

UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

FIFTH TO SEMESTER

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL & ELECTRONICS ENGG.

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL ENGINEERING

FIFTH SEMESTER

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 501	Analog and Digital Communications	3	1	-	50	3	100
EE04 502	Electro Magnetic Field Theory	3	1	-	50	3	100
EE04 503	Pulse and Digital Electronics	3	1	-	50	3	100
EE04 504	Power Systems I	3	1	-	50	3	100
EE04 505	Electrical Machines II	3	1	-	50	3	100
EE04 506	Electrical engineering Material Science	3	1	-	50	3	100
EE04 507(P)	Electronics Lab II	-	-	3	50	3	100
EE04 508(P)	Electrical Machines Lab I	-	-	3	50	3	100
	TOTAL	18	6	6	400		800

FIFTH SEMESTER**EE04 501: ANALOG AND DIGITAL COMMUNICATION**

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the basic principles of Analog and digital communication and information theory.

MODULE I (13Hours)

Frequency domain representation of finite energy signals and periodic signals – Energy spectral density and Power spectral density – Convolution theorem – Response of linear time invariant system – Sampling and reconstruction – Nyquist sampling theorem – Random processes – Ensemble and time averages – Stationarity – Correlation theory for wide sense stationary processes – Wiener-Khinchin-Einstein theorem – Properties of Gaussian random processes – White noise – Response of LTI system to white Gaussian noise.

MODULE II (13 Hours)

Amplitude Modulation: Spectrum – Power relations – Modulator and demodulator circuits – AM transmitter Block diagram – Tuned radio frequency and superheterodyne receivers – Calculation of signal to noise ratio for envelope detection and coherent detection of AM. Principle of single side band suppressed carrier modulation.

Frequency modulation: Deviation – Modulation Index – Spectrum of FM signal – Relationship between phase modulation and FM – JFET reactance modulator – FM transmitter block diagram – Foster Scelely discriminator – SNR calculation – Pre-emphasis and De-emphasis.

MODULE III (13 Hours)

Analog modulation scheme: PAM – PWM – PPM.

Digital Pulse Modulation Scheme: PCM – DPCM and Delta Modulation.

Base band data transmission : Base band transmission model – Additive white Gaussian Noise channel – Matched filter receiver – Inter symbol interference – basic ideas of pulse shaping – equalization – synchronization – scrambling and line coding .

Digital Pass band transmission: Elements of Digital Pass band transmission – Pass band transmission model.

Coherent Binary modulation schemes: ASK – PSK and FSK.

Multilevel Signaling schemes – Average Probability of error – Bit error rate – concept of an optimal receiver.

MODULE IV (13 Hours)

Elements of information theory: Measure of information – Shanon's source coding and channel coding theorems – Discrete memory-less channel – Shanon-Hartley theorem .

Error control strategies: Principles of forward error correction and ARQ - Linear block codes and syndrome decoding.

Elements of Data communication: Transmission impairments – synchronous and asynchronous transmission.

Multiple access: FDM – Synchronous and statistical TDM – CDMA – frequency hopped and direct sequence CDMA.

Computer Networks: Network topologies – Circuit switching – Packet switching .

Basic concepts of network protocols: OSI.

Text books

1. Communication Systems, 3rd Edition, Simon Haykin, John Wiley & Sons.
2. Electronics Communications, 4th Edition, Dennis Roddey and John Coolen, Prentice Hall of India 1997.

Reference:

1. Principles of Communications, R.E. Ziemer and W.H. Tranter, JAICO Publishing House.
2. Digital and Analog Communications, K. Samshanmugham, John Wiley & Sons.
3. Digital Communication: Design for the real world, Andy Bateman, Addison Wesley 1999.
4. Modern Digital and Analog Communication Systems, 3rd Edition, B.P. Lathi, Oxford University Press.
5. An Introduction to Analog and Digital Communication Systems, Simon Haykin, John Wiley & Sons.

Sessional work assessment

2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total Marks	50

University examination pattern

- Q I - 8 short answer type questions of 5 marks, 2 from each module.
- Q II - 2 questions A and B of 15 marks from module I with choice to answer any one.
- Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
- Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
- Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 502: ELECTROMAGNETIC FIELD THEORY

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the basic principle of Electric and Magnetic Fields.
Studying the governing relations between electric and magnetic fields.
Studying the principle behind electromagnetic wave propagation

Module – 1 (12 hours)

The Electric Field - Co-ordinate transformation, Vector fields, Divergence Theorem – Stokes Theorem, Static Electric field : Electric flux, Gauss's law, Electric scalar potential, Electric dipole moment, Electric field polarization, condition at boundary between dielectrics, method of images, Capacitance of isolated sphere, Capacitance between co-axial cylinder, Capacitance between parallel wires, Energy density in static field – Solution of Laplace's and Poisson's equation in electrostatics

Module – 2 (12 hours)

The Magnetic Field- : Steady magnetic field, Conduction current, Conduction current density, Biot-Savart's Law and Ampere's Law, Vector potential Concept of inductance, Inductance of solenoid, toroid Concept of resistance, magnetic moment, Torque on a loop, transmission lines Electromagnetic induction – Faraday's law.

Module – 3 (14 hours)

Maxwell's Equations -_Continuity equation, Displacement current, Maxwell's equation, Plane waves, Poynting vector and Poyntings theorem, solutions for free space condition, wave equation for a conducting medium, Harmonically varying field, wave polarization, linear, elliptic and circular polarization

Module – 4 (14hours)

Waves and Transmission Lines - Wave equation on transmission line. Co-axial and two wire transmission lines. Phase velocity and group velocity, Characteristic impedance, reflection coefficient, Standing wave ratio, Impedance matching, stub matching, Smith chart .Reflection and transmission of plane wave at boundaries, continuity equation at boundaries, dielectric – dielectric boundary, dielectric – conductor boundary, Law of reflection, Law of refraction(Snell's law),Concept of Brewster's angle.

Text books

- | | |
|------------------|-------------------------------------------------------|
| 1.W. H. Hayt | -Engineering Electromagnetics(Mc Graw Hill, Kogakusha |
| 2.David K. Cheng | -Field and Wave Electromagnetics , Pearson Education |

References

1. John D. Kraus - Electromagnetics (Mc Graw Hill)
- 2.Mattew N.O Sadiku - Elements of Electromagnetics(Addison – Wesley,2-nd edition)
- 3.B. Premlet -Electromagnetic Theory with Applications (Phasor Books, Kollam)
- 4.Guru & Hizirolu -Electromagnetic field theory – Fundamentals
- 5.Pramanik - Electromagnetism, Theory and Application, Prentice Hall of India.

Sessional work assessment

2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total Marks	=50

University examination pattern

Q I - 8 short answer type questions of 5 marks, 2 from each module.

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Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 503: PULSE AND DIGITAL ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Objective:**Creation of awareness about the basic principles of digital electronics.****Study of the logic design techniques.****Understanding the concepts behind the hardware implementation of a digital computer.****Module – 1 (13 Hours)****Pulse Circuits**

Forward Recovery and Reverse Recovery of Diodes, Switching Times of Diode, Switching Behavior of Transistors-Switch-on time components-resistive switching and clamped inductive switching of BJTs and switching times-Storage time and Schottky BJTs-Bistable Circuit-Symmetrical and Asymmetrical triggering of Bistable-Collector Coupled Monostable-Collector Coupled Astable-Transistor Schmitt Trigger Circuit-Voltage Sweep Errors-Constant Current Sweep Circuit-Miller Sweep using Opamps-Current Sweep Generation.

Module – 2 (15 Hours)

Logic Families Ideal Logic Gates-Truth Tables of basic gates-Logic Levels-Noise Margin-Basic Boolean algebra-De Morgan's Theorems-Different Logic Families- Comparison- Tristate logic.

Combinational Circuits

Number Systems-Boolean Functions-Canonical and Standard forms-Simplification of Boolean Functions by Karnaugh Map up to five variable map-NAND, NOR, EX-OR & EX-NOR implementation – Codes and Code Converters – Multi Level NAND Circuits-Multi Level NOR Circuits- Adders-Subtractors-Signed and unsigned numbers-one's complement and two's complement-BCD Adder-Magnitude Comparator-BCD Multiplier-Decoders and Encoders-Multiplexers and Demultiplexers- Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL

Module – 3 (13 Hours)**Sequential Circuits and Memories**

Flip Flops - RS , JK , T and D Flip Flops - Triggering of Flip Flops – Registers - Shift Registers - Ripple Counters - Synchronous Counters - Ring Counter - Johnson Counter - Memories -ROM , Static and Dynamic RAM, Read/Write Memory , EPROM , EEPROM, Memory Decoding. Analysis of clocked sequential circuits-state tables and state diagrams-state reduction and assignment-Flip Flop Excitation Tables-Algorithmic State Machine Design Procedure-Design of Modulo-m counters-Introduction to ASM Charts.

Module – 4 (11 Hours)

Computer Organization fundamentals- basic micro computer elements- data bus- control bus- address bus - arithmetic logic units- programme counter- flag- instructions- single and multibyte instructions- basic micro computer operations – Introduction to 8085 microprocessor – Architecture – Programming concepts.

TEXT BOOK:

- | | |
|-------------------|------------------------------------------------------------|
| 1. Millman & Taub | Pulse, Digital and Switching Waveforms |
| 2. Gaonker R S | :Microprocessor Architecture – Programming and Application |

REFERENCE BOOKS

- | | | |
|----|--------------------|----------------------------------------|
| 1. | Richard C Jaeger : | Microelectronic Circuit Design |
| 2. | M.Morris Mano : | Digital Design |
| 3. | Taub & Schilling : | Digital Integrated Electronics |
| 4. | Morris & Miller : | Designing with TTL Integrated Circuits |

Sessional work assessment

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- Q V - 2 questions of 15marks from module IV with choice to answer any one

EE04 504: POWER SYSTEMS – I

3 hours lecture and 1 hour tutorial per week

Objective:

**Creation of awareness on various methods for generating Electrical energy and its transactions.
Creation of awareness on electrical energy transmission and distribution procedures and the related problems.**

Design and analysis of transmission lines.

Module 1 (13 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 2 (16 Hrs)

Overhead Transmission Systems: Arrangement of conductors, 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.

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 3 (10 Hrs)

Distribution systems – classification and arrangement of distribution systems – Kelvin's law – Voltage drop calculations in radial and ring mains – comparison of different systems - DC ,AC - single phase , three phase 3 wire -4 wire systems – calculation of sag and tension

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 π methods of calculations, rigorous solution of long lines., power flow through a transmission line.

Text Book

1. Sony, Gupta, Bhatnagar - A Course in Electrical Power, Dhanpat Rai and Sons.
2. C.L.Wadhwa - Electric Power Systems, Wiley Eastern Ltd.

References:

- 1.Turan Gonen - Electric Power Transmission System Engineering, John Wiley
2. S.L.Uppal - Electrical Power, Khanna Publishers.
3. A.S.Pabla - Electric Power Distribution Systems, Tata McGraw Hill.

sessional work assessment

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Regularity &Participation in class	10%
Total Marks	=50

University examination pattern

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 Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 505: ELECTRICAL MACHINES II

3 hours lecture and 1 hour tutorial per week

Objectives:**Study of theory and working principles of ac machines.****Performance analysis of ac machines.****Control of ac machines.****Module I (14 Hours)**

Alternators: Construction – Principle of operation - Type and selection - A C Windings - Emf Equation - Distribution Factor - Chording Factor - Armature reaction – Voltage regulation - Predetermination of voltage regulation - EMF method -Synchronous reactance and short circuit ratio - MMF method - Potier method - Phasor diagrams - Two reaction theory - modified phasor diagram - Analysis by two reaction theory - Slip Test - Reluctance Power - Power angle characteristics - Sudden short circuit - Current waveforms - Transient and subtransient reactances - DC excitation - Static excitation - Brush less excitation and self excitation - Losses and Efficiency..

Module II (16 Hours)

Synchronous generator: Active and reactive power control - Parallel Operation - Load sharing - effect of armature reaction - Automatic synchronizing - Effect of change of fuel supply - Alternator connected to infinite bus - Governor characteristics - Synchronizing power and torque - Two identical generators in parallel - Locus of generated voltage for constant real power and variable excitation - Automatic voltage regulators.

Synchronous motor: Principle of operation - Equivalent circuit -Torque and Power relations - Effect of load changes on synchronous motor - Mechanical load diagram - Armature current as function of power developed and excitation -V curves - Inverted V curves - O curves -Transition of a machine from generator mode to motor mode - Phasor diagram - Minimum excitation for given power – Hunting - Periodicity of hunting – Suppression - Different starting methods.

Module III (12 Hours)

Theory of Induction Machines: 3 phase Induction motors - construction - Principle of operation - Flux and MMF wave in induction machines - Rotor MMF and production of torque - slip and frequency of rotor current - Phasor diagram - Equivalent circuit - Mechanical power developed - Maximum torque -Torque slip characteristics - Losses and power flow - Single phasing - No-load and blocked rotor tests - The circle diagram – Effect of deep bar and double cage rotors - Effects of air gap flux harmonics - Cogging and crawling - Line excited and self excited induction generators -Principle of Operation and applications - Single phase Induction motors - Double revolving field theory - equivalent circuit – Principle of operation of linear induction motor - Applications of all types of induction motors.

Module IV (10 Hours)

Starting and Speed control of Induction Motors: Starting methods for three phase Induction motors - Direct on line starting - Auto transformer starting - Star delta starting - Rotor resistance starting - Starters and contactors - Speed control - Basic methods - Voltage control - Frequency control - Rotor resistance control - Pole changing - Static frequency conversion and slip power recovery scheme - starting methods of single phase induction motors.

Text Books

1. M.G.Say , Perfomance and Design of AC Machines, Pitman ELBS
2. Dr.P.S.Bhimbra, Electrical Machinery ,Khanna Publishers.
- 3.Dr. 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 andPerfomance of Electrical Machines,S.Kataria and Sons

Sessional work assessment

2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total marks	= 50

University examination pattern

- Q I - 8 short answer type questions of 5 marks, 2 from each module.
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- Q III - 2 questions A and B of 15 marks from module II with choice to answer any one.
- Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one.
- Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one.

EE04 506: ELECTRICAL ENGINEERING MATERIAL SCIENCE

3 hours lecture and 1 hour tutorial per week

Objective:**Study of the properties of various materials used in electrical engineering.****Selection of proper material for a particular application.****MODULE I (13 hours)****Conducting materials:** Review of metallic conduction on the basis of free electron theory - Fermi-Diac 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 - Hysterisis 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 (13 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 - Ferroelectricity - Main features - Domain theory and explanation of hysterisis curve - (qualitative explanations only)**Module III (13 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 (13 hours)****Solar energy materials:** Photothermal 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
2. Seth S.P.& Gupta P.V., *A Course in Electrical Engineering Materials*, Ganapath Rai

Reference:

1. A.J.Dekker, *Electrical Engineering Materials*, Prentice Hall of India.
2. Agnihotri .O.P and Gupta B.K, *Solar Selective Surfaces*, John Wiley.
3. Tereev, *Electrical Engineering Materials*, Mir Publishers.
4. Arumugham M, *Material Science*, Anuradha Agencies.

Sessional work assessment

2Assignments	30%
2 tests	60%
Regularity &Participation in class	10%
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks, 2 from each module

Q II - 2 questions A and B of 15 marks from module I with choice to answer any one

Q III - 2 questions A and B of 15 marks from module II with choice to answer any one

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Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 507 (P): ELECTRONICS LABORATORY II

3 hours practical per week

Objective:

To design and set up different electronic circuits using operational amplifiers.

1. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator and differentiator.
2. OPAMP comparator – Design and set up of Schmit Trigger – Window comparator.
3. Phase shift and Wein’s Bridge oscillator with amplitude stabilization using OPAMPs.
4. Waveform generation – Square, triangular and sawtooth wave form generation using OPAMPs.
5. Precision rectification – Absolute value and averaging circuit using OPAMPs.
6. Second order LP and BP filters using single OPAMP.
7. Set up Analog to Digital converter (a) Successive Approximation method (b) Dual Slope Method.
8. a) Using Cd 40447 IC design and set up gated/ungated astable and monostable multivibrators.
b) Using Cd 4093 Schmitt NAND IC design and set up astable and monostable.
9. Design of Half adder and half subtractor circuits with NAND gates using mode control.
10. a) Design and realization of ripple counter using JK flip-flop. b) Cascading of ripple counters.
11. Design and realization of Johnson & Ring Counter using a) JK Flip Flop b) Shift Register
12. Synchronous UP/DOWN Counter design and realization.
13. IC 555 Applications.
14. Introduction to circuit simulation using PSPICE

Sessional work assessment

Record & Class work	=25
Attendance & Regularity	=5
Test	=20
Total	=50

EE04 508(P): ELECTRICAL MACHINES LAB – 1

3 hours practical per week

Objective: To conduct various tests on dc machines and transformers and to study the performance Characteristics**1.** Obtain the open circuit characteristics of self excited DC shunt generator at rated speed.Objectives:

- 1) Predetermine the OCC at different speeds.
- 2) Find the critical resistance and the critical speed for a given field circuit resistance.

2. Load test on DC shunt generator.Objectives:

- 1) The performance characteristics by conducting load test
- 2) Deduce the armature reaction curve.

3. Brake test on Dc shunt and series motor.Objectives Plot the following characteristics.

- a) Output vs Efficiency
- b) Output vs Line current
- c) Output vs Speed
- d) Speed vs Torque
- e) Line current vs Torque

4. Perform Swinburne's test on a DC shunt machine.Objectives: Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator delivering 1/4, 1/2, 3/4 and full rated output.**5.** Hopkinson's Test on a pair of DC machines.Objectives: Predetermination of the efficiency of the machine working as a motor and generator under various load conditions on the generator.**6.** Perform Retardation test on a DC machine.Objectives

- 1) Separate the losses.
 - 2) Find the moment of inertia of the rotating system.
- 7.** No load test at different excitations on DC shunt motors.

Objectives

- 1) Separation of losses of a DC machine.
- 2) Plot the efficiency vs output

8. O.C and S.C test on the single-phase transformer. Pre-determination of the following.Objectives

- 1) Efficiency at 1/4, 1/2, 3/4 and full loads at 0.5, 0.86 and unity p.f.
- 2) Regulation at same loads and p.f's.
- 3) Equivalent circuit referred to HV and LV sides.
- 4) Upf load at which efficiency is minimum.

9. At normal voltage and frequency separate the hysteresis and eddy current losses of a single phase transformer.**10.** Sumpner's testObjectives

Predetermination of efficiency and regulation at various loads and p.f.

11. Scott connection of the single phase transformers to find performance under various load conditions at upf and plotting the efficiency curves with

- 1) Main transformer secondary alone loaded.
- 2) Teaser transformer secondary alone loaded.
- 3) Balanced loading
- 4) Unbalanced loading.

Sessional work assessment

Record & Class work	=25
Attendance & Regularity	=5
Test	=20
Total	=50