ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY, GUWAHATI

Semester III : Electrical Engineering/ B Tech

Sl. No.	Sub Code	Subject	L	T	P	Credit
	Theory					
1	MA131301	Mathematics-III	3	2	0	4
2	EE131302	Circuits Analysis	3	2	0	4
3	EE131303	Material Science	3	0	0	3
4	EE131304	Electrical Machines I	3	0	0	3
5	ET131305	Analog Electronics	3	2	0	4
6	HS131306	Sociology	2	0	0	2
	Practical					
7	EE131312	Circuits Analysis Lab	0	0	2	1
8	EE131314	Electrical Machines I Lab	0	0	2	1
9	ET131315	Analog Electronics Lab	0	0	2	1
10	EE131317	Electrical Machine Drawing/ Autocad	0	0	4	2
Total			17	6	10	25
Total Contact Hours = 33						
Total Credits = 25						

Course Title: MATHEMATICS III
Course Code: MA131301
L-T-:: C **3-2=4**
Abstract:

This course of Mathematics is important for almost all the engineering disciplines. It deals with the partial differential equations of first order and 2nd order.

Prerequisites: Concept of solution of ODE, Elementary complex numbers and properties, Elementary probability and statistics ? measures of central tendency, dispersions. Basic differentiation and integration [HS / diploma level]

Course Outcomes:

The students will

- Be able to apply the fundamental concepts of Partial differential Equations.
- Get familiarised with the applications of Ordinary Differential Equations and Partial Differential Equations.

- ❖ Be able to apply different techniques of integration, including partial fractions, integration by parts and recurrence formulae, to solve problems.

Module	Topic	No of hours	Marks
1	**First order Partial differential equation:** Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge? method. **Second order Partial differential equation:** Second order partial differential equation The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.	15	30
2	**Complex Analysis:** Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping, Complex integration: Line integral in the complex plane, Cauchy? integral theorem, Cauchy? integral formula, Derivatives of analytic functions. **Mathematical Series**: Power Series, Taylor? series, Laurent? series, Singularit ies and zeros, Residue integration method.	15	30
3	**Probability and statistics:** (i)Definition of probability, Laws of probability, Bays theorem, random variables, probability distributions and characteristics, binomial distribution, poisson? distributions and Normal distribution. (ii) elementary sampling theory, tests of hypothesis (statistical inference), Standard error, Fudicial (Confidence) limits, Tests of significance- Students? T-tests, Chi square tests and Z ?tests.	10	25

4	**Laplace Transform** Definition of Laplace transform, Laplace transform of elementary functions, inverse of Laplace transforms. Properties of Laplace Transform- Linearity, multiplication by t^n and division by t. Laplace Transform of derivatives and integrals. Shifting theorems, Laplace transform of (i) periodic function (ii) unit step function, (iii) Dirac-delta function. Covolution theorem, Application of Laplace transform to initial value problems.	8	15

Reference books:

1. E. Kreyszig,?Advanced Engineering Mathematics:, Eighth Edition, Wiley India.
2. B.V. Ramana, ?Higher Engineering Mathematics?, McGraw Hil Education.
3. N.P.Bali and Manish Goel, ?A text book of Engineering mathematics?, Laxmi Publication.
4. B. S. Grewal , ?Highe r Engineering Mathematics?, Khanna Publication, Delhi.
5. Babu Ram, ?Engineering Mathematics?, Pearson .

CIRCUIT ANALYSIS

SUBJECT:	:CIRCUIT ANALYSIS
CODE:	:EE131302
L-T- -C:	:3-2-4
CLASS HOUR:	:4 hrs/week
TOTAL NO OF CLASSES:	: 36
EXPECTED NO OF WEEKS:	: 9 weeks

MODULE	TOPICS	COURSE CONTENT	HOURS
1	**NETWORK ELEMENTS (FUNDAMENTALS)** Marks: 15	The resistor: Practical engineering devices. Solid & wire frame of common resistive materials, carbon film and metal film resistors	2
		Heat dissipating area (wattage), tolerance and temperature stability of resistors. the capacitor: Comparison of properties of different traditional & modern dielectric materials	2
		Short description of electrolytic capacitor- wet & solid dielectrics, solid tantalum & aluminum capacitors	2
		Mathematical models, the inductors, energy stored in an inductor.	2
2	**TRANSIENTS IN ELECTRIC**	Concept of circuit transient; Transient response & steady state response;	2

	CIRCUITS Marks:15	Forcing functions-impulse, step and ramp functions Study and solution of simple circuits undergoing transient disturbances,	2
		A.C. transients, Time domain equations and solutions by Lap lace transforms	2
3	**NETWORK GRAPH THEORY** (Marks: 15)	Graph of a network and its parts; Elementary graph theory as applied to electrical networks, Oriented graph; Tree;	2
		Co-tree; Loops; Tie-set; Cut-set matrix; Incidence matrices; Network equilibrium equations.	2
4	**METHODS FOR SOLVING NETWORK EQUATIONS (Marks-15)**	Solution of network equations by matrix methods.	3
		Methods suitable for simulating electric circuits on digital computers.	2
5	**NETWORK THEOREMS** **(Marks-15)**	Review of basic theorems (Thevenins, Nortons, Superposition and Maximun power Transfer) Millman? theorem,	2
		Reciprocity theorem, Compensation & Tellegen? theorems? etc.	2
		Analysis of coupled circuits. The dot rule & equivalent conductivity coupled forms of magnetically coupled circuits	2
6	**TWO PORT NETWORK ANALYSIS**	Impedance; Admittance; Transmission (T) and hybrid (h) parameters of two port network;	1
		Condition for reciprocity & symmetry; Relation between the parameter sets;	1
	(Marks-15)	Equivalent T & Π section representation.	1
7	**NETWORK SYNTHESIS (Marks-10)**	Foster and Cour forms of realization of network for given driving point impedance function,	2
		Foster-I & Foster-II forms, Cour-I & Cour-II forms	2
		TOTAL	36

Books:

1. Electric Circuits ? E.J Edminister (McGrow Hill)
2. Engineering Circuit Analysis- Hayt ,Kemmerly &Durbin (TMH)
3. Network & Systems- D.Roy Choudhury (Wily Eastern)
4. Network Analysis and Synthesis- C.L.Wadhwa (New Age International)
5. Circuit Theory- A.Chakraborty (Dhanpat Rai)
6. Circuits & Networks: Analysis & Synthesis ? Sudhakar, Shyammohan (TMH)

THIRD SEMESTER
MATERIAL SCIENCE

SUBJECT	MATERIAL SCIENCE
CODE	EE 131303
L-T-C	3-0--3
CLASS HOUR	4 hrs/week
TOTAL NO OF CLASS	38 (APPROX)
EXPECTED NO OF WEEKS	10 (APPROX)

MODULE	CHAPTER	CONTENTS	HOURS
1	**CRYSTAL STRUCTURE AND DEFECTS (15 marks)**	Review of crystal structure, space lattice, atomic packing factor for SC, BCC, FCC, Miller indices for a cubic crystal, Bragg? law and its applications, Review of inter atomic bonding- Ionic, covalent, metallic and vander waals, Crystal imperfections, Grain boundaries & effects of imperfections on metal properties	5
2	**BEHAVIOUR OF DIELECTRIC MATERIALS IN AC AND DC FIELDS (25 marks)**	i) Types of Polarization and Mechanism , Static dielectric constant for mono atomic gases and polyatomic molecules, internal or local fields (one dimensional case), Clausius-Mossotti relation, spontaneous polarization, piezo electricity ii) Dielectric loss, frequency dependence of ionic and electronic polarization, dipolar relaxation	11
3	**MAGNETIC PROPERTIES** (20 marks)	Origin of magnetism, magnetism and related parameters, Elementary Ideas of classification of magnetic materials (Dia, Para, Ferro, antiferro & Ferri), Domain Theory of Hysteresis, soft and hard magnetic materials and their applications, magnetic anisotropy and magnetostriction	5
4	**CONDUCTORS (20 marks)**	Free electron theory of metals-Ohm? law, Joule? law of heating, Widemann -Franz law, Effects of various parameters in electrical conductivity, Electrical conducting materials (Cu, Al), Superconductivity and effect of magnetic field, Contact resistance and contact potential	4
5	**SEMICONDUCTORS AND FABRICATION (20 marks)**	Types of semiconductor, Derivation of Carrier concentration in intrinsic and extrinsic semiconductor, Hall Effect and its applications, Conductivity of semiconductor- Drift and Diffusion mechanism, Einstein relation, Fabrication of BJTs	6
		TOTAL	31

THIRD SEMESTER

ELECTRICAL MACHINES - I

SUBJECT	**Electrical Machines - I**
CODE	**: EE131304**
L-T-C	**: 3-0--3 /**
CLASS HOUR	**: 3 hrs / Week**
TOTAL NO OF CLASS	**: 36 (APPROX)**
EXPECTED NO OF WEEKS	**: 12 (APPROX)**

1		**Electro-mechanical Energy Conversion : Marks: 16**	
	(i)	Principle of energy conversion, Field magnets (stationary/rotating), Induced e.m.f. and torque in rotating machines	3 hrs.
	(ii)	Simple commutator and slip rings for supply and collection of current, Magnetically coupled circuits, principles of operation of transformer, voltage and current ratios.	2 hrs.
2		**D C Machines:**	
	(i)	Constructional features, Details of Lap and Wave windings, Principle of operation, Methods of excitations ? shunt, series and compound.	3 hrs.
	(ii)	E.M.F. equation, Armature reaction, Inter-poles and compensation windings, Commutation, Characteristic curves of D.C. Generators	3 hrs.
	(iii)	Efficiency and Regulation, Parallel operation of D.C. Generators.	2 hrs.
3		**D C Motors :**	
	(i)	Principle of operation , Speed and Torque characteristic curves of shunt, series and compound motors.	3 hrs.
	(ii)	Starting of D.C. motors ? Starters and grading of starting resistance, Speed control, Choice of motors for different duties, Losses and efficiency	3 hrs.
	(iii)	Testing ? Swinburne? test, Back to back test, Retardation test and Brake test.	2 hrs.
4		**Transformer :**	
	(i)	Construction ? shell type and core type, single phase and poly phase transformers. EMF equation and output equation, Magnetic circuit, leakage flux and leakage reactance.	3 hrs.
	(ii)	Phasor diagram, per unit values of resistance and reactance. Open circuit and short circuit tests, back to back test, Regulation, losses and efficiency, maximum efficiency, all-day efficiency.	:4 hrs.

	(iii)	Auto-transfer, 3-phase transformer, Phase transformation and connections.	2 hrs.
	(iv)	Parallel operation of transformer, Vector grouping of three-phase transformers, Effects of transformer Harmonics.	3 hrs.
5		**Special Machines:**	
	(i)	**Stepper motor:** Construction and principle of operation, Types, Characteristics, Selection and Application.	2 hrs.
	(ii)	**Servomotors:** Construction and principle of operation of AC and DC servomotors. Types, Damping in AC servomotors, Application.	1 hrs.
	(iii)	Brushless DC Motor: Construction and principle of operation	1 hrs.

Reference Books

i) Electrical Machines - D P Kothari, I J Nagrath ? Mc Graw Hill.
ii) Electrical Machines - Deepa el.al ? SCITECH.
Electric Machinery - A Fitzgerald, Charles Kingsley Jr.,
iii) Stephen D Umans - Mc Graw Hill.
iv) Advanced Electrical Technology - H Cotton - CBS Publication.
v) Electrical Machinery - P S Bimbhra ? Khanna Publication.
vi) Electrical Machines - R K Rajput ? Laxmi Publication.

ANALOG ELECTRONICS

SUBJECT	**ANALOG ELECTRONICS**
CODE	**ET 131305**
L-T-P-C	**3-2-0-4**
CLASS HOUR	**4 HRS/WEEK**
TOTAL NO OF CLASSES	**39 (APPROX)**
EXPECTED NO OF WEEKS	**10 (APPROX)**

CHAPTER	TOPIC	COURSE CONTENT	HOUR
1	**Conductors, Insulators and semiconductors**	Intrinsic carrier concentration, Effect of doping on carrier concentration, Majority and Minority carriers, Mobility and diffusion constants, Transport of carriers by drift and diffusion, Recombination and carrier life time, Carrier concentration in intrinsic semiconductor, Fermi level in intrinsic semiconductor	8
2	**P-N Junction**	Graded and Abrupt junction approximations, Built-in field and depletion region approximation, Forward and reversed biased diodes, Diode current equation, Injection of carriers, Analysis of the passage of current through a p-n junction	5
3	**The Bipolar junction Transistor**	Construction, The currents in a BJT and their relationship, Analysis of IC - VCE characteristics, The Ebers-Moll equations, Transistor biasing, DC load line and thermal stabilizatrion, Transistor as an amplifier	12
4	**Feedback Amplifiers**	General theory of feedback, Negative and Positive feedback, Their effects on the performance of amplifiers, Overview of negative feedback topologies	6
5	**Operational Amplifier Fundamentals**	Introduction, equivalent circuit of op-amp, characteristics of ideal op-amp, Open loop op-amp configurations (Differential, Inverting & Non-inverting), Closed loop op-amp configurations(Inverting & Non-inverting)	8
			39 Hrs

REFERENCES

1 Integrated Electronics ? Millman- Halkias (PHI)
2 Electronic devices and circuits: J.B. Gupta
3 Electronic devices and circuits: S Salivahanan, N Suresh Kumar, A Vallavaraj
4 Electronic devices and circuits: Sanjeev Gupta, Santosh Gupta

HS131306	SOCIOLOGY	L = 2 T = 0 C = 2
Module-I	Sociology in the Industrial Perspective: Concept of sociology/ Sociology as a science?/ Sociology of work and industry/ Perspectives for sociological analysis of work/ Class conflict in industry/ Social impact of industrialization	12 Hours
Module-II	Work and Social Change: Nature of modern societies/ Emergence of industrial capitalism/ Technology and social change/ The information society after the industrial society/ Postmodernity/ Globalization and convergence/ Significance of the service sector today/ Work restructuring and corporate management	12 Hours
Module-III	Work Experiences in Industry: The concept of alienation/ Work satisfaction/ Technology and work experience/ Social background of workers/ Work orientations/ Stress and anxiety of the worker/ Work and leisure/ Unemployment/ Conflicts in the workplace	12 Hours
	Total	36 Hours

Reference Books

1. Miller and Form, Industrial Sociology (London: Harper & Row, 1968)
2. N. R. Sheth, Social Framework of Indian Factory (Bombay: Oxford University Press, 1968)
3. Gisbert, Fundamentals of Industrial Sociology (New Delhi: Oxford University Press, 1971)
4. P. Gisbert, Fundamentals of Industrial Sociology (New Delhi: Oxford University Press, 1971)
5. Tony J. Watson, Sociology, Work and Industry (New York: Routledge, 2004 reprint)

SUBJECT:	**:CIRCUIT ANALYSIS LAB**
CODE:	**:EE131312**
L-T-P-C:	**:0-0-2-1**
CLASS HOUR:	**:4 hrs/week**
TOTAL NO OF CLASSES:	**:7**
EXPECTED NO OF WEEKS:	**:8 weeks**

Experiment No	Aim	Hours
1	To study the following passive circuit components:	3
	i) Resistors	
	ii) Capacitors	
	iii) Magnetic core material	
2	i) To study the characteristics of a R-C low pass filter	3
	ii) To design a R-C low pass filter	

3	i) To study the characteristics of a R-C high pass filter ii) To design a R-C high pass filter	3
4	i) To study the characteristics of a R-C Integrating Circuit. ii) To design a simple R-C integrator.	3
5	i) To study the characteristics of a R-C Differentiating Circuit. ii) To design a simple R-C differentiator.	3
6	To study the phenomenon of series resonance in a RLC circuit	3
7	To study the phenomenon of parallel resonance in a RLC circuit	3

THIRD SEMESTER
ELECTRICAL MACHINE ? I LAB

SUBJECT	Electrical Machine - I Lab
CODE	: EE131314
L-T-P-C	: 0-0-2-1 / Week
CLASS HOUR	: 3 hrs / Week
TOTAL NO OF CLASS	: 8 (APPROX)
EXPECTED NO OF WEEKS	: 8 (APPROX)

TOTAL MARKS: 50

	1	**Open circuit characteristic of a DC shunt generator.**	3 hrs.
	2	**Load test on a DC Shunt generator.**	3 hrs.
	3	**Load test on DC series motor.**	3 hrs.
	4	**Speed control of a DC Shunt motor.**	3 hrs.
	5	**Open circuit and short circuit test for a single-phase transformer.**	3 hrs.
	6	**Load test on a single-phase transformer.**	3 hrs.
	7	**Parallel operation of two dc shunt generators.**	3 hrs.

ANALOG ELECTRONICS LAB

SUBJECT	**ANALOG ELECTRONICS Lab**
CODE	**ET 131315**
L-T-P-C	**0-0-2-1**
CLASS HOUR	**3 HRS/WEEK**
TOTAL NO OF CLASSES	**09 (APPROX)**
EXPECTED NO OF WEEKS	**09 (APPROX)**

EXPERIMENT NO	**AIM OF THE EXPERIMENTS**	**HOUR**
1	To study the forward static characteristics of the diodes	3
2	To study the static characteristics of a Zener Diodes	3
3	a) To study a simple shunt type voltage regulator circuit based on a Zener Diode b) To find the voltage regulation of the above circuit	3
4	To study rectifier circuits	3
5	To study the biasing techniques of single stage BJT amplifiers (Fixed Bias)	3
6	To study the forward static characteristics of the diodes (Fixed Bias with Feedback)	3
7	To study the forward static characteristics of the diodes (Voltage divider Bias)	3
8	To study the forward static characteristics of the diodes (Dual supply)	3
		24 Hrs

THIRD SEMESTER
ELECTRICAL MACHINE DRAWING/ Auto Cad

SUBJECT	: ELECTRICAL Machine DRAWING/Auto Cad
CODE	: EE131317
L-T-P-C	: 0-0-2-1 / Week
CLASS HOUR	: 3 hrs / Week
TOTAL NO OF CLASS	: 16 (APPROX)
EXPECTED NO OF WEEKS	: 16(APPROX)

1		**Unit 1**	
	(i)	Standard symbols used in Electrical and Electronics Engineering.	3 hrs.
	(ii)	Insulators used in power transmission and distribution systems	3hrs.
	(iii)	Different types of underground cables and overhead conductors used in power transmission and distribution systems. (Only X-sectional view)	3hrs.
	(iv)	Various transmission and distribution towers	3hrs.
2		**Unit2**	
	(i)	D.C Armature windings- Simplex lap and wave windings.	3hrs.
	(ii)	Sectional front and side elevation of the yoke and pole assembly with field winding.	3hrs.
3		**Unit3**	
	(i)	Transformers: Sectional plan and elevation of core type and shell type single-phase transformer. Sectional plan and elevation of a three-phase transformer.	: 6hrs.
	(ii)	induction motor Sectional front and side elevation of slip ring and squirrel cage induction motor.	6hrs.
	(iii)	Alternators Sectional front and side elevation of salient pole and turbo alternators.	6hrs.
4		**Unit4**	
	(i)	Three-phase AC windings	3hrs.
	(ii)	Single layer windings- Mush windings and concentric windings.	3hrs.
	(iii)	Double layer lap windings- Full pitched, short pitched and fractional slot windings.	6hrs.

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