ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

SYLLABUS

6th Semester, B.Tech

Electrical Engineering

COURSE STRUCTURE

Sl No	Subject		Hrs/week			Credits C
			L	T	P	
	Theory					
1	EE131601	Electromagnetic Fields	3	0	0	3
2	EE131602	Control System II	3	2	0	4
3	EE131603	Power Systems II	3	2	0	4
4	EE131604	Non Conventional Energy Sources	2	2	0	3
5	CS131605	Object Oriented Programming And Data Structure	3	0	0	3
6	EE131606	Communication Engineering	3	2	0	4
	Practicals					
7	EE131612	Control System II Lab	0	0	2	1
8	EE131613	Power Systems II Lab	0	0	2	1
9	CS131615	Object Oriented Programming And Data Structure Lab	0	0	2	1
10	EE131616	Communication Engineering Lab	0	0	2	1
Total			17	8	8	25
Total Contact Hours = 33						
Total Credits = 25						

Course Title : ELECTROMAGNETIC FIELDS
Course Code: EE131601
L-T:: C 3-0 =3

ClassHours/week	3
Expected weeks	12
Total hrs. of classes	36

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Vector Analysis**	Dot and cross products, gradient, divergence and curl. Divergence and Stock's theorem, Cartesian, Cylindrical and Spherical co-ordinates system. Transformation between co-ordinates, General curvilinear co-ordinates. Value of gradient divergence and curl in general co-ordinates and to obtain there from their values in cylindrical and spherical co-ordinates.	6
2	**The Static Electric Field**	Electric Field strength, Field due to point charges, a line charge and a sheet of charge, field due to continuous volume charge, electric flux density, Gauss's law in integral form, Gauss's law in differential form (Maxwell's first equation in electrostatics), applications of the Gauss's law. Electrostatic potential difference and potential, potential and potential difference expressed as a line integral, potential field of a point charge, potential field of a system of charges, conservative property, potential gradient, the dipole, energy density in the electrostatic field.	8
3	**The Static Magnetic Field**	The Biot-Savart's law (the magnetic field of filamentary currents), the magnetic field of distributed surface and volume currents, ampere's circuital law in integral and differential form (Maxwell's curl equation for steady magnetic field). The scalar and vector magnetic potentials, Maxwell's Divergence equation for B, steady magnetic field laws, forces in magnetic field, force on a current element, force between two current elements, force and torque in a current loop.	6
4	**Electro-magnetic Field**	Faraday's law in integral and differential form (Maxwell's first curl equation for electro-magnetic field). The Lorentz force equation. The concept of displacement current and modified ampere's law (Maxwell's 2nd curl equation for electro- magnetic field), the continuity equation, power flow in an electromagnetic field, the poynting vector. Sinusoidally time varying fields, Maxwell's equation for Sinusoidally time varying fields, Power and energy considerations for	6

		Sinusoidally time varying fields. The retarded potentials, polarization of vector fields, review of Maxwell's equations.	
5	**Materials And Fields**	Current and current density, the continuity equation, conductor in fields. Dielectrics in fields: Polarization, flux density, electric susceptibility, relative permittivity, boundary conditions in perfect dielectrics, magnetic materials, magnetization, permeability, boundary conditions.	4
6	**Applied Electromagnetic I**	Poisson's and Laplace's equations, solution of one-dimensional cases, general solution of Laplace's equation.	2
7	**Applied Electromagnetic II**	Electromagnetic waves, the Helm Holtz Equation, wave motion in free space, wave motion in perfect lossy dielectrics, propagation in good conductors, skin effect, Reflection of uniform plane waves. Radiation of electromagnetic waves.	2
8	**Transmission Line equations and parameters**	Some Examples of Transmission Lines	2
		TOTAL	36

REFERENCES:

1. Hayt: Engineering Electromagnetics.
2. N. N. Rao: Basic Electromagnetics with applications.
3. Corson and Lofrain: Introduction to Electromagnetic Fields and waves.
4. Bradshaw and Byatt: Introductory Engineering Field Theory.
5. Nussbaum: Electromagnetic theory for engineers and scientists.

CONTROL SYSTEM-II

SUBJECT:	:CONTROL SYSTEM-II
CODE:	:EE131602
L-T-P-C:	:3-2-0-4
CLASS HOUR:	:4 hrs/week
TOTAL NO OF CLASSES:	:48
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTER	CONTENTS	NO. OF HOURS
1	**Compensation techniques**	Fundamentals in compensation, techniques- lead compensation, lag compensation and lead-lag compensation.	7
2	**Discrete time systems**	Introduction to discrete – time systems; Z-transform, inverse Z- transformation; solving difference equation by the Z-transform method; pulse- transfer function; stability analysis in the Z- plane.	7
3	**State – Space Analysis of control systems**	Concepts of space, state variables and state models; state – space representation of linear systems; transfer matrix; state- space representation of discrete- time systems. Solution of linear time- invariant and discrete- time state equations.	7
4	**Describing function analysis**	Introduction to nonlinear systems. Describing functions of common non linearities; nonlinear control systems, describing function analysis of nonlinear control systems	7
5	**Phase- Plane Analysis**	Introduction, methods of constructing phase-plane trajectories, singular points, phase- plane analysis of linear and nonlinear control systems.	7
6	**Stability Analysis by Liapunov's method**	Definition of stability in the sense of Liapunov; the second method of Liapunov; Stability analysis of linear and nonlinear systems.	6
7	**Design of Feedback Control systems**	Concept of controllability and observality; state feedback and output feedback; optimal control law; cost function or performance index; quadratic performance index; linear quadratic state feedback regulator problem; a brief introduction to model reference systems; adaptive control systems.	7
		TOTAL	48 hours

References:

1. Automatic Control Systems- Hasan Saeed- Katson Publishers
2. Modern Control Engineering – Ogata
3. Control System Engineering - Nagrath and Gopal
4. Control System Components – Gibson and Teylor
5. Control System Engineering- M.Gopal

POWER SYSTEM –II

SUBJECT:	:POWER SYSTEM-II
CODE:	:EE131603
L-T-P-C:	:3-2-0-4
CLASS HOUR:	:4 hrs/week
TOTAL NO OF CLASSES:	:48
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTER	CONTENTS	NO. OF HOURS
1	SUBSTATION	Classification. Interconnection of substations, Necessity. Function & arrangement of substation equipment. Layout diagram- single line diagram with different bus-bar arrangements. Current limiting reactors: Types and construction, substation grounding.	7
2	NEUTRAL GROUNDING	Effectively grounded system. Under grounded system. Arching ground. Methods of neutral grounding. Resonant grounding (Peterson coil). Earthing transformer. Generator neutral breaker. Grounding practice as per Indian electricity rules. Equipment grounding.	7
3	CIRCUIT BREAKERS	Fuses: Function: Important terms & classification. HRC fuses: Characteristics & advantages. Time delay fuse. Switchgears: Functions, principles of circuit breaking. DC & AC circuit breaking. Arc voltage & current waveforms. Restriking & recovery voltages, Current zero pause. Current chopping, capacitive current breaking. AC circuit breaker ratings. Arc in oil, arc irruption theories and processes. Bulk oil CB & MOCB, air circuit breaker, air –blast CBs. Vacuum & SF6 CBs. Testing of circuit breakers.	8
4	PROTECTIVE RELAYS	operating principles; Terminology & functional characteristics of Protective relays. Universal relay torque equation. Over current relays. Differential relays. Feeder, generator & transformer protection. Distance relays. Reverse, Translay relays, carrier current protection, comparators. Static relays: operating principles, advantages, types. Example with block/ power and overvoltage circuit diagrams and operation.	8
5	OVER-VOLTAGE PHENOMENON IN POWER SYSTEMS	Lightning phenomena, Switching surges, Travelling Waves, Shape and Specification of Travelling waves, Attenuation and distortion of traveling waves, attenuation due to corona, behaviour of traveling waves at a line transition, Construction of Bewely lattice diagram.	6

6	OVER-VOLTAGE PROTECTION AND INSULATION COORDINATION	Surge protection. Different types of lightening arresters & surge absorbers. Ground & counterpoise wires. Location & rating of lightening arresters. Introduction to Insulation co-ordination. Volt-time curve. Important terms. BIL & factors affecting it. co-ordination of system equipment.	6
7	HVDC TRANSMISSION AND SYSTEMS OF ELECTRIC POWER TRANSMISSION	Limitations of HVAC transmission. Advantages & limitations of HVDC transmission. Kinds of DC links. Ground return. Equipment for HVDC transmission. Economic distance. Application of HVDC systems. Review of Existing Systems, Advantages and Limitations of using high transmission voltages, Comparison of overhead and underground systems, Economic voltage of transmission, Economic size of conductors, Kelvin's law	6
		TOTAL	**48 hours**

REFERENCE:

1. Electrical Power—S.L.Uppal
2. Electrical Power System---C.L.Wadha.
3. Electrical Power System's design—M.V. Despande.
4. Switchgear principles—P.H.J.Crane.
5. Switchgear and Protection—S.S. Rao
6. Switchgear and Protection-- M.V. Despande.

NON CONVENTIONAL ENERGY SOURCES

SUBJECT	**:NON CONVENTIONAL ENERGY SOURCES**
CODE	:EE 131604
L-T-P-C	:2-2-0-3
CLASS HOUR	:3hrs/week
TOTAL NO OF CLASSES	:36

MODULE	CHAPTERS	CONTENTS	NO. OF HOURS
1	**Introduction to Non conventional energy sources**	Importance, primary & secondary energy sources, limitations to primary sources, various sources of non-conventional energy, renewable energy.	2
2	**Solar Energy**	Solar radiation, solar radiation angles, local solar time, solar collector-flat plate collector & solar concentrator, solar heater-water heater & air heater, solar cooker, solar distillation, solar energy storage- sensible heat storage & latent heat storage.	5
3	**Photovoltaic Energy Conversion**	Photovoltaic effect, equivalent circuit & V-I characteristics of PV cell, types of solar cell & their characteristics, effect of temperature, light intensity, cell-area & series resistance on PV cell, solar cell array & module and their configurations, specifications of PV module, PV system & their components, isolated & grid connected PV systems.	5
4	**Wind Energy**	Wind energy conversion, wind turbine rotor -classification, characteristics & analysis of ideal wind turbine rotor, power co-efficient, air foils, lift & drag forces, blade shape for ideal rotor, generalized rotor design procedure , wind turbine_ subsystems, components, design, power curve prediction, electrical aspects of wind turbine, grid connected wind turbine, wind farms, site selection.	5
5	**Fuel Cell**	Introduction, energy conversion principles, types of fuel cell, components of a fuel cell, polarization.	2

6	**Energy from bio-mass**	Introduction, Bio-mass conversion technologies, bio-gas generations, classifications of bio-gas plants, selection of site for bio-gas plant, utilization of bio-gas, thermal gasification of bio-mass.	3
7	**Geo thermal Energy**	Sources and use of geo-thermal energy, geo-thermal power plants, applications.	3
8	**Energy from the ocean**	Tidal power, components of tidal power plants, generation of tidal power, estimation of energy & power, ocean thermal energy conversion (OTEC)_ introduction, types, plants & their specifications.	4
9	**Magneto Hydro Dynamic Generation**	Principles of MHD generation, MHD generator, equivalent circuits, MHD system. Other resources: Small Hydro Schemes, Hydrogen Energy, Thermoelectric generations etc	4
10	**Combined Operation utilizing more than one source, composite systems**	Combined Operation utilizing more than one source, composite systems	3
		TOTAL	36

References:

1. Electrical Energy Utilization and conservation – S.C Tripathy. TMH, New Delhi
2. Generation, Distribution and Utilization of Electrical Energy- New Age International Pvt. Ltd, New Delhi- C.L Wadhwa
3. Utilization of Electrical Power by R.K.Rajput, Laxmi Publications Pvt. Ltd, New Delhi
4. Utilization of Electrical Power and Electric Traction- J.B Gupta, S.K Kataria and Sons, New Delhi.

OBJECT ORIENTED PROGRAMING AND DATA STRUCTURE

SUBJECT:	:Object Oriented Programming And Data Structure
CODE:	:CS131605
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	CONTENTS	HOURS
1	INTRODUCTION	Introduction To Oops, Difference between OOP and procedure oriented programming, Basic concept of OOPS, features of oops, and application of OOPS.	2
2	ARRAY,STRUCTURE AND POINTER	1-D array, 2-D array, Concept of structure, pointer and types of pointer	4
3	CLASS AND OBJECT CONCEPT	**:** Introduction to object and class, class syntax, defining member function, Access specifiers (Public, Private, Protected), nesting member function, Private member function, Inline function, static data member, static member function, array of class, array within the objects, object pointer, this pointer, friend function and friend class.	4
4	CONSTRUCTORS AND DESTRUCTORS	Introduction to constructors and destructors and their properties, types of constructors, example of parameterized constructors, example of multiple constructors, example of copy constructors, example of destructor.	3
5	INHERITANCE	Define derived and base class, Types of Inheritance; Base and Derived classes ,Syntax of derived classes, access to the base class; virtual function, virtual Base classes, Constructors and Destructors in Inheritance, abstract class..	4
6	POLYMORPHISM	Compile time(Early/Static binding)- Overloading functions and operators, Overloading new and delete operators; Run time polymorphism(Late/Dynamic Binding) – Pure Virtual functions, Virtual Destructors, Review of Virtual base classes,	4
7	WORKING WITH FILE	File handling	3
8	COMPLEXITY ANALYSIS	Time and Space analysis of Algorithms – Order Notations.	1
9	SORTING OF ARRAY	Bubble, selection, insertion, quick and merge sort technique	3
10	SEARCHING	Linear and binary search technique	1
11	LINKED LIST	Operation on singly and doubly	3
12	STACK	Push operation, pop operation, conversion from infix to postfix, conversion from infix to prefix, evaluate postfix expression	4
		TOTAL	**36**

Reference Books:

1.Introduction to Object oriented programming and C++ by Yaswant Kanetkar (B.P.B Publication)

2. Object Oriented Programming with C++ by Balaguruswamy (Tata Mcgraw Hill)

3. Data Structure by Lipschutz (PHI publication)

4.Data Structure through C++ by Yaswant Kanetkar

COMMUNICATION ENGINEERING

SUBJECT:	:**COMMUNICATION ENGINEERING**
CODE:	:**EE 131606**
L-T-P-C:	:3-2-0-4
CLASS HOUR:	:4 hrs/week
TOTAL NO OF CLASSES:	:48
EXPECTED NO OF WEEKS:	:12 weeks

MODULE	CHAPTERS	CONTENTS	HOURS
1	Properties of Fourier transform	Response of LTI systems – transfer functions and frequency responses, energy/power-type signals, auto-/cross-correlation functions, spectral density	7
2	Noise	Sources and characteristics of different noise, thermal and shot noise, concept of white Gaussian noise. Noise temperature, noise bandwidth and noise figure	7
3	Analog Communication	Need for modulation, Linear CW modulation – Amplitude modulation: AM –DSB /SC,AM-SSB/SC signals and spectra , generation and detection of AM , Angle CW modulation: PM and FM signals , generation and detection of AM , and FM	14
4	Radio Receivers	TRF receivers, Super heterodyne receivers, Image frequency, Image rejection ratio, Receiver sensitivity and selectivity, Phase locked loops, Synchronous detection.	7
5	Pulse Coded Modulation	PCM generation and reconstruction, quantization noise, non uniform quantization and compounding, signal to quantizing noise power ratio, Time Division Multiplexing	7
6	Digital Communication	Introduction to digital communications, Merits of digital systems, ASK, PSK, FSK	6
		TOTAL	**48**

REFERENCES

1) Digital Electronics- G. K. Kharate
2) Modern Digital Electronics- R.P.Jain
3) Digital Electronics- A.Kumar
4) Digital Electronics- B. R. Gupta & V. Singhal
5) Digital Fundamental – TL Floyd

PRACTICAL SYLLABUS

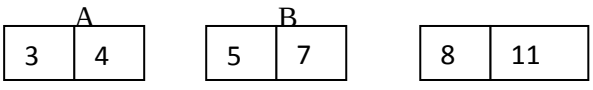
SUBJECT	**CONTROL SYSTEM –II LAB**
CODE	EE131612
L-T-P-C	0-0-2-1
NO OF WEEKS	12

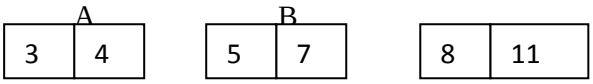
MODULE.	**CHAPTERS**	**CONTENTS**	**HOURS**
1	ROOT LOCUS	Plotting of root locus using various type of transfer functions and analyzing the results using Matlab	3
2	BODE AND NYQUIST PLOT	Obtaining Bode Plot and Nyquist Plot from given transfer functions in a specified frequency range	3
3	STATE SPACE ANALYSIS	Obtaining transfer function of given systems in state space form and plot bode and nyquist diagram using State-space form	3
4	STATE SPACE ANALYSIS AND MODELLING OF CIRCUITS	Modelling electrical circuits from state space form in both time domain and frequency domain.	3
5	FREQUENCE RESPONSE SPECIFICATIONS	Determining frequency response specifications for both closed loop and open loop system.	3
6	APPLICATIONS IN SIMULINK	Modelling of Dynamic system and obtaining various response in Simulink	3
7	Z-TRANSFORMATIONS	Applications of Z-transformation in Matlab.	3
8	STATE SPACE MODEL	Obtaining State space model from Simulink diagram.	3

SUBJECT: CODE: L-T-P-C: EXPECTED NO OF WEEKS:	:**POWER SYSTEM-II LAB** :EE131613 :0-0-2-1 :12

TOPICS	**OBJECTIVES**	**No. of hours**
PROTECTIVE RELAYS	1. Study the operation of Definite time overcurrent relay	3x6=18
	2. To plot characteristics of single pole or earth fault relay using static IDMT relay	
	3. To study the operation of static overvoltage relay.	
	4. Plot the characteristics of electromagnetic IDMT relay.	
	5. Study the operation of static Definite time reverse power relay	
	6. Study the operation of directional overcurrent relay.	
FUSE	To plot the characteristic of fuse wire	3
INSTRUMENT TRANSFORMER	To study the magnetizing characteristic of CT and PT.	3

SUBJECT	**OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURE LAB**
CODE	CS131615
L-T-P-C	0-0-2-1
NO OF WEEKS	12

EXPERIMENT NO.	AIM OF THE EXPERIMENT	LAB PERIOD
1	(a)Write a program to read and display the contents of an array and find the maximum and minimum from the array. (b) Design a structure "STUDENT " having the following elements "Roll", "Name", "Sem". Write different functions to read and display the structure elements. (c) Write a program to read and display records of 5 students using array of structure. (d) Write a program to read and display the content of an array in reverse order using pointer. (e) Design a structure "Book" having the following elements "Bookid", "Name", "Price" . Write a menu base program to do the following operations. 1. Read the records 2. Display the records 3. Find the book with highest price 4. Compare the price of two books using a function which accept two structure variables as argument. (f) Write a program to swap the content of two structure using structure pointer. (g) Write a program to perform the addition and multiplication of two matrices. (h)Write a program to display the Pascal triangle	1
2	(a) Design a class "STUDENT " having the following data members "Roll", "Name", "Sem". Write different member functions 1.Read the details of a student 2. Display the details (b) Design a class to read three integer . Write different member functions to 1. Find the sum of two numbers and display the result 2. Find the maximum of three numbers (c) Write a program to read and display the records of 5 employees using array of objects. (d) Write a program to count the no of objects created of a particular class. [Use static data member and static member function] (e) Write a program to perform the following operations  Where A and B are the objects of two different class. [Use friend function].	1

	(f) Write a program to perform the following operations  Using a function which accepts two objects as parameters. (g) Design a class to read the details of employees. Use object pointer to display the details of the employee.	
3.	(a) Write a program to evaluate the following series $X= 2^2/2! +3^2/3!+ 4^2/4! +------- n^2/n!$ Use constructor to initialize the value of X to 0. (b) Design a class having two integers as private data member. Use different constructors to initialize the data members. (c) Write a program to copy the content the one object into other using copy constructor. (d) Design a menu based program to implement banking system. Use constructor and destructor.	1
4.	(a)Define a class "STUDENT" having the following data members "Roll","name", "branch" . Define functions to read the data members. Define another class "EXAM" having data members marks [3], percent and also inherited the properties of class "STUDENT", Define member function to read the data members and display the values. (b)Create a base class Shapes, Use this class to store two float type values that will be used to calculate the area of figures. Derive two classes called Rectangle and Circle. Add to the base class a member function init() to initialize the data members to 0, and member function read() to read the values . Redefine the read function in derived classes. Use different functions in derive class to display the area.	1
5.	(a) Design a class having two integers as private data member. Overload binary + operator two add two objects. (b) Design a class having a float variable as a private data member. Overload > operator to compare two objects. (c)Define a class having a float data member age. Define a function which accept an object pointer as argument, Compare the age of both the objects i.e the object calling the function and the object passed as argument, return the object having maximum age. **[Use this pointer]** (d)Write a program to demonstrate the use of Virtual Base class. (e)Create a base class Book, Use this class to store bookid, name and price. Derive two classes called Reference and Journal. Add to the base class a member function read() to read the values . Make the read() **function virtual**and redefine this function in derived class. Use different functions in derive class to display the values.[Use base class and derive class pointer to call the member function].	1
6	(a)Write a program to insert an element in a particular position in an array. (b)Write a program to delete an element from a particular position from an array and delete a particular element. (c)Write a program to perform bubble sort in an array. (d)Write a program to perform selection sort in an array.	1

	(e) Write a program to perform insertion sort in an array. (f)Write a program to search a particular element from an array. (use linear and binary search technique)	
7	(a)Write a program to implement the following for a singly, doubly linked list (i) create a list (ii) insert a node at the beginning (iii) insert a node at the end (iv) insert a node at any specified position (v) display the list (vi) delete a node from the beginning (vii) delete a node from the end (viii) delete a node from a specified position (ix) searching a node (x) delete a node with a key value.	1
8	(a)Write a program to push and pop an element from a stack. (b)Write a program to convert an infix expression to postfix and prefix. (c) Write a program to evaluate a postfix expression	1

SUBJECT	**COMMUNICATION ENGINEERING LAB**
CODE	EE 131616
L-T-P-C	0-0-2-1
EXPECTED NO OF WEEKS	12

EXPERIMENT NO.	AIM OF THE EXPERIMENT	HOURS
1	To study Amplitude Modulation (DSB-SC) and Demodulation	3
2	To study AM Modulation (DSB-FC)	3
3	To study Demodulation of AM signal(DSB-FC)	3
4	To study Analog to Digital Converter	3
5	To study Digital to Analog Converter	3
6	To study data format	3
7	To study Pulse Amplitude Modulation (Sampling Theorem) & Time Division Multiplexing	3
8	To study ASK Modulation & Demodulation	3

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