ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

SYLLABUS

7th Semester, B.Tech

Electrical Engineering

COURSE STRUCTURE

Sl No	Sub Code	Subject	Hrs			Credits C
			L	T	P	
	Theory					
1	EE131701	Electrical Drives and Control	3	0	0	3
2	EE131702	Power System Operation and Control	3	0	0	3
3	EE131703	Operations Research	3	0	0	3
4	EE131704	Power Plant Engineering	3	0	0	3
5	EE1317E01	Elective 1 (Departmental)	3	0	0	3
6	HS1317E02	Elective 2 (Humanities)	2	0	0	2
	Practicals					
7	EE131711	Electrical Drives and Control Lab	0	0	2	1
8	EE131712	Power System Operation and Control Lab	0	0	2	1
9	EE131714	Power Plant Engineering Lab	0	0	2	1
10	EE131717	Project	0	0	8	4
11	EE131721	Seminar on Summer Training	0	0	0	1
Total			17	0	14	25
Total Contact Hours = 31						
Total Credit = 25						

Elective 1

i. EE1317E01 (i) Reliability Engineering
ii. EE1317E01 (ii) Illumination Engineering
iii. EE1317E01 (iii) FACTS
iv. EE1317E01 (iv) Optimization Techniques
v. Any other subject offered from time to time with the approval of the University.

Elective 2

i. HS1317E02(i) Value Education, Human Rights and Legislative Procedures
ii. Any other subject offered from time to time with the approval of the University.

ELECTRIC DRIVES AND CONTROL

Subject	**:Electric Drives and Control**
Code	**:EE131701**
L-T-P-C	**:3-0-0-3**
Class Hour	**:3hrs/week**
Total no of classes	**:36**
Expected no of weeks	**:12**

MODULE	CHAPTER	COURSE CONTENT	HOUR
1	Dynamics of Electric drives	Classification of electric drives, types of load, speed-torque characteristics of loads and motors, selection of motors, dynamics of motor- load combination, four-quadrant operation, moment of inertia, steady state and transient stabilities of electric drives.	4
2	Characteristics of motors	Review of the speed-torque characteristics of the important AC and DC drive motors.	2
3	Starting	Effect of starting on power supply, motor and load, starting method of automatic alerting circuits, time and current limit acceleration, energy relations and reduction of energy loss during starting, master controllers.	4
4	Electric braking	Braking methods, speed-torque characteristic under braking conditions, energy relations and reduction of energy loss during braking.	4
5	Rating of motors	Heating: Heating and cooling of motors, loading condition and classes of duty, power rating and selection of motors for different applications, load inertia and load equalization.	4
6	Mechanical Features for Electrical Motors	Types of enclosures, bearings, mountings and transmission of drive, reduction of noise.	2
7	Thyristorised DC motor Drives	Speed equations and performance characteristics of DC motors, single phase and three phase controlled converter drives, dual converter schemes, two/four quadrant chopper drives, regenerating braking with DC series motor fed from a chopper,	6

		closed loop control.	
8	Industrial application of electric motors	Important processes, requirements of drives and types of motors used in rolling mills, pulp and paper mills, cement mills, sugar mills, and coal mining, machine tool drives.	4
9	Thyristorised AC motor drives	Speed equations and performance characteristics of three phase induction motors, induction motor drives using thyristors for static voltage control, slippower recovery and rotor resistance control, variable frequency operation of three-phase induction motors with constant flux and torque. Inverter/cycloconverter control of induction and synchronous motors, closed loop control.	6
	TOTAL		**36**

REFERENCES

1 Thyristor Control of Electric Motors: Subramanium, V. -----TMH

2 AFirst Course in Electric Drives: Pillai, S.K.---Wiley Eastern

3 Fundamentals of Electric Drives: Dubey, G.K.----Narosa

4 Elements of Electric Drives: Gupta, J.B., Manglik, R., Manglik, R.---SK Kataria and Sons

POWER SYSTEM OPERATION & CONTROL

SUBJECT:	: POWER SYSTEM OPERATION AND CONTROL
CODE:	:EE131702
L-T-P-C:	:3-0-0-3
CLASS HOUR:	:3 hrs/week
TOTAL NO OF CLASSES:	:36
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTERS	COURSE CONTENT	HOURS
1	Economic Operation of Thermal plants	Methods of loading turbo-generators, input-output curves, heat ratio and incremental cost, co-ordination equation, economic loading of units, with and without transmission loss, penalty factor, iterative methods of solving co-ordination equation, economic thermal dispatching with network losses considered, B-matrix loss formula and its derivatives, economic dispatch versus unit commitment(UC), constraints in UC, UC solution method, optimal load flow solution, power system security, introduction to load forecasting.	8
2	Hydrothermal co-ordination	Advantages of combined operation , base load and peak load consideration , combined operation of run-off river and thermal plants , hydro electric plant models, scheduling problems, short-term hydro-thermal scheduling, long-term aspects of hydro and thermal plants, co-ordination equations in hydro-thermal operations, use of dynamic programming in hydro-thermal scheduling.	8
3	Power system Interconnection	Introduction, types of interconnections and their advantages, tie-line control in interconnected systems, economics of interconnected systems, estimation, economic dispatch calculation for interconnected systems, transmission losses in interconnected systems.	8
4	Automatic generation and voltage control	Introduction , reactive power requirements in peak and off-peak hours, real and reactive power control, effect of real power on system frequency , automatic excitation control, reactive power injection and use of tap changing and regulating transformers, use of models in the control of generation (generator, load, prime-movers, governor and tie-line models),generator allocation, automatic generation control(AGC), AGC features. Load frequency problem, load frequency control(LFC)	8

		for single area case , equipments for LFC, LFC and economic dispatch control, two area control, optimal LFC, LFC with generation rate constraints(GRCs), speed governing systems, speed governor dead band and its effect on AGC. Introduction to neural networks, fuzzy logic control.	
5	State estimation in power systems	Introduction, maximum likelihood weighted least-square estimation.	4
		TOTAL	**36**

References:

1. Wood and Wollenburg: Power generation, operation and control: John Wiley and sons.
2. Generation of Electrical Energy : B.R Gupta, S.Chand and Publication Company
3. Electrical Power System: C. L. Wadhwa, Newage International Pvt. Ltd.

OPERATIONS RESEARCH

SUBJECT:	OPERATIONS RESEARCH
CODE:	EE 131703
L-T-P-C:	3-0-0-3
CLASS HOUR:	3 hrs/week
TOTAL NO OF CLASSES:	36 (APPROX)
EXPECTED NO OF WEEKS:	12 (APPROX)

MODULE	CHAPTERS	CONTENTS	HOURS
1	INTRODUCTION AND HISTORY OF OR	Definition, Characteristics and limitations of OR, Phases of OR, Application of OR.	10
2	FIELDS OF APPLICATION OF LINEAR PROGRAMMING	Mathematical formulation of linear problems, Standard form of linear programs, Graphical and Simplex method of solution, Artificial variable techniques (Big M, Two Phase), Special cases in simplex method of application, Degeneracy in linear programming, Duality in LP, Dual simplex method	8
3	TRANSPORTATION PROBLEM(TP)	Formulation and solution of the model, Various solutions of finding initial solutions: North-West Corner, Row minima, Column Minima, Matrix Minima, Vogel's Approximation method, Degeneracy in TP, U-V method for optimal solution, Variants of TP.	10
4	ASSIGNMENT PROBLEM(AP)	Comparison with the transportation problem, Formulation and solution of the model using Hungarian method, Variants of AP	8
Total Hours			**36**

Text Books/References:

1) OPERATIONS RESEARCH – P K Gupta, S CHAND, 6th edition
2) OPERATION RESEARCH-An Introduction-TAHA H A,Prentice Hall
3) OPERATIONS RESEARCH - R Panneerselam, PHI Learning Pvt Ltd
4) Operations Research Theory And Application – J.K.Sharma
5) Optimization Theory and Application – SS Rao, Wiley Eastern Ltd.

POWER PLANT ENGINEERING

SUBJECT	POWER PLANT ENGINEERING
CODE	EE131704
L-T-P-C	3-0-0-3
CLASS HOUR	3hrs/week
TOTAL NO OF CLASS	36 (APPROX)
EXPECTED NO OF WEEKS	12 (APPROX)

MODULE	CHAPTER	CONTENTS	HOURS
1	INTRODUCTION TO POWER PLANT ENGINEERING	Power sources, choice of generation, effect of variable load on power-plant operation and design, choice of number and size of generating units.	4
2	COAL FIRED STEAM POWER PLANT	Operation of a steam power plant, schematic line diagram, operation of equipments like economiser air preheater, superheater, condenser, precipitator etc. Rankine cycle and efficiency, the reheat an regeneration cycles, steam prime movers type and suitability, impulses and reaction turbines, governing of turbines. Steam plant auxiliaries, methods of auxiliary drives, Principles of steam-plant design, selection of site, layout and foundation.	9
3	DIESEL PLANT	Fields of use and advantages, elements of diesel plant, air standard cycle, operation and control, engine cooling, heat balance and efficiency, starting, loading and stopping, building and layout	4
4	HYDRO-ELECTRIC PLANT	Introduction to and classification of hydro-electric plants, elements of a simple h.e. plant and their working, capacity calculation of hydro-power plant, types of water turbines, turbine governors, auxiliaries and auxiliary drives, characteristics and selection of turbines, layout and internal design of power house building, underground, automatic and remote-controlled hydro stations. Preventive maintenance, pumped storage plants, reversible pump turbine for pump storage schemes.	9
5	GAS-TURBINE PLANTS	Fields of use and advantages, the components of a simple gas-turbine plant, open and closed cycle gas turbines, compressor, turbine efficiency, plant layout, installation and maintenance.	5
6	MODERN TRENDS IN POWER PLANT OPERATION	Use of computers in power stations, on-line computer control of power systems (SCADA), load dispatching and load forecasting.	5
		TOTAL	**36**

References:

1. Gupta, B. R; *Generation of Electrical Energy*; Eurasia Publishing House; 2001.

2. Nag, P.K.; *Power Plant Engineering;* Steam and Nuclear; Tata McGraw Hill; N Delhi 1998.

3. Chakrabarti, A., Soni, M.L., Gupta, P.V., Bhatnagar, U.S.; *A text book on Power system Engineering.*

ELECTIVE-1(DEPARTMENTAL)

SUBJECT:	: RELIABILITY ENGINEERING
CODE:	:EE1317E01(i)
L-T-P-C:	:3-0-0-3
CLASS HOUR:	:3 hrs/week
TOTAL NO OF CLASSES:	:36
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTERS	COURSE CONTENT	HOURS
1	Introduction to Reliability	Concept of reliability engineering, Definition of reliability, Probability, Basic probability theorems, rules for combining probabilities, independent, mutually exclusive, complimentary, conditional events, simultaneous occurrence of events, random variables, discrete & continuous random variables & their properties, probability density function, cumulative density function, variance, standard deviation, binomial, poisson, exponential, normal, log-normal, Rayleigh, weibull, Gamma and extreme value distribution, shape and scale parameters; Standard distributions-discrete and continuous, discrete-Binomial and Poisson distributions, continuous-exponential, normal, log-normal, Rayleigh, Weibull, Gamma and extreme-value distribution.	8
2	Basics of reliability	Definition of reliability, Failure- causes of failures, modes of failures, life characteristics pattern (Bath-tub curve); Measures of reliability-failure rate, mean time between failure (MTBF), mean time to failure (MTTF), derivation of reliability function and its properties, relationship between density function, distribution function, reliability and failure rate; Hazard rate function-constant hazard model, linear hazard model; Probability plotting, reliability evaluation at component level	6

3	Evaluation of System Reliability	Reliability block diagram; Systems- series, parallel, series-parallel, parallel-series, k-out-of-m system, standby system; Complex system- decomposition technique, tie set and cut set method, Boolean truth table method; Fault tree and Event tree method; Redundancy technique in system design-component versus unit redundancy, weakest link technique, mixed redundancy, standby redundancy.	6
4	Availability Analysis	Markov process and general concept of modelling; Instantaneous and Steady-state availabilities; State-space diagram; Markov model for-two repairable components, three repairable components, standby redundant system, non-repairable system; Stochastic transitional probability matrix; Steady-state availability calculation of systems.	7
5	Maintained Systems	Maintenance, objectives of maintenance, forms of maintenance, types of maintenance; Preventive maintenance-idealized maintenance, effect of preventive maintenance on reliability; Corrective maintenance; Definition and derivation of Maintainability function.	3
6	Application of reliability engineering	Brief concept of power system reliability, Hierarchical levels, system, adequacy, security, adequacy evaluation in HL-1, LOLP, LOLE, contingency enumeration & COPT method for adequacy evaluation, numerical problems (up to 3 or 4 generating units)	6
		TOTAL	**36**

References:

1. Reliability Engineering - E. Balagurusamy, Tata McGraw Hill Publishing Comp. Ltd., 1984.
2. Reliability Engineering – A. K. Govil, Tata McGraw Hill Publishing Comp. Ltd., 1983.
3. Introduction to Reliability Engineering- E. E. Lewis, John Wiley and Sons, 1996.
4. Power system reliability – R. Billinton

ELECTIVE-1(DEPARTMENTAL)

SUBJECT:	: ILLUMINATION ENGINEERING
CODE:	:EE1317E01(ii)
L-T-P-C:	:3-0-0-3
CLASS HOUR:	:3 hrs/week
TOTAL NO OF CLASSES:	:36
EXPECTED NO OF WEEKS:	:12 weeks

Module	Topics	Course Content	Hours
1	Illumination Engineering Basics	Definition, objective and prospects of illumination engineering Concept of Luminous sources, illumination, intensity, brightness, other terms and units. The inverse square law. The cosine law. Solid angle relationship. Luminosity, relationship between brightness & luminosity for a perfectly diffusing source, illumination standards ,Wavelength, frequency & velocity, the radiation spectrum, Radiations from black bodies & other sources.	8
2	The Visual System	The structure of the eye, accommodation, aberration of the eye, the rods & cones, visual acuity, glare, color & color response of the eye, Purkinje effect, Luminosity of eye Comparison between eye and camera	6
3	Light Sources and their Characteristics, Control of Light	Day light incandescent, electric discharge (low & high pressure), fluorescent, arc lamps and laser beams, colour rendering, wiring, switching & control circuits. Starters & ballast. Reflection & reflection factor, absorption, transmission & transmission factor. Control of light by luminaries.	8

4	Illumination & Measurement	Illumination from point sources, light units in a row, area illumination, polar curves. Linear & surface sources, flat linear source, flat-strip of short length. Illumination of a vertical source, Radiant energy detectors, PVcell, Photo-tubes, Photometry, Electro-photometry, Photocells, Spectro-photometer, Colorimeters.	7
5	Lighting Applications and Design Calculations	Interior lighting of industrial, residential & commercial buildings. Effective utilizations of daylight. Daylight factor, Outdoor lighting, Lighting of Street, rail/shipyards, airports and sports area. Lighting design for signalling, advertising & security. Lighting Calculations	7
		TOTAL	**36**

References:

Books:

1) Cotton.H, Principles of Illumination, Chapman & Hall.
2) Boast. W.S., Illumination Engineering, McGraw-Hill.
3) IES Lighting Handbook, Illumination Engineering Society, New York.

ELECTIVE-1(DEPARTMENTAL)

SUBJECT:	: FACTS
CODE:	:EE1317E01(iii)
L-T-P-C:	:3-0-0-3
CLASS HOUR:	:3 hrs/week
TOTAL NO OF CLASSES:	:36
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTER	CONTENTS	HOURS
1	Power Flow Control	Power flow in AC Systems , Power Flow Control , Reactive power control in electric power transmission lines, compensated and uncompensated transmission lines, series and shunt compensation, Phase angle control	7
2	FACTS concepts	Definition of FACTS, Concept and opportunities for FACTS, basic types of FACTS controllers, benefits from FACTS controllers, Requirements and Characteristics of High Power devices – Voltage and Current rating and losses, Basic concept of voltage source converter (VSC) and Current source converter (CSC) .	8
3	Static Shunt Compensation	SVC and STATCOM. Operation and Control of TSC, TRC and STATCOM. Compensator Control. Comparison between SVC and STATCOM.	6
4	Static Shunt Compensation	TSSC, SSSC, Static voltage and phase angle regulators TCVR and TCPAR. Operation and Control Applications	7
5	Unified Power Flow Controller	Circuit Arrangement, Operation and Control of UPFC, Basic Principle of P and Q Control, independent real and reactive power flow control, Applications, Introduction to interline power flow controller	8
		TOTAL	**36**

Reference Book:

1. "Understanding FACTS " N.G.Hingorani and L.Guygi, IEEE Press, Indian Edition is available:--Standard Publications, 2001.
2. "Flexible a c transmission system (FACTS)" Edited by YONG HUE SONG and ALLAN T JOHNS, Institution of Electrical Engineers, London

ELECTIVE-1(DEPARTMENTAL)

SUBJECT:	: OPTIMIZATION TECHNIQUES
CODE:	: EE1317E01(iv)
L-T-P-C:	:3-0-0-3
CLASS HOUR:	:3 hrs/week
TOTAL NO OF CLASSES:	:36
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	TOPIC	COURSE CONTENT	HOURS
1.	Introduction to Optimization	Introduction, Historical development, Engineering Application of Optimization, Statement of an Optimization problem-Design Vector, Design Constraints, Constraint Surface, Objective Function Surfaces. Classification of Optimization Problems, Optimization techniques, Engineering Optimization Literature. Problems	8
2.	Classical Optimization Techniques	Introduction, single variable Optimization, multi-variable Optimization with no constraints, multivariable Optimization with equality constraints, multivariable Optimization with inequality constraints, convex programming problems.	7
3.	Linear Programming I: Simplex Method	Introduction, Application of Linear Programming, Standard form of a Linear Programming Problem, Geometry of a Linear Programming Problems, Definitions and Theorem, Solution of a system of Linear simultaneous equation, Pivotal reduction of a general system of equation, motivation of the simplex method, Simplex algorithm, two phases of the simplex method	7
4.	Linear Programming II: Additional Topics and Extensions	Revised simplex method, duality in linear programming, decomposition principle, sensitivity or postoptimality analysis, Transportation problem, Karmarkar's Method, quadratic programming.	7
5.	Non-linear Programming: One dimensional minimization methods	Introduction, unimodal function, Unrestricted search, exhaustive search, dichotomous search, Interval Halving method, Fibonacci method,	7
		TOTAL	**36**

Text Books/References:

i. Optimization Theory and Application – SS Rao, Wiley Eastern Ltd, 3rd edition
ii. Optimization Techniques-Chander Mohan, Kusum Deep, New Age Science.
iii. Optimization Techniques-Paban Kumar Oberoi, Global Vision Publishing House
iv. Computer based Optimization Techniques-Tanweer Alam- A.B.Publications
v. Operation Research-An Introduction-TAHA H A,Prentice Hall

ELECTIVE 2 (HUMANITIES)

SUBJECT:	: Value Education, Human Rights and Legislative Procedures
CODE:	: HS1317E02(i)
L-T-P-C:	:2-0-0-2
TOTAL NO OF CLASSES:	: 24
EXPECTED NO OF WEEKS:	:12 weeks

Module	Topics	Course content	Hours
1	Values and Self Development	Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Confidence, National unity, Patriotism, Love for nature, Discipline. Devotion, Self reliance.	5
2	Personality and Behaviour Development	Soul and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, Happiness vs. suffering love for truth, Aware of self destructive habits, Association and cooperation	4
3	Character and Competence	Science vs. God, Holy books vs. blind faith, Self management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self control	4
4	Human Rights	Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups.	5
5	Legislative Procedures	Indian constitution, Philosophy, fundamental rights and duties, Legislature, Executive and Judiciary, Constitution and function of parliament, Composition of council of states and house of people, Speaker, Passing of bills, Vigilance, Lokpal and functionaries.	6

		TOTAL	24

Text Books:

1. Chakraborty, S.K., Values and Ethics for Organizations Theory and Practice, Oxford University Press, New Delhi, 2001.

2. Kapoor, S.K., Human rights under International Law and Indian Law, Prentice Hall of India, New Delhi, 2002.

3. Basu, D.D., Indian Constitution, Oxford University Press, New Delhi, 2002.

Reference Books:

1. Frankena, W.K., Ethics, Prentice Hall of India, New Delhi, 1990.

2. Meron Theodor, Human Rights and International Law Legal Policy Issues, Vol. 1 and 2, Oxford University Press, New Delhi, 2000.

ELECTRICAL DRIVES AND CONTROL LABORATORY

SUBJECT	**ELECTRICAL DRIVES AND CONTROL LABORATORY**
CODE	**EE131711**
L-T-P-C	**0-0-2-1**
EXPECTED NO OF WEEKS	**12 (APPROX)**

1	To study Electrical braking of D.C. Shunt motor (Rheostatic, Plugging).	3
2	To study Electrical braking of 3 phase Induction Motor (DC Dynamic Braking, Plugging)	3
3	To study Single phase converter fed separately excited D.C. motor speed control characteristics (Fully controlled /Semi controlled).	3
4	To study Three phase (Fully controlled/Semi controlled) converter fed / Dual converter fed/ separately excited D.C. motor (Open Loop Control).	3
5	To study Chopper fed D.C. series motor speed control characteristics.	3
6	To study VSI fed 3 phase Induction motor (using V/f control PWM inverter) speed control characteristics.	3
7	To study Solid state stator voltage control of 3 phase Induction motor (Using AC voltage Regulator).	3
8	Simulation of starting characteristics of D.C. / 3 phase Induction motor.	3

NOTE: PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME, WHICH IS MANDATORY ALONG WITH THE MINIMUM NUMBER OF EXPERIMENTS TO BE DONE.

POWER SYSTEM OPERATION AND CONTROL LAB

SUBJECT CODE L-T-P-C EXPECTED NO OF WEEKS	POWER SYSTEM OPERATION AND CONTROL LAB EE131712 0-0-2-1 12 (APPROX)

MODULE	CHAPTERS	COURSE CONTENT	HOURS
1	Load Flow Analysis	Gauss Seidal load flow analysis using MATLAB Software, Newton Raphson method of load flow analysis using MATLAB Software, Fast decoupled load flow analysis using MATLAB Software	3+3
2	Transient stability analysis	Analysis of single machine infinite bus system and multi machine system	3+3
3	Load Frequency control	Load frequency dynamics of single area and two area system	3+3
4	Modeling of transmission lines	Computation of line parameters and modeling of short, medium and long transmission line	3

NOTE: PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME, WHICH IS MANDATORY ALONG WITH THE MINIMUM NUMBER OF EXPERIMENTS TO BE DONE.

POWER PLANT ENGINEERING LAB

EE131714	**POWER PLANT ENGINEERING LAB**	L = 0 T = 0 P = 2 C = 1
1. Modeling of Power System Plant in Computer using Matlab		
2. Testing of Transmission Network for different fault conditions.		
3. Test related with Transformer, Generator and Motor under faulted condition.		

NOTE: PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME, WHICH IS MANDATORY ALONG WITH THE MINIMUM NUMBER OF EXPERIMENTS TO BE DONE.

EE131717	**PROJECT**	L = 0 T = 0 P = 8 C = 4
GUIDELINES WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
EE131721	**SEMINAR ON SUMMER TRAINING**	L = 0 T = 0 P = 0 C = 1
GUIDELINES WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		