SCHEME AND SYLLABI

FOR

THIRD TO EIGHTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

Scheme for Electrical and Electronics Engineering (EEE) Branch for 3rd to 8th Semesters

3rd Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EN09 301	Engineering Mathematics III	3	1	-	30	70	3	4
EN09 302	Humanities and Communication Skills	2	1	-	30	70	3	3
EE09 303	Electric Circuit Theory	4	1	-	30	70	3	5
EE09 304	Electromagnetic Field Theory	3	1	-	30	70	3	4
EE09 305	Analog Electronics	3	1	-	30	70	3	4
EE09 306	Mechanical Engineering	3	1	-	30	70	3	4
EE09 307(P)	*Basic Electrical Engg Lab*	-	-	3	50	50	3	2
EE09 308(P)	*Analog Electronics Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

4th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EN09 401B	Engineering Mathematics IV	3	1	-	30	70	3	4
EN09 402	Environmental Science	2	1	-	30	70	3	3
EE09 403	Signals and Systems	4	1	-	30	70	3	5
EE09 404	DC Machines and Transformers	3	1	-	30	70	3	4
EE09 405	Digital Electronics	3	1	-	30	70	3	4
EE09 406	Electrical Measurements & Instrumentation Systems	3	1	-	30	70	3	4
EE09 407(P)	*Mechanical Engg. Lab*	-	-	3	50	50	3	2
EE09 408(P)	*Electrical Measurements & Instrumentation Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

5th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EE09 501	Synchronous and Induction Machines	4	1	-	30	70	3	5
EE09 502	Power System Generation, Transmission and Distribution	3	1	-	30	70	3	4
EE09 503	Linear Control Systems	3	1	-	30	70	3	4
EE09 504	Power Electronics	3	1	-	30	70	3	4
EE09 505	Digital system Design	3	1	-	30	70	3	4
EE09 506	Electrical Material Science	2	1	-	30	70	3	3
EE09 507(P)	*Electrical Machines Lab I*	-	-	3	50	50	3	2

EE09 508(P)	*Digital Electronics Lab*	-	-	3	50	50	3	2
	Total	**18**	**6**	**6**				**28**

6th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EE09 601	Microprocessors and Microcontrollers	4	1	-	30	70	3	5
EE09 602	Engineering Economics and Principles of Management	3	1	-	30	70	3	4
EE09 603	Modern Control Theory	3	1	-	30	70	3	4
EE09 604	Electric Drives	3	1	-	30	70	3	4
EE09 605	Electrical Engineering Drawing	-	-	3	30	70	3	3
EE09 Lxx	Elective I	3	1	-	30	70	3	4
EE09 607(P)	*Electrical Machines LabII*	-	-	3	50	50	3	2
EE09 608(P)	*Mini Project*	-	-	3	50	50	3	2
	Total	**16**	**5**	**9**				**28**

Elective I

EE09 L01 Generalized Machine Theory
EE09 L02 Numerical Analysis and Optimization Theory
EE09 L03 Computer Organization and Architecture
EE09 L04 Entrepreneurship
EE09 L05 Bio- Medical Engineering

7th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EE09 701	Power System Analysis	4	1	-	30	70	3	5
EE09 702	Analog & Digital Communication	3	1	-	30	70	3	4
EE09 703	Digital Signal Processing	2	1	-	30	70	3	3
EE09 704	Electrical Machine Design	2	1	-	30	70	3	3
EE09 Lxx	Elective II	3	1	-	30	70	3	4
EE09 Lxx	Elective III	3	1	-	30	70	3	4
EE09 707(P)	*Power electronics Lab*	-	-	3	50	50	3	2
EE09 708(P)	*Advanced Electrical Engg. Lab*	-	-	3	50	50	3	2
EE09 709(P)	*Project*	-	-	1		100	-	1
	Total	**17**	**6**	**7**				**28**

8th Semester

Code	Subject	Hours/week			Marks		Sem-end duration-hours	Credits
		L	T	P/D	Inte-rnal	Sem-end		
EE09 801	Electrical System Design	4	1	-	30	70	3	5
EE09 802	Power System Protection & Utilization	2	1	-	30	70	3	3
EE09 Lxx	Elective IV	3	1	-	30	70	3	4
EE09 Lxx	Elective V	3	1	-	30	70	3	4
EE09 805(P)	Seminar	-	-	3	100	-	-	2
EE09 806(P)	Project	-	-	11	100	-	-	7
EE09 807(P)	Viva Voce	-	-	-	-	100	-	3
	Total	**12**	**4**	**14**				**28**

Electives for 7th and 8th Semesters

EE09 L06 Special Electrical Machines
EE09 L07 Digital Control Systems.
EE09 L08 VLSI Design
EE09 L09 Energy Auditing, Conservation and Management
EE09 L10 Switched Mode Power Converters
EE09 L11 Professional Ethics
EE09 L12 Embedded Systems
EE09 L13 High voltage Engineering
EE09 L14 Advanced Topics in Power Systems
EE09 L15 Advanced Power system Analysis and control
EE09 L16 Optimal Control Theory
EE09 L17 Digital Image Processing
EE09 L18 Power System Planning and Load Forecasting
EE09 L19 Power Quality Issues and Remedial Measures
EE09 L20 Management Information Systems
EE09 L21 Organizational Behavior
EE09 L22 Soft Computing Techniques
EE09 L23 Process Control and Instrumentation
EE09 L24 Mechatronics
EE09 L25 Robotics & Automation
EE09 L26 Satellite Communication

GLOBAL ELECTIVES

ME09 L23 Industrial Safety
CS09 L24 Computer Based Numerical Methods
IC09 L23 Bio-Informatics
PE09 L24 Industrial Psychology
PE09 L25 Entrepreneurship
CH09 L23 Nanomaterial and Nanotechnology
BM0 9 L23 Operation Research

EE09 501 Synchronous and Induction Machines

Teaching scheme **Credits:** 5

4 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the basic working principle of electrical machines*
- *To analyse the performance of synchronous and induction machines*

Module I (18 hours)

Alternators : Construction – Principle of operation – Types – AC windings –Distribution factor – Chording factor - EMF equation – Armature reaction – phasor diagrams - voltage regulation – Predetermination of voltage regulation – EMF method – short circuit ratio(SCR) - significance of SCR – MMF method – Potier method — Two reaction theory – modified phasor diagram – Analysis by two reaction theory – Slip test – Reluctance Power – Power angle characteristics – symmetrical short circuit transient —transient and subtransient reactances – losses and efficiency.

Module II (20 hours)

Synchronous generator – parallel operation – methods of synchronizing - alternator connected to infinite bus – two identical generators in parallel - load sharing – effect of change of fuel supply – effect of change of excitation – governor characteristics – synchronizing power and torque– locus of generated voltage for constant real power and variable excitation.

Synchronous motor - Principle of operation — different starting methods - equivalent circuit – phasor diagram- torque and power relations – effect of load changes on synchronous motor – mechanical load diagram – armature current as a function of power developed– O curves -armature current as function of excitation–V curves – inverted V curves – transition of a machine from generator mode to motor mode – hunting - synchronous condenser - applications of synchronous motors.

Module III (18 hours)

Theory of induction machines – 3 phase induction motors – construction – principle of operation – rotating magnetic field — slip and rotor frequency – phasor diagram – equivalent circuit – torque equation - mechanical power developed – maximum torque – torque slip characteristics – losses and efficiency – no load and blocked rotor tests – circle diagram – single phasing – effect of deep bar and double cage rotors – effects of air gap flux harmonics – cogging and crawling – induction generator - line excited and self excited – principle of operation - applications.

Module IV (16 hours)

Starting and speed control of induction motors – starting methods for three phase induction motors – direct on line starting – stator impedance starting - autotransformer starting – star delta starting – rotor resistance starting – speed control – voltage control – frequency control – rotor resistance control – pole changing – static frequency conversion and slip power recovery scheme.

Single phase induction motors – double revolving field theory – equivalent circuit – no-load and blocked-rotor tests - types of single phase induction motors - principle of operation of linear induction motor – applications of induction motors.

Text Books

1. M.G. Say, *Performance and Design of AC machines*, Pitman ELBS
2. P.S. Bhimbra, *Electrical Machinery*, Khanna Publishers
3. K. Murukesh Kumar, *Induction and Synchronous Machines*, Vikas Publishing house Pvt Ltd

Reference Books

1. Fitzgerald A.E and Kingsley, *Electrical Machinery*,Mc Graw Hill.
2. Langsdorf A S, *Theory of A C Machinery*, Mc Graw Hill
3. Nagrath I J and Kothari D P, *Electric Machines*,Tata Mc Graw Hill
4. Stephen J Chapman, *Electric Machinery Fundamentals*, Mc Graw Hill.
5. Vincent Del Toro, *Electrical Machines and Power Systems*,Prentice Hall
6. Charles Hubert, *Electric Machines*, Pearson Education
7. J.B Gupta, *Theory and Performance of Electrical Machines*, S.K. Kataria and Sons

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40 marksks*

Maximum Total Marks: 70

EE09 502 ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the various conventional and non- conventional energy sources.*
- *To develop an understanding about transmission and distribution systems.*
- *To evaluate the performance of transmission lines*

Module I (14 Hrs)

Conventional & non-conventional sources of energy – thermal, hydroelectric, diesel, nuclear power plants - solar, wind geothermal, tidal, MHD power Generation.[Layout & description needed] – Power Plant economics-load factor – demand factor – diversity factor – plant factor – tariff – depreciation – economics of pf improvement – capacity of phase advancing plant.

Module II (13 Hrs)

Overhead Transmission Systems**:** Arrangement of conductors, calculation of sag and tension, transmission line supports and their location, economic span, choice of transmission voltage, line insulation types, string efficiency, impulse ratio, arcing horns and rings, failure of insulation.
Corona: Disruptive critical voltage, advantages and disadvantages of corona

Module III (14 Hrs)
Distribution systems – classification and arrangement of distribution systems –Voltage drop calculations in radial and ring mains – comparison of different systems - DC, AC - single phase, three phase 3 wire - 4 wire systems

Underground cables: Different types, insulation resistance, capacitance of single core cables, grading of cables, capacitance of three core cables, sheath effects, laying and testing of cables.

Module 4 (13 Hrs)
Performance of Transmission Lines: Calculation of transmission line inductance and capacitance, GMD and GMR, bundled conductors, transposition, representation of short, medium and long lines, ABCD constants**,** Effect of capacitance: Nominal **T** and **p** methods of calculations, rigorous solution of long lines., power flow through a transmission line.

Text Books

1. S. Sivanagaraju & S. Satyanarayana , *Electric Power Transmission and Distribution*, Pearson Edn
2. S. N. Singh, *Electric Power Generation, Transmission and Distribution*, PHI
3. Sony, Gupta, Bhatnagar, *A Course in Electrical Power*, Dhanpat Rai and Sons
4. V. K. Mehta, *Electric Power Systems*, S. Chand & sons

Reference Books

1. C. L. Wadhwa, *Electric Power Systems*, Wiley Eastern Ltd.
2. S. L. Uppal, *Electrical Power*, Khanna Publishers.
3. A. S. Pabla, *Electric Power Distribution Systems*, Tata Mc Graw Hill
4. B. R. Gupta, *Power System Analysis and Design*, Wheeler Publishing Company, New Delhi

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Short answer questions (one/two sentences)* *5 x 2 marks=10 marks*

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: *Analytical/Problem solving questions* *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: *Descriptive/Analytical/Problem solving questions* *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

EE09 503 LINEAR CONTROL SYSTEMS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- *Understanding system analysis and design in classical control theory based on time domain and frequency domain approaches.*

Module 1(13 Hrs)

Principle of Automatic control- Open loop and closed loop systems – examples
System modeling & approximations -modeling of electrical systems – dynamic equations using KCL & KVL of RL, RC and RLC circuits - development of block diagrams of electrical networks - block diagram reduction - signal flow graphs - Mason's gain formula -Modeling of translational and rotational mechanical systems - differential equations for mass, spring, dashpot elements - D'Alembert's principle - dynamic equations & transfer function for typical mechanical systems - analogous systems - force-voltage & force-current analogy - toque-voltage & torque-current analogy – electromechanical systems - transfer function of armature controlled dc motor & field controlled dc motor.

Module II(14 Hrs)

Time domain analysis – continuous systems -standard test signals - step, ramp, parabolic, impulse - transient and steady state response –first order systems - unit impulse, step & ramp responses of first order systems - second order systems -- unit step response- under damped and over damped systems - time domain specifications - steady state error - static position, velocity & acceleration error constants -Concept of stability - stability & location of the poles in S-plane - Routh-Hurwitz stability criterion-Root Locus Method- Construction of root locus- Effect of poles and zeros and their location on the root locus-

Module III(14 Hrs)

Frequency Domain Analysis- Frequency Response representation- Polar Plot- Logarithmic Plots-Frequency Domain Specifications- Non- Minimum Phase Systems- Transportation Lag- Nyquist Stability Criterion—Stability from polar and Bode Plots- Relative Stability- Gain Margin and Phase Margin- M- N Circles-Nichols Chart

Sampled data Control Systems - data reconstruction and hold circuits- zero and first order hold –Pulse transfer function- stability in the z- plane- extension of Routh's stability criterion for discrete data systems-Jury's stability test.

Module IV (13 Hrs)

Design Using Conventional Methods- Cascade Compensation- PI, PD and PID controllers – tuning of PID Controller- Lead, Lag and Lead- Lag compensation using RC networks- Design of lead, lag and lead- lag compensators using frequency response and root locus methods.

Text Books

1. Nagrath & Gopal, *Control Systems Engineering*, New Age International (P) Limited
2. Katsuhiko Ogata, *Modem Control Engineering*, Pearson Education

Reference Books

1. Kuo, *Automatic Control Systems*, Prentice Hall
2. Norman S. Nise, *Control Systems Engineering*, Wiley India Pvt. Ltd.
3. S. Palani, *Control Systems Engineering*, Tata McGraw Hill
4. K. Ogata, *Discrete- Time Control Systems*, Pearson Education
5. A. Nagoorkani, *Control Systems*, RBA Publications
6. A. Anand Kumar, *Control Systems*, PHI

All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*

Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*

Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

EE09 504 POWER ELECTRONICS

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *Understanding the fundamentals of various power electronic components. Study and develop simple circuits involving power electronic components.*
- *Control of electric power using power electronic devices.*

Module 1(13 Hrs)

Silicon Controlled Rectifier-structure- V-I Characteristics- Two transistor analogy- turn-on methods – gate triggering circuits-turn on characteristics- turn-off characteristics-methods of commutation - series and parallel connection of SCRs-structure and characteristics of GTO thyristors, power diodes, power transistors, power MOSFET and IGBT-working of TRIAC-DIAC. Comparison of Power Semiconductor devices.

Module II (14 Hrs)

Phase control using SCR-single phase half wave converters with R and RL loads- single phase half controlled and fully controlled bridge converter with R and RL loads- output

voltage and waveforms-principle of discontinuous operation- fully controlled and half controlled 3 phase bridge converter- output voltage and waveforms- dual converter- Inverters-single phase series and parallel inverters-single phase bridge inverter- 3 phase bridge inverter-120° and 180° operation-PWM inverters using single pulse, multiple pulse and SPWM techniques.

Module III(13 Hrs)

Choppers-step down chopper-principle of operation-classes of chopper - step up chopper- Four quadrant operation of a chopper with motor load- single phase to single phase cycloconverters- principle of operation-single phase ac regulator-R and RL loads.

Module IV (14 Hrs)

Switching regulators-buck regulators-boost regulators- buck boost regulators- cuk regulators- Principle of operation- Continuous Conduction Mode-Output voltage equation-switched mode power supply- push pull converter - principle of operation and analysis-comparison with linear power supply-. Applications (block diagram approach) –induction cooking- electronic ballast- ups

Text Books

1. H. Rashid, *Power Electronics*, Pearson Education, Third Edn.
2. Ned Mohan, *Power Electronics*, John Wiley Publications

Reference Books

1. Singh MD & Khanchandani KB, *Power Electronics*, Mc Graw Hill
2. Dubey.G.K., *Thyristorised Power Controllers*,
3. Ashfaq Ahmed, *Power Electronics for Technology*, Pearson Education
4. P.S. Bimbhra, *Power Electronics*

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

EE09 505: DIGITAL SYSTEM DESIGN

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To make students able to design and build real digital circuits*
- *To make students able to do VHDL programming*

Module I (14 hours)

Hardware description languages-HDL based digital design-VHDL hardware description language- Program structure-Types, constants and arrays-Functions and procedures-libraries and packages-structural design elements-data flow design elements- behavioral design elements-time dimension-simulation –test benches-VHDL features for sequential logic design.

Module II (13 hours)

Combinational logic design-analysis procedure-design procedure-documentation-block diagram-gate symbols-signal names and active levels-bubble-to- bubble logic design-

signal namings in HDL programs-schematic structures. Circuit timing- timing diagrams-propagation delay- timing specifications.
Design using VHDL-decoders-encoders-tri state devices-multiplexer-parity generators-comparators- adders- subtractors and ALUs –combinational multiplexers.

Module III (13 hours)
Sequential logic design-clocked synchronous state machine analysis-state machine structure-output logic-characteristic equations-state table-state equations-state diagram-Flip-Flop input equations-Analysis of state machines with D Flip-Flops, JK Flip-Flops.
Synchronous state machine design- state table design example- state minimisation- state assignment- synthesis using D and JK Flip-Flops- Clocked sequential circuit design using VHDL- state machine design-state assignment-pipelined outputs.

Module IV (14 hours)
Feedback sequential circuit-basic analysis-analysing circuits with multiple feedback loops-races-state tables and flow tables
Design of feedback sequential circuits-latches-designing fundemental-mode flow tables-flow table minimisation-race-free state assignment-excitation equations-design using VHDL.
Algorithmic state machine-introduction-components of ASM chart-salient features-examples.
Complex programmable logic devices and FPGAs-Xilinx XC 9500 CPLD family-function block architecture- nput output block architecture-switch matrix.
FPGAs-Xilinx XC4000 FPGA family-configurable logic block-input output block-programmable interconnect.

Text Books

1. John F Wakerly, *Digital Design*, Pearson Education, Delhi, 2002
2. Morris Mano,*Digital Design*, Pearson Education, Delhi, 2002
3. A Anandakumar, *Digital Electronics*,Prentice Hall India Feb 2009.(Module IV)

Reference Books

1. Ian Grout, *Digital Systems Design with FPGAs*,Elsevier.
2. Volnei A Pedroni *Digital Electronics and Design with VHDL*,Elsevier
3. R Padmanabhan, B Bala Tripura Sundari, *Design through Verilog HDL*,Wiley India
4. David Money Harris and Sarah L Harris, *Digital Design and Computer Archiecture*, Elsevier
5. James R Armstrong, F Gail Gray, *VHDL Design/Representation and Synthesis*, Pearson Education, Delhi, 2002
6. Charles S. Roth, *Fundamentals of Logic Design*, Jaico Publishing House, 1999
7. Stephen Brown and Zvonoko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, McGraw Hill
8. B.Holdsworth, R.C Woods, *Digital Logic Design*, Newnes, Elsevier
9. Mohammad A. Karim, Xinghao Chen, *Digital Design, Basic Concepts and Principles*

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Short answer questions (one/two sentences)* All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.	*5 x 2 marks=10 marks*
PART B:	*Analytical/Problem solving questions* Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.	*4 x 5 marks=20 marks*
PART C:	*Descriptive/Analytical/Problem solving questions* Two questions from each Module with choice to answer one question.	*4 x 10 marks=40*

Maximum Total Marks: 70

EE09 506 ELECTRICAL MATERIAL SCIENCE

Teaching scheme **Credits:** 3
2 hours lecture and 1 hour tutorial per week

Objectives

- *To study the properties of various materials used in Electrical Engineering*
- *Selection of proper material for a particular application*

Module 1(9 hours)

Conducting materials: Review of metallic conduction on the basis of free electron theory - Fermi-Dirac distribution - Variation of conductivity with temperature and composition - Contact potential - Materials for electric resistances, brushes of electrical machines, lamp filaments, fuses and solders.

Semiconductors: Compound semiconductors - Basic ideas of amorphous and organic semiconductors

Magnetic materials: Classification of magnetic materials - Ferromagnetism - Hysteresis curve - Ferromagnetic domains (qualitative explanation only) - Curie - Weiss law - Hard and soft magnetic materials and applications - Ferrites - Magnetic materials used in electrical machines, instruments and relays.

Module II (9 hours)

Dielectrics: Dielectric polarization under static fields - Derivation of the expression for electronic polarization in monoatomic gases - Expressions for electronic, ionic and dipolar polarizations in polyatomic gases - Derivation of expression for polarization in solids and liquids - Clausius - Mosotti relation - Behaviour of dielectrics in alternating fields - Complex dielectric constant - Dipolar relaxation - Dielectric loss - Ferro electricity - Main features - Domain theory and explanation of hysteresis curve - (qualitative explanations only)

Module III (9 hours)

Dielectric breakdown: Mechanism of breakdown in gases, liquids and solids - Factors influencing dielectric strength - Capacitor materials.

Insulating materials: Good insulator properties and classification on temperature basis - Common insulator materials used in electrical apparatus - Inorganic materials (Mica, glass, porcelain, asbestos) - Organic materials (Paper, rubber, cotton silk fibre, wood, plastics, bakelite) - Resins and varnishes - Liquid insulators (transformer oil) - Gaseous insulators (air, SF6, and hydrogen) - Ageing of insulators.

Module IV(9 Hrs)

Solar energy materials: Photo thermal conversion - Use of coatings for enhanced solar thermal energy collection - Solar selective coatings - Cold mirror coatings - Heat mirror coatings - Antireflection coatings - Photovoltaic conversion - Solar cells - Silicon, Cadmium sulphide and Gallium arsenide - Magnetic resonance - Nuclear magnetic resonance - Electron spin resonance - Ferromagnetic resonance .

Text Books

1. Indulkar C. S. & Thiruvengadam S., *An Introduction to Electrical Engineering Materials,* S. Chand & Co.

2. Seth S. P. & Gupta P. V., *A Course in Electrical Engineering Materials*, Dhanpath Rai & Sons.

Reference Books

1. A. J. Dekker, *Electrical Engineering Materials,* Prentice Hall of India

2. Agnihotri O. P. and Gupta B. K., *Solar Selective Surfaces*, John wiley.

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70

EE09 507(P) ELECTRICAL MACHINES LAB I

Teaching Scheme **Credits**: 2
3 hours per week

Objective

- *To conduct various tests on dc machines and transformers and to study the performance.*

1. Obtain the open circuit characteristics of self excited DC shunt generator at rated speed

a) Predetermine the OCC at different speeds
b) Determine the critical field resistance
c) Obtain maximum voltage built up with given shunt field resistance
c) Obtain critical speed for a given shunt field resistance

2. Load test on DC shunt generator

a) Determine the external & internal characteristics
b) Deduce the armature reaction curve

3. Brake test on DC shunt / series motor
:
Plot the following characteristics
i) Efficiency Vs Output
ii) Line current Vs Output
iii) Speed Vs Output
iv) Speed Vs Torque
v) Line current Vs Torque

4. Perform Swinburne's test on a DC shunt machine

Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.

5. Hopkinson's test on a pair of DC machines

Determination of the efficiency of the given dc shunt machine working as a motor and generator under various load conditions.

6. Retardation test on a DC machine

a) Separation of hysteresis, eddy current, friction & windage losses
b) Find the moment of inertia of the rotating system

7. No load test at different excitations on a DC shunt motor

a) Separation of hysteresis, eddy current, friction & windage losses
b) Plot the losses vs. speed curves

8. O.C. & S.C. tests on the single phase transformer
:
Predetermination of the following
a) Efficiency at different load conditions and different power factors
b) Regulation at different load conditions and different power factors
c) Equivalent circuit referred to HV and LV sides
d) UPF load at which efficiency is maximum
f) Power factors at which regulation is maximum and zero
g) Plot % regulation vs. p.f. curves

9. Load test on the single phase transformer

a) Determination of the efficiency at different load conditions and unity power factor
b) Determination of the regulation at different load conditions and unity power factor
c) Plot efficient vs. output & regulation Vs output curves

10. Separation of losses in a single phase transformer

Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence

i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & plot losses vs. frequency curves

ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages &
plot losses vs. voltage curves.

11. Sumpner's test

a) Predetermination of efficiency at different load conditions and power factors
b) Predetermination of regulation at different load conditions and power factors
c) Plot efficiency vs. output & regulation vs. power factor curves
d) Obtain the equivalent circuit referred to LV & HV sides

12. Scott connection of the single phase transformers
:
Determine the efficiency at different load conditions when
a) Main transformer alone loaded
b) Teaser transformer along loaded
c) both transformers loaded under balanced conditions
d) both transformers loaded under unbalanced conditions
Plot efficiency vs. output curves for each case.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

EE09 308(P) DIGITAL ELECTRONICS LAB

Teaching Scheme **Credits**: 2
3 hours per week

Objective

- *Design and implementation of basic digital circuits*
- *Familiarisation of Hardware Description Language (VHDL)*
- *Introduction of 8085 microprocessor programming and interfacing.*

1. Design of Half adder and half subtractor circuits with NAND gates using mode control.
2. Design and realization of ripple counter using JK flip-flop.
3. Design and realization of Johnson & Ring Counter using a) JK Flip Flop b) Shift Register

4. Synchronous UP/DOWN Counter design and realization.
5. Implementation of multiplexer and demultiplexer using gates.
6. Logic circuit implementation using multiplexer IC.
7. VHDL implementation of adder circuit and three bit counter.
8. VHDL simulation of adder circuit and counter.
9. 8085 simple programming addition, data transfer, multiplication.
10. 8085 interfacing –waveform generation-square wave generation, saw-tooth wave and triangular wave.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

Internal Continuous Assessment *(Maximum Marks-30)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Short answer questions (one/two sentences) *5 x 2 marks=10 marks*
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

PART B: Analytical/Problem solving questions *4 x 5 marks=20 marks*
Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.

PART C: Descriptive/Analytical/Problem solving questions *4 x 10 marks=40 marks*
Two questions from each Module with choice to answer one question.

Maximum Total Marks: 70