. Gupta,"Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad.

Reference Books:

4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
5. S. L. Uppal, "Electrical Power", Khanna Publishers.

03BTEE505-ELECTRICAL MACHINES-II

Course objective

To clearly understand the basic concepts of the electrical machines working in the modern power system. Furthermore, modeling and analysis of various types of generators and motors is also carried out.

Unit-1:Introduction: General equation of inducted emf, AC armature windings: concentric and distributed winding, chording, skewing, effect on induced emf. Armature and field mmf, effect of power factor and current on armature mmf, harmonics. Rotating fields.

Unit-2:Induction Motors: Construction of squirrel cage & slip ring induction motor, basic principles, flux and mmf waves, induction motor as a transformer. Equivalent circuits, torque equation, torque-slip curves, no load & block rotor tests, circle diagram, performance calculation. Effect of rotor resistance. Cogging, Crawling. Double cage squirrel cage induction motor, induction generator, induction regulator.

Unit-3:Starting & Speed Control of Induction Motors: Various methods of starting & speed control of squirrel cage & slip ring motor, cascade connection, braking. **Single-Phase Induction Motor:** Revolving field theory, starting methods, equivalent circuits.

Unit-4:Synchronous Generator: Construction, types, excitation systems, principles. Equation of induced emf, flux and emf waves, theory of cylindrical rotor and salient pole machines, two reactance theory, phasor diagrams, power developed, voltage regulation, OC & SC tests, zero power factor characteristics, potier triangle and ASA method of finding voltage regulation, synchronization, parallel operation, hunting and its prevention.

Unit-5: Synchronous Motors: types, construction, principle, phasor diagrams, speed torque characteristics, power factor control, V-curves, starting methods, performance calculations, applications, synchronous condenser, synchronous induction motor.

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.
2. P.C. Sen " Principles of Electrical Machines and Power Electronics" John willey & Sons, 2001
3. G.K.Dubey "Fundamentals of Electric Drives" Narosa Publishing House, 2001

Reference Books:

4. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987
5.M.G. Say " Alternating current Machines"Pitman & Sons

03BTME506 -INDUSTRIAL ENGINEERING

Course Objective: The course aims to develop the skills of the students in the area Industrial management and their problems. This will be necessary for understanding the Industry system.

Unit l:- Introduction:concept, development, application and scope of Industrial management.Productivity: Definition, measurement, productivity index, types of production system, industrial ownership.

Unit 2:- Management Function:Principles of Management – Management Tools – time and motion study production planning, specification of Production requirements.

Unit 3:- Inventory Control: Inventory cost, Deterministic models, Introduction to supply chain management.

Unit 4:- Building construction, Inspection of site, high rise building, Fire protection introduction , Earth quake, Lightning and electrical hazard protection, Building construction, Building materials, Plan reading and method, Standard, symbols, designation, Personal hazards, Fire escape structural precaution, Fire hazard in a building, Building collapse and symptoms, Fire tower/fire escape.

Unit 5:- Environmental Issues: Environmental pollution – various management techniques to control Environmental pollution – various control Acts for Air, Water, Solid waste and Noise Pollution.

Reference Books :-

1. Industrial Engineering - O P Khanna
2. Industrial Engineering – Buffa & Sarin
3. Industrial Engineering – M Mahajan
4. cementing work, Transportation of men and material, Lock out and tag out, Shoring, Waste control disposal
5. Environmental, safety, and health engineeringBy Gayle Woodside, Dianna S. Kocurek, john wiley & sons.

03BPEE501-POWER ELECTRONICS LAB-I

1 Study the following devices: (i) Analog & digital multimeter (ii) Function/ Signal generators (iii) Regulated d. c. power supplies (constant voltage and constant current operations)
2 Study of digital storage CRO and store a transient on it.
3 Study of analog CRO, CRO probes, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
4 Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances.
5 Plot V-I characteristic of zener diode and study zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
6 Plot frequency response curve for audio amplifier and to determine gain bandwidth product.
7 Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss & Vp
8 Plot gain- frequency characteristic of two stages RC coupled amplifier & calculate its bandwidth and compare it with theoretical value.
9 Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
10 Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters.
11 Study half wave rectifier and effects of filters on wave. Also calculate ripple factor.
12 Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.

03BPEC502-MICROPROCESSOR LAB

1. Program to perform addition (1) 8-bit numbers (2) 16-bit numbers.
2. Program to perform subtraction (1) 8-bit numbers (2) 16-bit numbers.
3. Program to perform division: (1) 8-bit by 8-bit (2) 16 bits by 8 bit.
4. Program to perform multiplication: 8-bit by 8-bit
5. Find one's and two's complement of 16-bit numbers.
6. Transfer of a block of data in memory to another place in memory.
7. Sorting of array in: (1) Ascending order (2) Descending order.
8. Program to perform following conversion (1) Binary to ASCII (2) Binary to BCD.
9. Program to find the smallest number in an array.
10. Program to the largest number in an array.
11. To display 'n' elements of the Fibonacci series using 8085
12. To generate Sawtooth, triangular, sine and square waveform using 8085 microprocessor.
13. Find addition of 32-bit numbers using 8086.
14. To move contents of array from one memory location to another memory location.
15. To convert a BCD number into hexadecimal with 8086 microprocessor.
16. Transfer of a block of data in memory to another place in memory using 8086.
17. To separate odd and even numbers using 8086 microprocessor.

03BPEC503-COMMUNICATION LAB-I

1. Harmonic analysis of a square wave of a modulated wave form.
2. Observe the Amplitude modulated wave form & measure modulation index. Demodulation of AM signal.
3. Generation & Demodulation of DSB – SC signal.
4. Modulate a sinusoidal signal with high frequency carrier to obtain FM signal. Demodulation of the FM signal.
5. To observe the following in a transmission line demonstrator kit :
(a) The propagation of pulse in non reflecting transmission line.
(b) The effect of losses in transmission line.
(c) Transmission with standing waves on a Transmission line.
(d) The resonance characteristics of a half-wave length long X-mission line.
6. (a) To observe the operation of sampling and sample & hold circuits.
(b) To study the effect of sampling time (sampling pulse width).
(c) To study the effects of changing the sampling frequency & observing aliasing phenomena.
7. To study & observe the operation of a super heterodyne receiver.
8. To study & observe the amplitude response of automatic gain controller (AGC).
9, 10. PAM, PWM & PPM: Modulation and demodulation.

03BPEE505-ELECTERICAL MACHINES LAB-II

1 Separation of transformer core losses and to determine the hystersis and eddy current losses at rated voltage and frequency.
2 To plot the O.C.C. & S.C.C. of an alternator and to determine its regulation by synchronous impedance method.
3 To synchronize an alternator across the infinite bus (RSEB) & summarize the effects of variation of excitation on load sharing.
4 To plot the V-curve for a synchronous motor for different values of loads.
5 To perform sumpner's back-to-back test on 3 phase transformers, find its efficiency & parameters for its equivalent circuits.
6 To perform the heat run test on a delta/delta connected 3-phase transformer and determine the parameters for its equivalent circuit.
7 To perform no load and blocked rotor test on a 3 phase induction motor and to determine the parameters of its equivalent circuits. Draw the circle diagram and compute the following (i) Max. Torque (ii) Current (iii) slip (iv) p.f. (v) Efficiency.
8 To perform the load test on a 3-phase induction motor and determine its performance characteristics (a) Speed vs load curve (b) p.f. vs load curve (c) Efficiency vs load curve (d) Speed vs torque curve
9 Determination of losses and efficiency of an alternator.
10 To find Xd and Xq of a salient pole synchronous machine by slip test.

Year-III Semester-VIth

03BTEC601-DIGITAL COMMUNICATION

Course objective

The objective of this course is to develop an understanding of the fundamental principlesof the digital communication system, and proficiency in applying the principles to theanalysis and design of sophisticated digital communication systems. The course is intendedfor both senior undergraduate students and graduate students who wish to major in digitalcommunication, wireless communication or are interested in learning the basic principlesand technologies used in today's digital communication systems.

Unit-1: PCM & DELTA Modulation Systems: PCM and delta modulation, quantization noise in PCM and delta modulation. Signal-to-noise ratio in PCM and delta modulation, T1 Carrier System, Comparison of PCM and DM. Adaptive delta Modulation. Bit, word and frame synchronization, Matched filter detection.

Unit-2: Digital Modulation Techniques: Various techniques of phase shift, amplitude shift and frequency shift keying. Minimum shift keying. Modulation & Demodulation.

Unit-3: Error Probability in Digital Modulation: Calculation of error probabilities for PSK, ASK, FSK & MSK techniques.

Unit-4: Information Theory: Amount of Information, Average Information, Entropy, Information rate, Increase in Average information per bit by coding, Shannon's Theorem and Shannon's bound, Capacity of a Gaussian Channel, BW-S/N trade off, Orthogonal signal transmission.

Unit-5 Coding: Coding of Information, Hamming code, Single Parity-Bit Code, Linear Block code, cyclic code & convolution code.

Text Book:

Haykin, simon / "Communication System" / John Wiley /4th Ed.

Reference Books:

1. Singh, R.P. & Sapre, S.D. /"Communication Systems: Analog &Digital" /Tata McGraw-Hill.
2. Lathi, B.P. / "Modern Digital &Analog Communication System" /Oxford University Press.
3. Simon Haykin/ "Prinicples of Communication Systems"/ Tata McGraw-Hill
4. Taub & Schilling/"Communication Systems"/Tata McGrw-Hill.
5. A.B. Carlson / "Digital Communication Systems"/Tata McGraw-Hill.
6. Prokis J.J/ "Digital Communications" /McGrawHill
7. Charkrabarti, P. / "Analaog & Digital Comminication" / Tata McGraw –Hill
8. Kennedy, Georg & Davis, Bernard/ "Electronic communication systems" / Tata McGraw-Hill.

03BTEE602-POWER ELECTRONICS-II

Course objective The scope and objective of the course is to develop an understanding of state of the art in power electronics devices and circuits, oscillators, op-amp and its application, power amplifiers: their operation, performance, and applications.

Unit-1: Feedback Amlifiers: Classification, Feedback concept, transfer gain with feedback. General characteristics of negative feedback amplifiers. Analysis of voltage series, voltage shunt, current series and current shunt feedback amplifiers. Stability criterion.

Unit-2: Oscillators: Classification of oscillators and Criterion for oscillation. RC-phase shift, Hartley, Colpitts, tuned collector, Wein Bridge and crystal oscillators. Astable, monostable and bistable multivibrators. Schmitt trigger.

Unit-3: OP-AMP and Its Applications: Operational amplifier: inverting and non-inverting modes. Characteristics of ideal op-amp. Offset voltage and currents. Basic op-amp applications. Differential Amplifier and common mode rejection ratio. Differential DC amplifier and stable ac coupled amplifier. Integrator and differentiator. Analog computation, comparators, sample and hold circuits, logarithmic & antilog Amplifiers and Analog multipliers.

Unit-4: Integrated Circuits: Precision AC/DC converters-precision limiting, Precision half wave and full wave rectifiers. Active average and peak detectors, A to D and D to A converters. IC 555 timer and its application. Regulated power supplies, Series and shunt voltage regulators, Brief idea of Monolithic regulator.

Unit-5 Power Amplifiers: Class –A large signal amplifiers, second harmonic distortion, higher order harmonic generation, Transformer coupled audio power amplifier, collector efficiency. Pushpull amplifier: Class A, Class B and Class AB operations. Comparison of performance with single ended amplifiers.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd
Edition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics"Tata MC Graw Hill, 2005
3. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press,2007.

Reference Books:

4. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
5. Chakrabarti & Rai, "Fundamentals of Power Electronics &Drives"Dhanpat Rai & Sons.
6. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications and Design", Wiley India Ltd,2008.
7. S.N.Singh, "A Text Book of Power Electronics" Dhanpat Rai & Sons

03BTEE603-MODERN CONTROL THEORY

Course objective

This course is for those who want to know about control methods that can handle difficult situations or optimize performance. The course presents methods of getting mathematical models directly from data (system identification), so that one can start the control design process. It presents how to construct state estimates in real time based on feedback measurements, to use in modern state feedback control laws.

Unit-1: Introduction: Concept of Linear vector space Linear Independence, Bases & Representation, domain and range. Concept of Linearity, relaxedness, time invariance, causality.

Unit-2: State Space Approach of Control System Analysis: Modern Vs conventional control theory, concept of state, state variable state vector, state space, state space equations, Writing statespace equations of mechanical, Electrical systems, Analogous systems.

Unit-3: State Space Representation using physical and phase variables, comparison form of system representation. Block diagram representation of state model. Signal flow graph representation. State space representation using canonical variables. Diagonal matrix. Jordan canonical form, Derivation of transfer function from state-model.

Unit-4 Solution of State Equations: Diagonalization, Eigenvalues and eigen vectors. Matrix exponential, State transition matrix, Properties of state transition matrix. Computation of State transition matrix concepts of controllability & observability. Pole placement by state feedback, Ackerman's formula

Unit-5 Digital Control Systems: Introduction, sampled data control systems, signal reconstruction, difference equations. The z-transform, Z-Transfer Function. Block diagram analysis of sampled data systems, z and s domain relationship, digital PID controller.

Text Books:

1. Nagrath & Gopal, "Control System Engineering", 4th Edition, New age International.
2. K. Ogata, "Modern Control Engineering", Prentice Hall of India.
3. B.C. Kuo & Farid Golnaraghi, "Automatic Control System" Wiley IndiaLtd, 2008.
4. D.Roy Choudhary, "Modern Control Engineering", Prentice Hall of India.

Reference Books:

5. Norman S. Mise, Control System Engineering 4th edition, Wiley Publishing Co.
6. Ajit K Mandal, "Introduction to Control Engineering" New Age International, 2006.
7. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, "Design of Feedback Control Systems" Oxford University Press.
8. N.C. Jagan, " Control Systems", B.S. Publications,2007.

03BTEE604-TRANSMISSION & DISTRIBUTION OF ELECTRICAL POWER

Course objective

This online course provides facilities engineers with guidelines on the safe operation and maintenance of electrical equipment and installations used for transmission and distribution of electrical power. The contents cover general safety practices; switching, tagging, testing of circuits and equipment; overhead lines, switchyards, substations and underground line maintenance.

At the conclusion of this course, the student will:

- Have a better understanding of the electrical hazards in Transmission and Distribution Maintenance work; and
- Be familiar with the general safety practices and the required safety equipment.

Unit-1: (i) Supply systems: - Basic network of power system. Transmission and distribution voltage, effect of system voltage on size of conductor and losses. Comparison of DC 2- wire, DC 3- wire, 1- phase AC and 3- phase AC (3- wire and 4- wire) systems.

(ii) Distribution Systems: - Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems. Kelvin's law for conductor size.

Unit-2: Mechanical features of overhead lines:- Conductor material and types of conductor. Conductor arrangements and spacing. Calculation of sag and tension, supports at different levels, effect of wind and ice loading, stringing chart and sag template. Conductor vibrations and vibration dampers.

Unit-3: Parameters of Transmission Lines: Resistance inductance and capacitance of overhead lines, effect of earth, line transposition. Geometric mean radius and distance. Inductance and capacitance of line with symmetrical and unsymmetrical spacing Inductance and capacitance of double circuit lines. Skin and proximity effects. Equivalent circuits and performance of short and medium transmission lines**.**

Unit-4: (i) Generalized ABCD line constants, equivalent circuit and performance of long transmission line. Ferranti effect. Interference with communication circuits. Power flow through a transmission line.

(ii) Corona: Electric stress between parallel conductors. Disruptive critical voltage and visual critical voltage, Factors affecting corona. Corona power loss. Effects of corona.

Unit-5: (i) Insulators: Pin, shackle, suspension, post and strain insulators. Voltage distribution across an insulator string, grading and methods of improving string efficiency**.**

(ii) UndergroundCables: Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses. Causes of breakdown. Thermal rating of cable. Introduction to oil filled and gas filled cables.

Text Books:

(1) Transmission and distribution electrical engineering by Colin R. Bayliss

(2) Electrical Power Transmission And Distribution by M.V.Bakshi U.A.Bakshi, technical publication.

03BTEE605-SCADA & ENERGY MANAGEMENT SYSTEM

Course objective

Explore the design principles and practical applications of modern energy management systems, communications, and user interfaces. Develop a clear understanding of the philosophy of modern power system operations and the role of energy management systems, their design, and actual implementation. Survey past and current practices, as well as trends in the state-of-the-art design of energy management systems.

Unit-1: SCADA: Purpose and necessity, general structure, data acquisition, general power system hierarchical Structure, Overview of the methods of data acquisition systems, commonly acquired data, transducers, RTUs, data concentrators, various communication channels- cables, telephone lines, power line carrier, fiber optical channels and satellites.

Unit-2: Supervisory and Control Functions:

Data acquisitions, status indications, monitoring alarm and event application processing. Operation and control of Interconnected Power Systems, Automatic generation control. Regulatory functions: Set points and feedback loops, data collection and analysis.

Unit-3: MAN- Machine Communication:

Automatic sub-station Control, sub-station control functions arranged through SCADA systems. Operator Automatic sub-station Control Automatic sub-station Control, displays, operator dialogues, alarm and event loggers, mimic diagrams.

Unit-4: Data basis- SCADA, EMS and network data basis. SCADA system structure – local system, communication system and central system. SCADA Configurations-Remote Terminal Units and Interfacing with computer, Power system planning and design.

Unit-5: Energy Management System:

Functions performed at a centralized management center, Redundant computer system and sophisticated SCADA system, Tools for integration, database systems Integration, System operating states, System security, State estimation, Expert systems using Artificial Intelligence for power system operation, SCADA system for power system.

Text Books:

1. Torsten Cergrell, " Power System Control Technology", Prentice Hall International.
2. George L Kusic "Computer Aided Power System Analysis",, Prentice Hall of India,
3. A. J. Wood and B. Woolenberg, "Power Generation Operation and Control", John Wiley & Sons.
4. Sunil S Rao, "Switchgear Protection & Control System" Khanna Publishers 11 th Edition.

03BTEE606- HIGH VOLTAGE ENGINEERING

Course objective

This course deals with study of various breakdown in solid, liquid and gases, alsomeasurement and testing of high voltage & current.

Unit-1: (i) Breakdown in Gases: Introduction to mechanism of breakdown in gases, Townsend's breakdown mechanism. Breakdown in electromagnetic gases. Application of gases in power system.

(ii) Breakdown in Liquids: Introduction to mechanism of breakdown in liquids, suspended solid particle mechanism and cavity breakdown. Application of oil in power apparatus.

(iii) Breakdown in solids: Introduction to mechanism of breakdown in solids, electromechanical breakdown, treeing & tracking breakdown and thermal breakdown.

Unit-2: (i) High DC Voltage Generation: Generation of high dc voltage, basic voltage multiplier circuit.

(ii) High AC Voltage Generation: Cascaded Transformers.

(iii) Impulse Voltage generation: Impulse voltage, basic impulse circuit, Mark's multistage impulse generator.

(iv) Measurement of High Voltage: Potential dividers - resistive, capacitive and mixed potential dividers. Sphere gap- Construction and operation. Klydonorgraph.

Unit-3: Nondestructive Insulation Tests: (i) Measurement of resistively, dielectric constant and loss factor. High Voltage Schering Bridge- measurement of capacitance and dielectric loss.

(ii) Partial Discharges: Introduction to partial discharge, partial discharge equivalent circuit. Basic wide-band and narrow band PD detection circuits.

Unit-4: (i) Over voltages: Causes of over voltages, introduction to lightning phenomena, over voltages due to lighting.

(ii) Travelling Waves: Travelling waves on transmission lines-open end line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at a T-junction and line terminated through a capacitance. Attenuation of tavelling waves.

Unit-5: (i) Over Voltage Protection: Basic construction and operation of ground wires-protection angle and protective zone, ground rods, counterpoise, surge absorber, rod gap and arcing horn, lighting arresters - expulsion type, non -linear gap type and metal oxide gapless type.

Text Book:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.

Reference Books:

2. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
3. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers
4. R. S. Jha, "High Voltage Engineering", Dhanpat Rai & sons
5. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
6. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
7. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

03BPEC601-COMMUNICATION LAB-II

1. (a) To observe sampling of analog signal. Identify & solve the aliasing problem.
(b) To observe the Transmission of two signals over a single channel using sampling methods.
2. TDM-PAM: Modulation & demodulation.
3. Operation of a PCM encoder & decoder.
4 TDM-PCM: Modulation & demodulation.
5. Observe the performance of a Delta modulation system & to derive from it a delta sigma modulation system.
6. To generate and study the various data formatting schemes (Unipolar, Bi-polar, Manchester,AMI etc.).
7. Generate ASK signals, with and without carrier suppression. Demodulation of these two types of modulated signal.
8. Generate the FSK wave forms & demodulate the FSK signals based on the properties of (a) Tuned circuits (b) PLL
9. Generate the PSK signals and demodulate it.

Simulation using any virtual Instrumentation Software:

10. To carry out convolution in both continuous time and discrete time systems.
11. Companding and multiplexing of PCM signals.
12. Perform various keying Techniques: PSK, ASK, FSK & MSK.

03BPEE602- POWER ELECTRONICS LAB-II

1 Plot gain-frequency characteristics of BJT amplifier with and without negative feedback in the emitter circuit and determine bandwidths, gain bandwidth products and gains at 1KHz with and without negative feedback.
2 Study of series and shunt voltage regulators and measure line and load regulation and ripple factor.
3 Plot and study the characteristics of small signal amplifier using FET.
4 Push Pull amplifier: To study variation of output power & distortion with load.
5 Study Wein bridge oscillator and observe the effect of variation in R & C on oscillator frequency
6 Study transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.
7 Study the following oscillators and observe the effect of variation of C on oscillator frequency: (i) Hartley (ii) Colpitts
8 (i) Study op-amp in inverting and non-inverting modes. (ii) Use op-amp as scalar, summer and voltage follower.
9 Use of op-amp as differentiator and integrator.
10 Study Op-amp characteristics and get data for input bias current, measure the output-offset voltage and reduce it to zero and calculate slow rate.
11 Obtain a frequency response of filters.
12 Analyze filter circuits to produce voltage frequency & phase-frequency response graphs using

03BPEE603-MATLAB PROGRAMMING LAB

1 Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multi-dimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets)
2 Simulink: Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)

03BPEE606-HIGH VOLTAGE ENGINEERING LAB

1 Study filtration and Treatment of transformer oil.
2 Determine dielectric strength of transformer oil.
3 Determine capacitance and dielectric loss of an insulating material using Schering bridge.
4 Study solid dielectrics used in power apparatus.
5 Study applications of insulating materials.
6 Study direct testing and indirect testing of circuit breakers.
7 Study high voltage testing of electrical equipment: line insulator, cable, bushing, power capacitor, and power transformer.
8 Design an EHV transmission line.

Year-IV Semester-VIIth

04BTEE701-EHV AC/DC TRANSMISSION

Course objective

To understand the various aspects of EHV AC and HVDC system and its operation and to understand about the harmonics and its effects on power system

Unit-1: EHV AC Transmission:

Need of EHV transmission lines, power handling capacity and surge impedance loading. Problems of EHV transmission, bundled conductors: geometric mean radius of bundle, properties of bundle conductors. Electrostatic fields of EHV lines and their effects, corona effects: Corona loss, audio and radio noise.

Unit-2: Load Frequency Control:

Introduction to control of active and reactive power flow, turbine speed governing system. Speed governing characteristic of generating unit and load sharing between parallel operating generators. **Method of Load Frequency Control:** Flat frequency, flat tie line and tie line load bias control. Automatic generation control (description of block diagram only).

Unit-3: Voltage Control:

No load receiving end voltage and reactive power generation. Methods of voltage control. Synchronous phase modifier, shunt capacitors and reactors, saturable reactors, Thynstorised static VAR compensators- TCR, FC-TCR and TSC- TCR.

Unit-4: FACTS:

Introduction to FACTS controllers, types of FACTS controllers, Brief description of STATCOM, Thyristor controlled series capacitors and unified power flow controller.

Unit-5: HVDC Transmission:

Types of D.C. links, advantages and disadvantages of HVDC transmission. Basic scheme and equipment of converter station. Ground return. Basic principles of DC link control and basic converter control characteristics. Application of HVDC transmission.

Text Books :

1.R. D. Begamudre, "Extra High Voltage AC Transmission Engineering" Wiley Eastern.
2.K. R. Padiyar, "HVDC Power Transmission Systems: Technology and System Reactions" New Age International.
3.J. Arrillaga," High Voltage Direct current Transmission" IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
4.M. S. Naidu & V. Kamaraju, "High Voltage Engineering" Tata Mc Graw Hill.

Reference Books:

5.M. H. Rashid , " Power Electronics : Circuits, Devices and Applications" Prentice Hall of India.
6.S. Rao, "EHV AC and HVDC Transmission Engineering and Practice" Khanna Publisher.
7."EPRI, Transmission Line Reference Book, 345 KV and above" Electric Power Research Institute. Palo Alto, California, 1982.

04BTEE702-POWER SYSTEM ANALYSIS

Course objective

This course, which provides students with a working knowledge of power system problems and computer techniques used to solve some of these problems. Topics include: load flow analysis, optimal dispatch of generation, symmetrical three-phase faults, symmetrical components, unsymmetrical faults, technical treatment of the general problem of power system stability and its relevance.

Unit-1: (i) Percent and per unit quantities. Single line diagram for a balanced 3-phase system. **(ii) Admittance Model:** Branch and node admittances Equivalent admittance network and calculation of Y_{bus}. Modification of an existing Y_{bus}.

Unit-2: (i) Impendence Model: Bus admittance and impedance matrices. Thevenin"s theorem and Z_b Direct determination of Z_{bus}. Modification of an existing bus.

(ii) Symmetrical fault Analysis: Transient on a Transmission line, short circuit of a synchronous machine on no load, short circuit of a loaded synchronous machine. Equivalent circuits of synchronous machine under su transient, transient and steady state conditions. Selection of circuit breakers, Algorithm for short circuit studies. Analysis of 3 phase faults.

Unit-3: (i) Symmetrical Components: Fortescure theorem, symmetrical component transformation. Phase shift in star-delta transformers. Sequence Impedances of transmission lines, Synchronous Machine and Transformers, zero sequence network of transformers and transmission lines. Construction of sequence networks of power system. **(ii) Fault Analysis:** Analysis of single line to ground faults using symmetrical components, connection of sequence networks under the fault condition.

Unit-4: Unsymmetrical Fault Analysis: (i) Analysis of line-to-line and double line to ground faults using symmetrical components, connection of sequence networks under fault conditions. **(ii)** Analysis of unsymmetrical shunt faults using bus impedance matrix method.

Unit-5: Load Flow Analysis:

Load flow problem, development of load flow equations, bus classification. Gauss Seidel, Newton Raphosn, decoupled and fast decoupled methods for load flow analysis. Comparison of load flow methods.

Text Books:

1. W.D. Stevenson, Jr. " Elements of Power System Analysis", Mc Graw Hill.
2. C.L. Wadhwa, "Electrical Power System", New Age International.
3. Chakraborthy, Soni,Gupta & Bhatnagar, "Power System Engineering", Dhanpat Rai & Co.
4. T.K Nagsarkar & M.S. Sukhija, "Power System Analysis" Oxford University Press,2007.

Reference Books:

5. L. P. Singh; "Advanced Power System Analysis & Dynamics", New Age International
6. Hadi Sadat; "Power System Analysis", Tata McGraw Hill.
7. D.Das, " Electrical Power Systems" New Age International, 2006.
8. J.D. Glover, M.S. Sharma & T.J.Overbye, "Power System Analysis and Design" Thomson, 2008.
9. P.S.R. Murthy " Power System Analysis" B.S. Publications,2007.
10. Stagg and El-Abiad, "Computer Methods in Power System Analysis" Tata Mc Graw Hill
11. Kothari & Nagrath, "Modern Power System Analysis" Tata Mc. Graw Hill.

04BTEE703-ECONOMIC OPERATION OF POWER SYSTEMS

Course objective

The course is intended to present fundamentals as well as state-of-the-art techniques for economic operation and control of electric power systems. The prerequisite for this course is a good background in power system fundamentals (e.g. undergraduate course on power system analysis).

Unit-1: Economics of Power Generation:

Introduction, cost of electrical energy, expression for cost of electrical energy, depreciation, power plant cost analysis, economics in plant selection, selection of types of generation and types of equipments, factors effecting economic generations and distributions, generating cost, economics of different types of generating plants.

Unit-2: Economical Operations of thermal power plants:

Methods of loading turbo generators, input, output and heat rate characteristics, incremental cost, two generations units, large no of units, sequence of adding units, effects of transmission losses, economic scheduling considering transmission losses, coordination equations, penalty factors

Unit-3: Hydro Thermal coordination:

Advantages of combined operation, base load peak load operation requirement, combined working of run-off river and steam plant, reservoirs hydro plants and thermal plants (long term operational aspects), short term hydro thermal coordination, coordination equations, scheduling methods and applications.

Unit-4: Parallel Operations of Generators:

Conditions, synchronizing current and power, two alternators in parallel (effect of change in excitation, load sharing, sharing of load currents), Infinite bus bars, active and reactive power control, synchronizing power, torque, operating limits of alternators, operating characteristics of cylindrical alternator rotor.

Unit-5: Economics for Electrical Engineers:

Concepts of physical and financial efficiencies of electrical goods and services, supply and demand, break even and minimum cost analysis, linear and nonlinear break even, min cist analysis.

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murty, "Operation and control in Power Systems" B.S. Publications.
3. N. G. Hingorani & L. Gyugyi, " Understanding FACTs" Concepts and Technology of Flexible AC Transmission Systems"
4. J. Wood & B.F. Wollenburg, " Power Generation, Operation and Control " John Wiley & Sons.

Reference Books:

5. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. P. Kundur, " Power System Stability and Control Mc Graw Hill.
7. M.H. Rashid, "Power Electronics: Circuits, devices and Applications" Prentice Hall of India,3rd Edition.
8. T. K. Nagsarkar & M.S.Sukhiza," Power System Analysis" Oxford University Press.

04BTEE704-SWITCH GEAR & PROTECTION

Course objective

To introduce the students to different types of circuit breakers and protective relays for protecting power system equipments

Unit-1: (i) Static Relays: Introduction to static relays, merits and demerits. **Comparators:** amplitude and phase comparators, duality between amplitude and phase comparators. Introduction to (a) amplitude comparators-circulating current type, phase splitting type and sampling type, (b) phase comparators-vector product type and coincidence type.

(ii) Static over Current Relays: Introduction to instantaneous, definite time, inverse time and directional overcurrent relays.

Unit-2: (i) Static Differential Relays: Brief description of static differential relay schemes-single phase and three phase schemes. Introduction to static differential protection of generator and transformer.

(ii) Static Distance Relays: Introduction to static impedance, reactance and mho relays.

Unit-3: (i) Carrier Current Protection: Basic apparatus and scheme of power line carrier system. Principle of operation of directional comparison and phase comparison carrier protection and carrier assisted distance protection.

(ii) Distance Protection: Effect of power swings on the performance of distance protection. Out of step tripping and blocking relays, mho relay with blinders. Introduction to quadrilateral and elliptical relays.

Unit-4: Circuit Breakers I:

Electric arc and its characteristics, arc interruption-high resistance interruption and current zero interruption. Arc interruption theories–recovery rate theory and energy balance theory. Restriking voltage and recovery voltage, develop expressions for restriking voltage and RRRV. Resistance switching, current chopping and interruption of capacitive current. Oil circuit breakers-bulk oil and minimum oil circuit breakers. Air circuit breakers.

Unit-5: (i) Circuit Breakers II: Air blast, SF_6 and vacuum circuit breakers. Selection of circuit breakers, rating of circuit breakers.

(ii) Digital Protection: Introduction to digital protection. Brief description of block diagram of digital relay. Introduction to digital overcurrent, transformer differential and transmission line distance protection.

Text Books:

1. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, iley Eastern Ltd.

Reference Books:

3. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill
4. Y. G. Paithankar and S R Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
5. T.S.M Rao,"Power System Protection: Static Relays with Microprocessor Applications" Tata Macgraw Hill".
6. A.R. Van C. Warringtaon , " Protective Relays- Their Theory and Practice, Vol. I & II" Jhon Willey & Sons.

04BTEE705-COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

Course objective

Basic design methodology and engineering considerations. Propertiesof elect r ic, magnet ic and insulating materials. Choice of materials, frames etc. Computerisation of design procedures. Optimisation techniques and their application to design problems. Design of large and h.p. motors. Database and knowledge based expert systems. Development of PC based software.

Unit-1: Basic Principles of Electrical Machine Design:

Specifications, Factors affecting the design, Limitations, main dimension, loadings, output equation, factor affecting the size and rating, Electrical Engineering Materials: conducting, magnetic and insulating materials. **Magnetic Circuit Calculation:** Ohm"s law for magnetic circuit, mmf required for air gap and iron parts, tapered teeth, real and apparent flux density, magnetizing current.

Unit-2: Heating and Cooling of Electrical Machines:

heat dissipation and heat flow equations, Newton"s law of cooling, equations for temperature rise, **Rating of Machines**: Continuous, short and intermittent ratings, mean temperature rise, hydrogen cooling of turbo alternators, quantity of cooling medium.

Unit-3: Computer Aided Design of Transformers:

Power and Distribution Transformers, core and yoke cross sections, square and stepped core, output equations, main dimensions, types &, design of windings, optimization concepts.

Unit-4: Computer Aided Design of Synchronous Machines:

Turbo and Hydro alternators, choice of specific magnetic & electric loading, short circuit ratio and its effects, air gap length, output equation, main dimensions, flow charts for design of synchronous machine, design of stator core & winding.

Unit-5: Computer Aided Design of Induction Machines:

Output equation, main dimensions, design criteria, flow charts for design of induction motor, air gap length, design of stator core and winding, rotor design.

References:

1. Computer- Aided Design of Electrical Equipment- by Dr. M. Ramamoorthy-Affiliated East-Westpress Pvt. Ltd. New Delhi.2
2. Electrical Machine Design- by A.K. Sawhney, Dhanpat Rai & Sons.
3. Principles of Electrical Machine Design with Computer Programmes by- S.K. Sen, Oxford & IBHPublishing Co.4
4. Performance and Design of A.C. Machines-M.G. Say, Affiliated East West Press Pvt. Ltd., NewDelhi.5
5. Performance and Design of D.C. Machines- Clayton & Hancock.

04BTEE706-POWER SYSTEM ENGINEERING

Course objective

This course deals with the economic operation of power system, power system stability including critical clearing angle and critical clearing time and Excitation system.

Unit-1: Economic Operation of Power Systems:

Introduction, system constraints, optimal operation of power systems. Input output, heat rate and incremental rate curves of thermal generating units. Economic distribution of load between generating units within a plant. Economic distribution of load between power stations, transmission loss equation. Introduction to unit commitment and dynamic programming.

Unit-2: Power System Stability -I:

Power angle equations and power angle curves under steady state and transient conditions. Rotor dynamics and swing equation (solution of swing equation not included), synchronizing power coefficient. Introduction to steady state and dynamic stabilities, steady state stability limit.

Unit-3: Power System Stability-II:

Introduction to transient stability. Equal area criterion and its application to transient stability studies under basic disturbances, critical clearing angle and critical clearing time. Factors affecting stability and methods to improve stability.

Unit-4: (i) Excitation Systems:

Introduction of excitation systems of synchronous machines, types of excitation systems, Elements of various excitation systems and their control (functional block diagrams and their brief description)- DC excitation systems, AC excitation systems, brushless excitation system. **(ii) Interconnected Power Systems:** Introduction to isolated and interconnected powers systems. Reserve capacity of power stations, spinning and maintenance resaves. Advantages and problems of interconnected power systems. Power systems inter connection in India.

Unit-5: (i) Tap Changing transformer, phase angle control and phase shifting transformer. Series compensation of transmission lines, location and protection of series capacitors, advantages and problems. **(ii)** Introduction to power system security. (iii) Introduction to voltage stability. 153

Text Books :

(1) Power System Engineering by R.K. Rajput

(2) Power System Engineering by Kothari & Nagrath

04BPEE702-POWER SYSTEM MODELLING & SIMULATION LAB

1 Simulate Swing Equation in Simulink (MATLAB)

2 Modelling of Synchronous Machine.

3 Modelling of Induction Machine.

4 Simulate simple circuits using Circuit Maker.

5 (a) Modelling of Synchronous Machine with PSS (b) Simulation of Synchronous Machine with FACTS device.

6 (a) Modelling of Synchronous Machine with FACTS device (b) Simulation of Synchronous Machine with FACTS devices.

7 FACTS Controller designs with FACT devices for SMIB system.

04BPEE704-Switch & Gear Protection LAB

1. Obtain the burden effect on the performance of CT.
2. To measure ratio error and phase angle error of C.T.
3. Find out the sequence components of currents in three 1-Phase transformers and Phase transformers and compare their result
4. Find out the sequence components of currents in three Phase transformers and compare with three 1-Phase transformers their result
5. Draw the current-time characteristic of an over current relay for TMS=1 & 0.5 and PSM=1.25 & 1.0.
6. To plot the characteristics of a percentage bias differential relay for 20%, 30% and 40% biasing.
7. To analysis the operation of gas actuated Buchholz relay.
8. Study under frequency relay and check it's setting experimentally.
9. To obtain the characteristics of oil circuit breaker.
10. To obtain differential protection of 3 phase transformer

04BPEE706 POWER SYSTEM DESIGN LAB

1 Generating station design: Design considerations and basic schemes of hydro, thermal, nuclear and gas power plants. Electrical equipment for power stations,

2 Auxiliary power supply scheme for thermal power plant.

3 Distribution system Design: Design of feeders & distributors. Calculation of voltage drops in distributors. Calculation of conductor size using Kelvin's law.

4. Sending end and receiving end power circle diagrams.

5.Instrument Transformers: Design considerations of CTs & PTs for measurement and protection.

6. Substations: Types of substations, various bus–bar arrangements. Electrical equipment for substations.

7.Design of a high voltage transmission line.

8. Study of a typical grid substation.

9.Single line diagram of 220/132 KV G.S.S. and 33/11 KV substation

10. Three line diagram of 33/11 KV substation

INDUSTRIAL TRAINING
Subject Code: 04BPEE709

Year-IV Semester-VIIIth

04BTEE801–NON CONVENTIONAL ENERGY SOURCES

Course objective-

1. Study of Power Station performance evaluation & economic analysis.
2. Study of various non-conventional energy sources & principles of energy conservation & audit.

Unit 1: Global and National scenarios, Form and characteristics of renewable energy sources **Solar Energy:** Solar radiation, its measurements and prediction. Solar thermal collectors, flat plate collectors, concentrating collectors. Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. **Solar Photovoltaic :**
Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes

Unit 2: Wind Energy
Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, applications.

Unit 3: Ocean Energy
Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean wave energy conversion and tidal energy conversion.

Unit 4: Other Sources:
Nuclear fission and fusion; Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion. Formation of biomass, photosynthesis; Biomass resources and their classification; Chemical constituents and physicochemical characteristics of biomass; Biomass conversion processes;

Unit 5: Fuel Cells
Thermodynamics and electrochemical principles; Basic design, types, applications.
Hydrogen Energy: Economics of hydrogen; Production methods.

Reference Books –

1. Renewable Energy by Garg Prakash

04BTEE802-ELECTRIC DRIVES AND THEIR CONTROL

Course objective

This course is designed to understand fundamentals of electric drives and their control through knowledge of electrical machines and power electronics. The scope of this course covers basics, dynamics, selection, braking, and control of AC DC drives. Students are expected to learn more by studying application of drives in industry

Unit-1: Dynamics of Electric Drives: Fundamental torque equations, speed-torque conventions and multiquardant operation, equivalent values of drive parameters, nature and classification of load torques, steady state stability, load equalization, close loop configurations of drives.

Unit-2: DC Drives: Speed torque curves, torque and power limitation in armature voltage and field control, Starting, **Braking-**Regenerative Braking, dynamic braking and plugging. **Speed Control-**Controlled Rectifier fed DC drives, Chopper Controlled DC drives.

Unit-3: Induction Motor Drives-I: Starting, **Braking-**Regenerative braking, plugging and dynamic braking. **Speed Control-**Stator voltage control, variable frequency control from voltage source, Voltage Source Inverter (VSI) Control.

Unit-4: Induction Motor Drives-II: Variable frequency control from current source, Current Source Inverter (CSI) Control, Cycloconverter Control, Static rotor resistance control, Slip Power Recovery-Stator Scherbius drive, Static Kramer drive.

Unit-5: Synchronous Motor Drive: Control of Synchronous Motor-Separately Controlled and VSI fed Self-Controlled Synchronous Motor Drives. Dynamic and Regenerative Braking of Synchronous Motor with VSI. Control of Synchronous Motor Using Current Source Inverter (CSI)

Text Books:

1. G.K. Dubey, "Fundamentals of Electric Drives", Narosa publishing House.
2. S.K.Pillai, "A First Course on Electric Drives", New Age International.

Reference Books:

3. M.Chilkin, "Electric Drives",Mir Publishers, Moscow.
4. Mohammed A. El-Sharkawi, "Fundamentals of Electric Drives", Thomson Asia, Pvt. Ltd. Singapore.
5. N.K. De and Prashant K.Sen, "Electric Drives", Prentice Hall of India Ltd.
6. V.Subrahmanyam, "Electric Drives: Concepts and Applications", Tata McGraw Hill

04BTEE803-PROTECTION OF POWER SYSTEM

Course objective

This is a first course on power system protection. Power system protection is about (1) detecting faults or abnormalities in the electrical energy systems and (2) taking remedial action like tripping of faulty apparatus to minimize damage as well as provide safety to the human life. This function is implemented by a `decision making element' called a relay. A relay can be thought of as a microprocessor which primarily processes analog current and voltage signals for decision making. The voltage and current signals are derived from transducers called voltage and current transformers. A clear understanding of CTs and VTs and its interaction with relays is a must.

Unit-1 (i) Causes and consequences of dangerous currents: Faults, overloads and switching over currents. Introduction to protection, trip circuit of a circuit breaker. Functional characteristics of a relay, zone of protection, primary and backup protection.

(ii) CTs & PTs: Current transformer construction, measurement and protective CTs. Type of potential transformers. Steady state ratio and phase angle errors in CTs and PTs. Transient errors in CT and CVT (Capacitive Voltage Transformer).

Unit-2 Induction Motor Protection: Introduction to various faults and abnormal operating conditions, unbalance supply voltage and single phasing. Introduction to protection of induction motors- HRC fuse and overcurrent, percentage differential, earth fault and negative sequence voltage relays.
Unit-3 Generator Protection: Stator protection – differential and percentage differential protection, protection against stator inter-turn faults, stator overheating protection. Rotor protection against excitation and prime mover failure, field earth fault and unbalanced stator currents (negative sequence current protection).
Unit-4 (i) Transformer Protection: Percentage differential protection, magnetizing inrush current, percentage differential relay with harmonic restraint. Buchholz relay. Differential protection of generator transfer unit.
(ii) Busbar Protection: Differential protection of busbars, high impedance relay scheme, frame leakage protection.
Unit-5 (i) Transmission Line Protection: Introduction to distance protection. Construction, operating principle and characteristics of an electromagnetic impedance relay. Effect of arc resistance. Induction cup type reactance and mho relays. Comparison between impedance, reactance and mho relays. Three stepped distance protection of transmission line.

Text Books:1. B.R. Gupta,"Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad.
Reference Books:
1. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
2. S. L. Uppal, "Electrical Power", Khanna Publishers.

04BTEE804-FACTS DEVICES & THEIR APPLICATIONS

Course objective
To provide engineers with a comprehensive understanding of HVDC systems, FACTS devices, and alternative energy sources as well as technical problems that may be encountered when installing these elements in an existing power system. The course presents operating and control fundamentals along with discussing modeling principles and advanced analytical tools available.

Unit-1: Problems of AC transmission systems, power flow in parallel paths and meshed system, factors limiting loading capability, stability consideration. Power flow control of an ac transmission line. Basic types of facts controllers. Advantages of FACTS technology.
Unit-2: (i) Voltage-Sourced Converters: Basic concept of voltage-sourced converters, single and three phase bridge converters. Introduction to power factor control. Transformer connections for 12-pulse, 24 pulse and 48 pulse operations.
(ii) Static Shunt Compensators: Mid point and end point voltage regulation of transmission line, and stability improvement. Basic operating principle of Static Synchronous Compensators (STATCOM). Comparison between STATCOM and SVC.

Unit-3: Static Series Compensators: Concept of series capacitive compensation, voltage and transient stabilities, power oscillation and subsynehronous oscillation damping. Introduction to thyristor- switched series capacitor (TSSC), thyristor controlled series capacitor (TCSC), and static synchronous series compensator, - operation, characteristics and applications.
Unit-4: (i) Static Voltage and Phase Angle Regulators: Voltage and phase angle regulation. Power flow control and improvement of stability by phase angle regulator. Introduction to thyristor controlled voltage and phase angle regulators (TCVR and TCPAR)
(ii) Introduction to thyristor controlled braking resistor and thyristor controlled voltage limiter.
Unit-5: (i) UPFC: Unified Power Flow Controller (UPFC), basic operating principles, conventional transmission control capabilities. Comparison of UPFC to series compensators and phase angle regulator. Applications of UPFC.
(ii) IPFC: Interline Power Flow Controller (IPFC), basic operating principles and characteristics. Applications of IPFC.

Text Books:
1. Ned Mohan, T.M.Undeland and William P.Robins, "Power Electronics: Converters, Applications and Design", John Wiley & Sons.
2. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications" Prentice Hall of India.
Reference Books:
3. K.R.Padiyar, "HVDC Power Transmission: Technology and System Reactions" New Age International

04BTEE805- UTILIZATION OF ELECTRICAL ENERGY & TRACTION

Unit-1(i)Electric Heating: Different methods of electric heating. Principle of high frequencyinduction and di-electric heating. Construction, operation, performance and applications of arcfurnace and induction furnace. **(ii) Electric Welding:** Welding process, welding transformer,Classification of Electric Welding: arc welding, resistance welding, welding of various metals.
Unit-2Illuminations: Definitions, laws of illuminations, polar curves, luminous efficiency, photometer, incandescent lamps: filament materials, halogen lamp. electric discharge lamps: sodium vapour lamp mercury vapour lamp and fluorescent lamp. **Light Calculations:** commercial, industrial, street and flood lighting.
Unit-3Electrolytic Process: Principles and applications of electrolysis, electro-deposition, manufactures of chemicals, anodizing, electro polishing electro-cleaning, electroextraction, electrorefinig, electro-stripping (parting) power supplies for electrolytic process.
Unit-4 Electric Traction & Means of Supplying Power: Systems of Electric Traction: DC & ACSystems, Power Supply for Electric Traction System: Comparison and application of differentsystems. Sub-station equipment and layout, conductor rail & pantograph.

Unit-5 Traction Methods: Types of services, speed time and speed distance curves, estimation ofpower and energy requirements, Mechanics of train movement. Co-efficient of adhesion,Adhesive weight, effective weight. **Traction Motor Controls:** DC and AC traction motors,Series parallel starting. Methods of electric braking of traction motors.

Reference/Suggested Books

1. H. Partab,"Art and Science of Electrical Energy" Dhanpat Rai & Sons
2. H. Partab, "Modern Electric Traction" Dhanpat Rai & Sons.
3. C.L. Wadhwa – Utilization of Electric Traction Electric Power.
4. G.K.Dubey,"Fundamentals of Electric Drives" Narosa Publishing House
5. Vedam and Subrahmanyam – Concept & Application of Electric Drives (TMH)

04BPEE802-ELECTRICAL DRIVES AND CONTROL LABS

1 Study and test the firing circuit of three phase half controlled bridge converter.
2 Study and obtain waveforms of 3 phase half controlled bridge converter with R and RL loads.
3 Study and test the firing circuit of 3-phase full controlled bridge converter.
4 Study and obtain waveforms of 3-phase full controlled bridge converter with R and RL loads.
5 Study and test 3-phase AC voltage regulator.
6 Control speed of dc motor using 3-phase half controlled bridge converter. Plot armature voltage versus speed characteristic.
7 Control speed of dc motor using 3-phase full controlled bridge converter. Plot armature voltage versus speed characteristic.
8 Control speed of a 3-phase induction motor in variable stator voltage mode using 3-phase AC voltage regulator.
9 Control speed of universal motor using AC voltage regulator.
10Study 3-phase dual converter.
11 Study speed control of dc motor using 3-phase dual converter.
12 Study three-phase cycloconverter and speed control of synchronous motor using cycloconverter.
13 Control of 3-Phase Induction Motor in variable frequency V/f constant mode using 3-phase inverter.

04BPEE803-COMPUTER BASED POWER SYSTEM LAB

1. Fault analysis (for 3 to 6 bus) and verify the results using MATLAB or any available software for the cases: (i) LG Fault (ii) LLG Fault (iii) LL Fault and (iv) 3-Phase Fault
2. Load flow analysis for a given system (for 3 to 6 bus) using (i) Gauss Seidal (ii) Newton Raphson (iii) Fast Decoupled Method and verify results using MATLAB or any available software
3. Study of voltage security analysis
4. Study of overload security analysis and obtain results for the given problem using MATLAB or any software.
5. Study of economic load dispatch problem with different methods.
6. Study of transient stability analysis using MATLAB/ETAP Software
.ii) The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.
iii) At all the steps of the project, students must submit a written report of the same

04BPEE808 Seminar

04BPEE809 Major Project