UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

THIRD AND FOURTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL & ELECTRONICS ENGINEERING

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL & ELECTRONICS ENGINEERING

THIRD SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hours	Marks
EN04 301A	ENGINEERING MATHEMATICS-III	3	1	-	50	3	100
EE04 302	COMPUTER PROGRAMMING IN C	2	-	2	50	3	100
EE04 303	STRENGTH OF MATERIALS	3	1	-	50	3	100
EE04 304	MECHANICAL ENGINEERING II	3	1	-	50	3	100
EE04 305	ELECTRONICS I	3	1	-	50	3	100
EE04 306	ELECTRIC CIRCUIT THEORY	3	1	-	50	3	100
EE04 307(P)	**ELECTRONICS LAB I**	-	-	3	50	3	100
EE04 308(P)	**BASIC ELECTRICAL ENGINEERING LAB**	-	-	3	50	3	100
TOTAL		**17**	**5**	**8**	**400**	**-**	**800**

FOURTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hours	Marks
EN04 401A	ENGINEERING MATHEMATICS-IV	3	1	-	50	3	100
EN04 402	ENVIRONMENTAL STUDIES	3	1	-	50	3	100
EE04 403	ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS	3	1	-	50	3	100
EE04 404	ELECTRONICS II	3	1	-	50	3	100
EE04 405	ELECTRICAL MACHINES I	3	1	-	50	3	100
EE04 406	LINEAR SYSTEMS ANALYSIS	3	1	-	50	3	100
EE04 407(P)	**MECHANICAL ENGINEERING LAB**	-	-	3	50	3	100
EE04 408(P)	**ELECTRICAL MEASUREMENTS LAB**	-	-	3	50	3	100
TOTAL		**18**	**6**	**6**	**400**	**-**	**800**

SYLLABI OF THIRD SEMESTER

EN04 301A ENGINEERING MATHEMATICS-III

(Common for all branches except CS and IT)

3 hours lecture and 1 hour tutorial per week

Module I : Linear Algebra

Vector spaces – Linear dependence and independence, and their computation – Bases and dimension – Subspaces – Inner product spaces – Gram-Schmidt orthogonalisation process – Linear transformations – Elementary properties of linear transformations – Matrix of a linear transformation. (Proofs of theorems omitted.)

Module II : Fourier Transforms

Fourier integral theorem (proof not required) – Fourier sine and cosine integral representations – Fourier transforms – Fourier sine and cosine transforms – Properties of Fourier transforms – Singularity functions and their Fourier transforms.

Module III : Probability Distributions

Random variables – Mean and variance of probability distributions – Binomial and Poisson distributions – Poisson approximation to binomial distribution – Hypergeometric and geometric distributions – Probability densities - Normal, uniform, and gamma distributions.

Module IV : Theory of Inference

Population and samples – Sampling distributions of mean and variance – Point and interval estimations – Confidence intervals for mean and variance - Tests of hypotheses - Hypotheses concerning one mean, two means, one variance, and two variances – Test of goodness of fit.

TEXT BOOKS

For Module I

K. B. Datta, *Matrix and Linear Algebra for Engineers*, Prentice-Hall of India, New Delhi, 2003.
(Sections: 5.1, 5.2, 5.3, 5.4, 5.5, 5.8, 6.1, 6.2, 6.3)

For Module II

C R Wylie & L C Barrett, *Advanced Engineering Mathematics (Sixth Edition)*, McGraw Hill.
(Sections: 9.1, 9.3, 9.5)

For Module III

Richard A Johnson, *Miller & Freund's Probability and Statistics for Engineers*, Pearson Education, 2000.
(Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7)

For Module IV

Richard A Johnson, *Miller & Freund's Probability and Statistics for Engineers*, Pearson Education, 2000.
(Sections: 6.1, 6.2, 6.3, 7.1, 7.2, 7.4, 7.5, 7.8, 8.1, 8.2, 8.3, 9.5)

REFERENCES

1. Bernard Kolman & David R Hill, *Introductory Linear Algebra with Applications (Seventh Edition)*, Pearson Education, 2003.
2. Lipschutz S, *Linear Algebra – Schaum's Outline Series*, McGraw Hill
3. Erwin Kreyszig, *Advanced Engineering Mathematics (Eighth Edition)*, John Wiley & Sons.
4. Larry C Andrews & Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice-Hall of India, 2003.
5. Ronald E Walpole, et al, *Probability and Statistics for Engineers and Scientists(Seventh Edition)*, Pearson Education, 2004
6. Robert V Hogg & Elliot A Tanis, *Probability and Statistical Inference*, Pearson Education, 2003.
7. Chatfield C, *Statistics for Technology, Chapman & Hall*

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

University examination pattern

Q1 - 8 short type questions of 5 marks, 2 from each module
QII - 2 questions of 15 marks from module I with choice to answer any one
QIII - 2 questions of 15 marks from module II with choice to answer any one
QIV - 2 questions of 15 marks from module III with choice to answer any one
QV - 2 questions of 15 marks from module IV with choice to answer any one

EE04 302 COMPUTER PROGRAMMING IN C

(Common to all Branches except CS, IT & PT)

2 hours lecture & 2 hours practical per week

Module 1(12 hours)

Programming and problem solving – Basic computer organization – Developing algorithms – Flow charts – High level and low level languages – Compilers and Interpreters – Steps involved in computer programming –

Writing, Compiling and Executing a program – Debugging a program – Description of a programming language.

Module II (18 hours)

Basics of C – Overview of C – Program structure – Lexical elements – Numerical constants – Variables – Arithmetic operators – Arithmetic Expressions – Arithmetic conversion – Increment and Decrement operators

– Assignment Expressions – Multiple assignments – Input and Output – Format specifiers – Fundamental data

types – Bit level operators and applications – Relational operators – Relational expressions – Logical operators

– Logical expressions – Conditional operator – Precedence and associativity of operators.

Module III (16 hours)

Compound statements – Conditional statements – if statement – if else statement – nested if statement – switch

statement – Loop control statements – while statement - do while statement – for statement – continue statement – break statement – go to statement – Functions – user-defined functions – library functions – Recursion – Global, local and static variables.

Module IV(20hours)

Arrays – single dimensional – multi dimensional – Arrays in functions – Stacks – Strings – String processing –

Bit-wise operators – Enumerated data types – Structures – Typedef – Structures in Arrays – Arrays in Structures – Unions – Pointers – Pointers and Arrays – Pointers and Functions – Linear linked lists and list operations – Files – sequential files – unformatted files – text files.

Text Book:

Rajaraman V, Computer Programming in C, Prentice Hall of India

Reference Books:

1. Kernighan B.W. & Ritchie, D.M., The C Programming Language, Prentice Hall of India
2. Balaguruswami E, Progrmming in ANCI C, Tata McGraw Hill
3. Venugopal K.R. & Prasad S.R., Programming with C, Tata McGraw Hill

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

University examination pattern

Q1 - 8 short type questions of 5 marks, 2 from each module

QII - 2 questions of 15 marks from module I with choice to answer any one

QIII - 2 questions of 15 marks from module II with choice to answer any one

QIV - 2 questions of 15 marks from module III with choice to answer any one

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

EE04 303 STRENGTH OF MATERIALS

3 hours lecture and 1 hour tutorial per week

Module I

Tension, compression & shear: (7 hours)

Types of external loads - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams - elongation of prismatic bars - Temperature stresses.

Analysis of stress on oblique sections and strain: (5 hours)

Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette

Module II

Shear force & Bending Moment: (4 hours)

Review of Bending moment and shear force for Cantilever and Simply supported cases, SFD & BMD for over hanging beams (with concentrated load, u.d.l and Moment)

Stresses in laterally loaded symmetrical beams: (9 hours)

Theory of simple bending –assumptions and limitations – Stresses in beams – moment of resistance – Section modulus - shearing stresses in bending - Flitched Beam

Module III

Deflection of beams: (8 hours)

Differential equation of the elastic curve – Deflection of statically determinate beams - Method of successive integration – Macaulay's method

Torsion: (5 hours)

Torsion of circular bars – strength and stiffness of solid and hollow circular shafts (uniform cross section), Transmission of power. Close coiled helical springs.

Module IV

Theory of columns: (5 hours)

Combined Direct and bending stress - Euler's load for columns with different end conditions - Rankine formula

Thick Cylinders (5 hours)

Lame's equation - stresses in thick cylinders due to internal and external pressures - compound cylinders

Introduction to riveted and welded connection (2 hours)

Riveting – Lap joint, Butt joint, Staggered riveting, Chain riveting. Welding – Butt welds, Fillet welds.

Testing of materials (2 hours)

Tension, flexure, shear, hardness, toughness, fatigue

Text Books:

1. James M Gere & Stephen P Timoshenko , Mechanics of Materials , CBS Publishers & Distributers, New Delhi
2. Bhavikatti.S.S., Strength of Materials, Vikas Publishers, New Delhi
3. Vazirani & Ratwani, Analysis of Structures, Vol-1, Khanna Publishers

Reference books:

Timoshenko & Young, Elements of Strength of Materials, Affiliated East West Press Ltd.

Egor P Popov , Mechanics of solids, Prentice Hall of India, New Delhi.

Warnock F.V., Strength of Materials, Isaac Pitman

Nash W.A., Strength of Materials, Schaum's Outline Series, McGraw

Sessional work assessment	
2 Assignments	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
QIII	- 2 questions A and B of 15 marks from module II with choice to answer any one
QIV	- 2 questions A and B of 15 marks from module III with choice to answer any one
QV	- 2 questions A and B of 15 marks from module IV with choice to answer any one

EE04 304 MECHANICAL ENGINEERING II

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Fluid Mechanics – Fluid properties – density, viscosity, surface tension and capillarity – Newton Law of viscosity – Fluid statics – Fluid pressure – Variation of pressure in static fluid – Absolute and gauge pressure, Burden tube pressure gauge, manometers – Hydrostatic forces on plane and curved surfaces – Centre of pressure – Buoyancy and stability of submerged and floating bodies – Metacentric height – Simple numerical problems.

Module II (14 hours)

Fluid dynamics – Continuity equation, momentum equation and energy equations. One dimensional flow along a streamline – Euler's momentum equation, Bernoulli's equation, Pitot and pitot static tubes – Venturimeter, orifice meter, flow nozzle, notches and weirs – simple numerical problems.

Module III (14 hours)

Dimensional analysis – Rayleigh's method, Buckingham – -Theorem – Principles of modelling and similitude as applied to fluid mechanics problems – Non-dimensional parameter on fluid mechanics and fluid machinery.

Hydraulic machines – Hydraulic turbines – Impulse and reaction turbines – Pelton Wheel, Francis turbine and Kaplan turbines – their constructional features and performance characteristics – factors affecting performance – turbine selection criteria – Governing, Surging and Cavitation (theory only detailed analysis not expected)

Module IV (14 hours)

Hydraulic pumps – General features of positive displacement anxd roto dynamic pumps, Centrifugal pump – Classification – Principles of working. Multi-stage pumpsd – Self priming pumps – Deep well pumps. Reciprocating pumps – Use of air vessels – Pump characteristics. Rotary pumps – Gear pumps – Rotary piston pumps – Wane pump – Screw pumps (working principle only. Detailed syllabus not expected)

Mechanical Power Transmission – Belts and pulleys – Classification – Expression for ration of belt tension, slip, length of belt, centrifugal tension, Simple problems (V belts and flat belts) chain drivers – Classification, uses, ropes – application.

Text Books

1. Fluid Mechanics & Hydraulic Machines - Modi & Seth
2. Theory of Machines - P.L. Bellaney

Reference books

1. Hydraulic Machines - Dr. Jagdish Lal
2. Fluid mechanics - K.L. Kumar
3. Fluid mechanics - D.S. Kumar
4. Theory of Machines - Dr. Jagdish Lal

Sessional work assessment

Assignments	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
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 305 ELECTRONICS I

3 hours lecture & 1 hour tutorial per week

Objective:

Understanding the basics of electronics.
Procedures for design a simple electronic circuit involving diodes, transistors etc.
Understanding the selection of proper components from the specifications available and implement the same practically.

Module I: Semiconductors and devices (14 hours)

Field intensity - Potential energy - Mobility - Conductivity - Electrons and holes - Charge density in semiconductors - Electrical properties of silicon and germanium - Diffusion - Potential variation within graded semiconductors - Open circuit p-n junction - p-n junction as a rectifier - V-I characteristics - Temperature dependence - Diode resistance - Transition capacitance - Minority carrier storage - Diffusion capacitance - Breakdown diode - Schottky diode - Junction transistor - Current components - Construction - CE and CB characteristics - Ratings - Construction and characteristics of JFETS and MOSFETS

Module II: Diode circuits (12 hours)

Diode as a circuit element - Load line - Piecewise linear model - Single phase half wave and full wave rectifier circuits - Voltage regulation - Ripple factor - Rectifier efficiency - Transformer utilization factor- Bridge rectifier- Rectifier filters - LC and RC filters and comparison - Diode currents and supply line currents for various filters - Diode clipping circuits - Single level and two level clippers - Clamping circuits - Clamping circuit theorem

Module III: Amplifier circuits (13 hours)

Operating point of a BJT - Bias stability - Thermal runaway - Fixed bias and self bias design - Concept of small signal operation - Amplification in CE amplifier - Transconductance and its relation to CE voltage gain - h parameter model of a BJT- CE, CB and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers - Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers- Class B and Class AB Power amplifiers using BJT

Module IV: Frequency response of amplifiers (s-domain approach is envisaged) (13 hours)

Low frequency response of BJT and FET amplifiers - Dominant time constant - selection of coupling and bypass capacitors - Hybrid Π equivalent circuit of BJT - High frequency response of CE current gain - α cut off and β cut off frequencies - Gain bandwidth product - Miller effect - Emitter follower at high frequencies - FET at high frequencies.- Differential amplifiers - Common mode and differential mode gains - CMMR - Current source biasing - Offset behavior

Text Book :
1. Millman J., *Microelectronics*, McGraw Hill
2. David Abell- Electronic Devices and Circuits, Prentice Hall of India
3.Millman &Halkias –Integrated Electronics, McGraw Hill

Reference books

1. Schilling & Belove, *Electronic Circuits*, McGraw Hill
2. Sedra & Smith, *Microelectronic Circuits* Oxford University Press
3. Jaeger R.C., *Microelectronic Circuit Design*, McGraw Hill
4. Horowitz P. & Hill W., *The Art of Electronics*, Foundation
5. Boylested & Nashesky, *Electronic Devices & Circuit Theory*, Prentice Hall of India
6. Rama Reddy. S, Electronic Devices and Circuits, Narosa publications

Sessional work assessment	
Assignments	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
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 306 ELECTRIC CIRCUIT THEORY

3 hours lecture and 1 hour tutorial per week

Objective:

Familiarization of various network topologies related to two-phase and three-phase systems.
Understanding the various methods for analysis and synthesis of electrical networks.
Design and set up of simple analog filter circuits.

Module I Three phase systems(8 hours)

Review of three phase systems, Three phase loads with mutual coupling between phases - 3 wire and 4 wire systems - Neutral shift - Neutral current - Active power, reactive power, complex power, apparent power and power factor in balanced and unbalanced three phase systems - Symmetrical components - Analysis of unbalanced systems using symmetrical components - Sequence impedances - Analysis of three phase unbalanced systems with mutual coupling between phases using symmetrical components - Sequence coupling

Module II: S-domain analysis of circuits (16 hours)

Laplace transform - Transform pairs - Gate functions - Shifting theorem - Solution of differential equations by Laplace transforms - Initial and final value theorems - Laplace transforms of periodic signals - Inversion of transforms by partial fractions - Convolution theorem and convolution integral - Transformation of a circuit into s-domain - Transformed equivalent of inductance - Capacitance and mutual inductance - Impedance and admittance in the transform domain - Node analysis and mesh analysis of the transformed circuit - Nodal admittance matrix and mesh impedance matrix in the s -domain - Solution of transformed circuits including mutually coupled circuits - Input and transfer immittance functions - Transfer functions - Impulse response and transfer function - Poles and Zeros - Pole Zero plots.- Sinusoidal steady state from Laplace transform inversion - Frequency response by transform evaluation on jω axis - Frequency response from pole-zero plot by geometrical interpretation

Module III (13 hours)

Two port networks

Two port networks - Characterization in terms of impedances and admittances - Hybrid and transmission parameters - Inter relationships among parameter sets - Reciprocity theorem - Interconnection of two port networks - Series, parallel and cascade – Network functions - Pole zero plots and steady state response from pole - zero plots

Symmetrical two port networks

T and Π Equivalent of a two port network – Image impedance – Characteristic impedance and propagation constant of a symmetrical two port network – Properties of a symmetrical two port network

Symmetrical two port reactive networks as filters

Filter fundamentals - Pass and stop bands-behavior of iterative impedance-Constant-k low pass filter-Constant-k high pass filter- m-derived T and Π sections and their applications for infinite attenuation and filter terminations-band pass and band elimination filters

Module IV (15 hours)

Elementary synthesis operations- LC network synthesis- properties of RC network functions- Foster form of RC networks – properties of RL network functions - Foster form of RL networks- the Cauer form of RC and RL networks

Introduction to network topology

Definition of graph, trees, incidence matrix - Properties of incidence matrix - Cut sets - Fundamental cut sets - Cut set schedule - Tie sets - Fundamental tie sets - Tie set schedule - relationships among incidence matrix, cut set matrix and tie set matrix - Kirchhoff's laws in terms of network topological matrices - Formulation and solution of network equations using topological methods - Loop analysis - Cut set analysis

Text Book

1. Valkenberg, *Network Analysis*, Prentice Hall of India
2. Abhijit Chakrabarthi, Electric Circuit Theory, Dhanpat Rai &Sons

Reference books

1. Desoer C.A. & Kuh E.S., *Basic Circuit Theory*, McGraw Hill
2. Siskind C.S., *Electrical Circuits*, McGraw Hill
3. Ryder J.D., *Networks, Lines & Fields*, Prentice Hall
4. Edminister, *Electric Circuits - Schaum's Outline Series*, McGraw Hill
5. Huelsman L.P., *Basic Circuit Theory*, Prentice Hall of India
6. Balabanian, Network Synthesis , Prentice Hall of India
7. M.A.Pai, Introduction to Electric Circuits & Machines, East West.
8. Nilson, Electric Circuits, Adison Wiley.

Sessional work Assessment

Assignments	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
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 307(P) ELECTRONICS LAB I

3 hours practical per week

1. Study & Use of CRO: a) Measurement of current voltage, frequency and phase shift.
2. Semiconductor diodes: V-I and transfer characteristics of Si, Ge and zener diodes
3. Transistor characteristics in CB and CE configurations - Identification of cut off, active and saturation regions
4. JFET characteristics in the common source configuration- Determination of equivalent circuit parameters
5. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
6. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
7. UJT relaxation oscillator- Design for a particular frequency
8. Rectifiers and filters with and without shunt capacitors- Characteristics of half-wave, full wave and bridge rectifiers- Ripple factor, Rectification efficiency, and % regulation
9. BJT emitter follower- Measurement of voltage gain, current gain, input impedance, output impedance and load characteristics
10. Characteristics of clipping and clamping circuits using diodes and zener diodes
11. Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output

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

EE04 308(P) BASIC ELECTRICAL ENGINEERING LAB

3 hours practical per week

1. Study of PMMC/MI voltmeters/ammeters, dynamometer type wattmeter, clip on ammeter ,analog/digital multimeters and static energy meters

2. a) Determination of voltage-current characteristics of a wire-wound rheostat and (b) an incandescent lamp

3. Methods of measurement for low/high resistance using voltmeter and ammeter

4. Potential divider connection of a rheostat and study of the dependence of output voltage upon the value of the load resistance

5. Verification of Kirchoff's laws in D.C circuit

6. Verification of super position theorem in a D.C circuit

7. Verification of Thevenin's theorem in D.C circuit

8. Verification of Generalised Reciprocity theorem in a D.C circuit

9. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits

10. Determination of fusing time versus current characteristics and fusing factor different specimens of fuse wires

11. Single-phase power measurement using a dynamometer type wattmeter

12. Single-phase power measurement of 3 ammeter method and 3 voltmeter method

13. Three-phase power measurement using one wattmeter and two wattmeters.

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

SYLLABI OF FOURTH SEMESTER

EN04 401A ENGINEERING MATHEMATICS-IV

(Common for all branches except CS and IT)

3 hours lecture and 1 hour tutorial per week

Module I : Functions of a Complex Variable I

Functions of a complex variable – Derivatives and analytic functions – Cauchy-Reimann equations - Laplace equation – Conformal mapping – Exponential function – Trigonometric functions - Hyperbolic functions - Logarithm - Linear fractional transformations

Module II : Functions of a Complex Variable II

Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Cauchy's integral formula – Derivatives of analytic functions (Proof to be omitted) -Taylor series – Laurent series – Singularities and zeros - Residues and residue theorem – Evaluation of real integrals

Module III : Series Solutions of Differential Equations

(i) Power series method for solving ordinary differential equations – Legendre's equation and Legendre polynomials – Rodrigue's formula – Generating functions – Relations between Legendre polynomials – Orthogonality property of Legendre polynomials (proof omitted)

(ii) Frobenius method for solving ordinary differential equations – Bessel's equation – Bessel functions – Generating functions – Relations between Bessel functions – Orthogonality property of Bessel functions (proof omitted).

Module IV : Partial Differential Equations

Basic concepts - Classification of linear PDE's –Derivation of the one-dimensional wave equation and the one-dimensional heat equation – Solutions of these equations by the method of separation of variables – Solutions satisfying initial and boundary conditions – D' Alembert's solution of the one-dimensional wave equation – Steady-state two dimensional heat flow.

TEXT BOOK: Erwin Kreyszig, *Advanced Engineering Mathematics* (8th Edition) John Wiley & Sons.

Module 1
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9

Module 2
Sections: 13.1, 13.2, 13.3, 14.4, 15.1, 15.2, 15.3, 15.4

Module 3
Sections: 4.1, 4.3, 4.4, 4.5

Module 4
Sections: 11.1, 11.2, 11.3, 11.4, 11.5.

REFERENCES

1. C R Wylie & L C Barrett, *Advanced Engineering Mathematics (Sixth Edition),* McGraw Hill.
2. Churchill R V, Brown J W & Verhey R F, *Complex Variables and Applications,* McGraw Hill .
3. Pipes L A & Harvill L R, *Applied Mathematics for Engineers & Physicists,* McGraw Hill
4. Michael D Greenberg, *Advanced Engineering Mathematics* (*Second Edition*) Pearson education Asia.
5. Sastry S S, *Engineering Mathematics – Volumes 1 & 2,* 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 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

EN04 402 ENVIRONMENTAL STUDIES

(Common for all branches)

3 hours lecture & 1 hour tutorial per week

Objective:

The importance of environmental science and environmental studies cannot be disputed. Continuing problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of bio diversity etc have made everyone aware of environment issues. The objective of this course is to create general awareness among the students regarding these environmental issues.

Module I (12 Hours)

The Multidisciplinary nature of environmental studies

Definition - scope and importance-need for public awareness.

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems - forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people. - Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies - Land resources: Land as a resource, land degradation, man induced land slides, soil crosion and desertification - Role of an individual in conversation of natural resources - Equitable use of resources for sustainable lifestyle.

Module II (14 Hours)

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features , structure and function of the following ecosystem:-Forest ecosystem - Grassland ecosystem - Desert ecosystem - Aquatic ecosystem(ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity - Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels - India as a mega-diversity nation – Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wild life, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module III (11 Hours)

Environmental Pollution

Definition - Causes, effects and control measures of:- Air pollution - Water pollution - Soil pollution - Marine pollution-Noise pollution -Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes -Role of an individual in prevention of pollution - Pollution case studies - Disaster management : floods, earthquake, cyclone and landslides - Environmental Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and Control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation - Public Awareness

Module IV (10 Hours) Social Issues and the Environment

From unsustainable to sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people; its problems and concerns,case studies - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies - Wasteland reclamation - Consumerism and waste products

Human Population and the environment

Population growth, variation among nations - Population explosion – Family welfare Programme - Environment and human health – Pollution hazards, Sanitation and health - Human Rights for clean environment - Value Education - HIV/AIDS-social concern - Women and Child Welfare - Role of information Technology in Environment and human health - Case studies

Field Work (5 Hours)

- Visit to a local area to document environmental assets – river/forest/grassland/hill/mountain
- Visit to local polluted site – Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems – pond, river, hill slopes, etc.

Text books:

1.Clark, R.S. Marine Pollution. Clanderson Press Oxford
2.Mhaskar A.K, Matter Hazardous. Techno-science Publications
3.Miller, T.G. Jr. Environmental Science. Wadsworth Publishing Co.
4.Townsend, C., Harper, J. and Michael Begon, Essential of Ecology. Blackwell Science
5.Trivedi. R.K. and Goel . P.K. Introduction to air pollution. Techno – Science Publications

References:

1. Agarval. K.C.2001 Environmental biology. Nidi Publ. Ltd. Bikaner
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email: mapin@icenet.net
3. Brunner, R.C. 1989. Hazardous Waste Incineration. McGraw Hill Inc. 480p
4. Cunningham, W.P., Cooper, T.H., Gorhani, E & Hepworth, M.T. 2001Environmental encyclopedia Jaico publ. House Mumbai 1196p
5. De, A.K. Environmental Chemistry. Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environment
7. Gleick, H.P. 1993. Water in crisis. Pacific Institute for Studies in Dev., Environment and security, Stockholm Env. Institute. Oxford Univ. Press. 473p
8. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay
9. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
10.Jadhav, H. & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi
11. Mckinney, M.L. & School, R.M. 1996. Environmental Science system & Solutions, Web enhanced edition, 639p.
12.Odum, E.P. 1971. Fundamentals of Ecology. W.B.Saunders Co. USA, 574p
13. Rao, M.N. & Datta, A.K 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd., 345p
14.Sharma, B.K. 2001. Environmental Chemistry. Goel Publ. House, Meerut.
15. Survey of the Environment, The Hindu (M)
16.Trivedi, R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol I and II . Enviro Media
17.Wagner.K.D. 1998. Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p
(M) Magazine

Internal assessment:

2 Tests	= 20
Field work and Report (Internal Assessment)	= 25
Regularity	= 5
Total marks	= 50

UniversityExamination Pattern :

Part A: Short answer questions 12 out of 16(4 from each module) - 12x5 = 60 Marks

Q II - 2 questions A and B of 10 marks from module I with choice to answer any one

Q III - 2 questions A and B of 10 marks from module II with choice to answer any one

Q IV - 2 questions A and B of 10 marks from module III with choice to answer any one

Q V - 2 questions A and B of 10 marks from module IV with choice to answer any one

EE04 403 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the basic working principles of electrical measuring instruments.
Measurement of electrical parameters using appropriate instrument.
Design and calibrate an electrical measuring instrument.

Module I (13 hours)

Indicating instruments

Principle - Different types of control and damping arrangements in indicating instruments - Permanent magnet moving coil, moving iron, hot wire, electrostatic and dynamometer type meters - Ammeters and Voltmeters - Errors in indicating instruments - Rectifier type meters - Factors influencing its performance - Extension of instrument range - Shunts for ammeters - Voltmeter multipliers - Instrument transformers - Current transformer - Phasor diagram - Ratio and phase angle error - Use of instrument transformers with wattmeter - Clip on meters - Hall effect clip on meters - Errors

Module II (13 hours)

Wattmeters, energy meters and other measuring instruments

Measurement of energy and power - Dynamometer type wattmeter - Error and Compensation - Principle of working of ampere hour meter - Single and Three phase energy meters - Errors and Compensation - Calibration using wattmeter and rotating substandard - Static watt meters and Energy meters - Principles and block diagram - Tri vector meter - Frequency meters - Power factor meters

Module III (13 hours)

Measurement of resistance

Wheatstone`s bridge – Kelvin`s double bridge - Carry Foster Slide wire bridge - Sensitivity of dc bridges - Interchange of battery and galvanometer - Bridge current limitations - ohmmeter - Meggar - Measurement of insulation resistance by direct deflection method - Earth electrodes - Earth resistance - Earth tester - Localization of cable fault by Murray and Varley loop tests

AC bridges

Measurement of inductance using Maxwell and Anderson bridges - Measurement of capacitance using schering bridge

Module IV (13 hours)

Potentiometers

General principle - Modern form of dc potentiometers - Vernier dial principle - Standardization - ac potentiometers - Coordinate and polar types - Application of dc and ac potentiometers

Magnetic measurements

Classification of magnetic measurements - Measurement of flux and permeability - Hibbert's magnetic standard - Fluxmeter - Hall Effect Gaussmeter - Ballistic galvanometer - BH curve and permeability - Measurement of bar and ring specimen - Hysteresis measurement - Core loss and measurement with Lloyd - Fisher square

Text books

1. Sawhney A.K., *A course in Electrical & Electronic Measurements & Instrumentation*, Dhanpat Rai.
2. Golding E.W., *Electrical Measurements & Measuring Instruments*, Wheeler Pub

References

1. Cooper W.D., *Modern Electronics Instrumentation*, Prentice Hall of India
2. Stout M.B., *Basic Electrical Measurements*, Prentice Hall
3. Harris F.K., *Electrical Measurement*, John Wiley
4. Oliver & Cage, *Electronic Measurements & Instrumentation*, McGraw Hill
5. Baldwin C.T., *Fundamentals of Electrical Measurement*, Lyall Book Depo

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
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 on

EE04 404 ELECTRONICS II

3 hours lecture and 1 hour tutorial per week

Objective:

Analysis of closed loop complex electronics circuits.
Understanding the fundamental topology related to Integrated Circuits.
Synthesize a signal processing environment involving ICs.

Module 1: Concepts of Feed back (13 hours)

Basics – negative and positive feed back – loop gain – types of feed back – analysis of the advantages of negative feed back and positive feed back – analysis of voltage series, voltage shunt, current series, current shunt, feed back circuits of BJT's
Oscillators basics bark hausen's criterion – phase shift oscillators- wein bridge oscillators – crystal oscillators- Stability - Advantages.

Module II: Linear Op amp Circuits (13 hours)

Operational amplifier - Ideal opamp properties - Properties of practical opamps - Different stages in an opamp - Internally compensated and externally compensated opamps - Slew rate - Offsets - Analysis of opamp circuits using ideal opamp model - Concept of virtual short and its relation to negative feedback - Non inverting amplifier - Gain bandwidth product - Voltage follower - Inverting amplifier - Summing amplifier - Subtracting circuits - Instrumentation amplifier - Voltage to current converter for floating and grounded loads - Opamp integrator - Opamp differentiator - Series voltage regulators - Monolithic regulators - Three terminal regulators - Regenerative comparator circuits using opamps - Comparator IC LM311 and its applications - Square, triangle and ramp generator circuits using opamps and comparator ICs - Effect of slew rate on waveform generation - Principles of VCO circuits.

Module III: Nonlinear IC Applications (13 hours)

Opamp based astable and monostable circuits - Precision half wave and full wave rectification using opamps - Log and anti-log amplifiers and applications - Analog multiplier based on log/antilog amplifiers.- Phase locked loops – Principles - Lock and Capture ranges - Capture process - Loop filter - PLL dynamics under locked condition - Study of NE565 - Applications of PLL in signal reconstruction - Noise rejection - Frequency multiplication - Frequency synthesis - FSK demodulation - FM demodulation - Line synchronization etc. Timer - 555 applications - Active filtering - Butterworth lowpass filter functions - Lowpass filter specifications - Order and cut off frequency of Butterworth function from lowpass specifications - Sallen and Key second order LP section - gain adjustment in Butterworth LP filters - Butterworth high pass filters - Second order wide band and narrow band bandpass filters.

Module IV: Signal conditioning and signal conversion (13 hours)

Analog switches - Sample and hold amplifier - Data conversion fundamentals - D/A conversion - Weighed resistor DAC - R/2R ladder DAC - Current switching DAC - Multiplying DAC - Bipolar DACs - A/D conversion - Quantiser characteristics - Single slope and dual slope ADCs - Counter ramp ADC - Tracking ADC - Successive approximation ADC - Simultaneous ADC.
Linear wave shaping - high pass and low pass by R&C – Steady State Responses to step, pulse, ramp and square wave inputs.

Text Book:

1. Millman J., *Microelectronics*, McGraw Hill
2. Gayakwad R.A., *OPAMPS & Linear Integrated Circuits*, Prentice Hall of India

Reference books

1. Schilling & Belove, *Electronic Circuits*, McGraw Hill
2. Sedra & Smith, *Microelectronic Circuits*, Oxford University Press
3. Jaeger R.C., *Microelectronic Circuit Design*, McGraw Hill
4. Anvekar D.K. & Sonde B.S., *Electronic Data Converters*, Tata McGraw Hill
5. Clayton G.B., *Operational Amplifiers*, ELBS
6. Frederiksen T.M., *Intuitive Operational Amplifiers*, McGraw Hill
7. Millman & Taub., Pulse Digital and switching waveforms
8. Robert F Coughlin, Operational Amplifiers and Linear Integrated Circuits

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
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 405 ELECTRICAL MACHINES I

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the basic working principle of electrical machines.
Analyzing the performance of electrical machines.
Conducting performance analysis of a given electrical machine.

Module I (12 hours)

Electromagnetic Machines: Fundamental principles - Classification - Generators, motors and transformers - Elements of electromagnetic machines -
DC Machines: Construction - Principle of operation - Magnetic circuit - Flux distribution curve in the air-gap -Armature windings - Lap and Wave Windings - Dummy coils Equalizer connections - Armature reaction - Demagnetising and cross magnetising ampere turns - Commutation - Methods to improve commutation performance

Module II (10 hours)

DC Generators: Working principle - EMF Equation - Types of Excitation - Power flow diagram - Circuit model - Magnetisation characteristics - Process of voltage build up - Terminal characteristics - Control of terminal voltage - Parallel operation - Applications

Module III (14 hours)
DC Motors: Working principle - Back EMF - Torque and speed equations - Power flow diagram - Circuit model - - Performance characteristics – Applications - Starting methods - Design of starters - Methods of speed control -Solid state speed controllers (Block Diagram) Testing - Swinburne's test - Hopkinson's test - Separation of losses - Retardation test - Permanent magnet DC motor

Module IV (16 hours)
Transformers: Types and construction - Principle of operation - Magnetising current – Harmonics - Ideal and real transformer - Dot convention - Current and voltage ratio - Equivalent circuit - Phasor diagram - Per unit impedance - OC and SC test Losses - efficiency and regulation - All day efficiency - Sumpner's test - Parallel operation - Tap changing - Switching transients - Auto transformers - Voltage and current relationships - Saving of copper - Different connections of three phase transformers - Notations - Scott connection - Cooling methods - Three winding transformer.

Text Books

1.Clayton & Hancock, *Performance & Design Of DC Machines*, ELBS
2.Dr.P.S.Bhimbra, Electrical Machinery, Khanna Publishers
3.Dr.K.Murukesh Kumar , DC Machines & Transformers, Vikas Publishing House Pvt Ltd.

Reference books

Langsdorf A. S., *Theory of DC Machinery*, McGraw Hill
Nagarath I. J. & Kothari. D. P., *Electric Machines*, Tata McGraw Hill
Fitzgerald,Charles Kingsley, Stephen Dumas, Electrical Machinery, Tata McGraw Hill
Chapman S.J., *Electric Machine Fundamentals*, McGraw Hill.
Toro V.D., *Electrical Machines & Power Systems*, Prentice Hall.
J.B.Gupta, Theory and Perfomance of Electrical Machines, S.Kataria and Sons.
Charles Hubert, Electric Machines., Pearson Education.

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
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 406 LINEAR SYSTEMS ANALYSIS

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the concepts of electro-mechanical systems.
Studying the various methods of analysis of linear systems.
Modeling and analysis of systems for various topologies.

Module I: System concepts and modelling of systems (11 hours)

Systems – Subsystems - Elements - Systems approach - Classification of systems - Static and dynamic systems - Linear and Nonlinear Systems - Distributed and lumped systems - Time invariant and time varying systems - Stochastic and deterministic systems - System modeling and approximations - Superposition principle - Homogeneity and additivity - Modelling of electrical systems - Active and Passive elements - Resistance inductance and capacitance - dynamic equations using Kirchhoff's current and voltage laws. RL, RC and RLC circuits and their dynamic equations - Block diagrams and signal flow graphs - Masons gain formula

Module II: Modelling of non-electrical systems (11 hours)

Modelling of translational and rotational mechanical systems - Differential equations for mass spring dashpot elements, D'Alembert's principle - Rotational Inertia - Stiffness and bearing friction - Gear trains - Equivalent inertia and Friction referred to primary and secondary shafts - Dynamic equations for typical mechanical systems - Electromechanical Analogues - Force-current and force-voltage analogue - Capacitance and Resistance of thermal, hydraulic pneumatic systems - Dynamic equations for simple systems - Comparison of electrical, electromechanical, hydraulic and pneumatic systems

Module III (16 hours)

Fourier series

Fourier series representation of non-sinusoidal periodic waveforms – Fourier coefficients -Determination of coefficients - Waveform symmetry - Exponential Fourier Series - Discrete amplitude and phase spectra - Steady state solution of circuits with non-sinusoidal periodic inputs by Fourier Series - Harmonics in three phase sources - Harmonic currents in star and delta connected non-linear loads - Triplen harmonics in three phase voltages and currents

Fourier transforms

Fourier representation of aperiodic signals - Fourier transform and inverse transform - Transform pairs - Properties of Fourier transforms - Continuous amplitude and phase spectra - Frequency response function - Impulse response and its Fourier transform – Relation € between Laplace transforms and Fourier transforms - Power spectral density - Energy spectral density - Parseval's theorem - Signal transmission systems - Signal distortion - Bandwidth requirement for signal transmission

Module IV: Transfer function and time domain analysis (12 hours)

Review of Laplace transforms - Impulse response - Convolution theorem and integral - Response to arbitrary inputs - Transfer function of typical systems discussed in Module I - Time domain analysis - Test Inputs - Step - velocity and ramp inputs - Transient and steady state response - First and second order - under damped and over damped responses - Maximum Overshoot - settling time - Rise time and time constant - Higher order systems - Steady state error - Error constants and error different types of inputs

Books

1. Cheng D.K. Addison Wesley, *Linear Systems Analysis*, Addison Wesley
2. Tripati J.N., *Linear Systems Analysis*, New Age International
3. Nilson, Electric Circuits, Adison Wiley.
4. Umesh Sinha, Electric Circuit Theory, Network Analysis & Synthesis, Sathya Prakash

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
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 407(P) MECHANICAL ENGINEERING LAB

3 hours per week

1. Fluid mechanics lab – calibration of flow meters – venturi meter, nuzzle meter, orifice meter, notches – pipe friction – metacentric height
2. Hydraulic machinery lab – characteristics of turbines and pumps – Pelton, Francis turbines – centrifugal, reciprocating, gear pumps, hydrams
3. Heat engines lab: constant speed characteristics of IC engines- SI engines, CI engines – air compressors, determination of viscosity, heat exchangers

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

EE04 408(P) ELECTRICAL MEASUREMENTS LAB

3 hours per week

(Any TWELVE Experiments is to be done)

1. Determination of B-H curve of an iron ring specimen
2. Calibration of magnetic flux meter using standard solenoid and search coil and Hibbertz's magnetic standard
3. Measurement of resistance using Wheat stone's bridge and Kelvin's double bridge
4. Measurement of self/mutual inductance and coupling coefficient of iron cored coil and air cored coil
5. Calibration of dynamometer type wattmeter, using precision type vernier potentiometer
6. Extension of range of ammeter/voltmeter and calibration of the extended meters using standard ammeter/voltmeter
7. Extension of range of a dynamometer type wattmeter using CT/PT and calibration of the extended meter using a standard wattmeter
8. Calibration of single-phase energy meter by direct loading and phantom loading at various power factors
9. Calibration of 3 phase energy meter using standard wattmeter
10. Measurement of capacitance using Schering bridge
11. Determination of hysteresis loop of an iron ring specimen using 6 point method and CRO
12. Measurement of branch voltages in a series RLC circuit using A.C potentiometer
13. Calibration of static Energy Meter.(Single Phase & Three phase)
14. Murray-Varley loop test - Cable fault location

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

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 Sceley 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 – equlization – 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, Poyinting vector and Poyintings 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 & Hiziroglu -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.

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 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

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

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
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 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.

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 506: ELECTRICAL ENGINEERING MATERIAL SCIENCE

3 hours lecture and 1 hour tutorial per week

Objective:

Study of the properties of various materials used in electical 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
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 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 Torq ue

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 D C 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 test
Objectives
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

UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

SIXTH SEMESTER

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL & ELECTRONICS ENGG.

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL ENGINEERING

SIXTH SEMESTER

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 601	Engineering economics and Principles of Management	3	1	-	50	3	100
EE04 602	Microprocessors and Microcontrollers	3	1	-	50	3	100
EE04 603	Control Systems I	3	1	-	50	3	100
EE04 604	Power Systems II	3	1	-	50	3	100
EE04 605	Electrical Machine design	3	1	-	50	3	100
EE04 606	Electrical Engineering Drawing	1	-	3	50	3	100
EE04 607(P)	Electrical Machines Lab II	-	-	3	50	3	100
EE04 608(P)	Mini Project	-	-	3	50	3	-
	TOTAL	**16**	**5**	**9**	**400**		**700**

SIXTH SEMESTER

EC04 601: ENGINEERING ECONOMICS & PRINCIPLES OF MANAGEMENT

(Common with AI 04 601,BM 04 601,EC 04 601,CE 04 601)

3 hours lecture and 1 hour tutorial per week

PART A: ENGINEERING ECONOMICS

Objective: To create general awaremness on the basic principles of Economics with special reference to India.

Module I (13 Hours)

1. Introductory Background – Nature and scope of Economics, Science, Engineering and Technology, their relationship with economic development.
2. Basic Economic Concepts – Wants and utility, Demand and supply, Elasticity of demand and supply, concept of cost and revenue, concept of equilibrium and margin, wealth and capital.
3. Money and Banking – Functions of money – Functions of banks – Commercial and Central Banks. Monetary policy of the Reserve Bank of India.

Module II (13 Hours)

4. Industrialisation and Economic Planning in India – Need for industrialization, Development of Indian Industry since independence, Role of public sector in India, Industrial Policy of the Government of India. A brief study of Five Year Plans of India.
5. Agriculture – Role of Agriculture in Indian Economy – Problems of Indian Agriculture – Green Revolution in Indian Features and effects.
6. Foreign exchange and International Trade – Determination of rate of exchange – Balance of payments and Trade – India's Foreign Trade Policy – A short note on International Monetary Fund (I.M.F.).

PART B: PRINCIPLES OF MANAGEMENT

Objective: An elementary level exposure of management principles relevant for industrial sector.

Module III (13 hours)

Need for management – principles of management – management functions – span of control – delegation – directing – leadership and motivation (basic concepts only)

Theories of scientific management (an overview only expected) - Fredric Taylor's theory – Frank Gilbreth's theory – Henry Foyal's theory – present concepts of management.

Financial management – objectives and functions – time value of money (numerical examples included) – basics of financial accounting (problem solving not required) – profit and loss account – balance sheet (only introduction) – sources of industrial finance – shares – debentures – public deposits – bank loans – financial institutions.

Module IV (13 hours)

Marketing management –concept of market and marketing – marketing mix – market research – advertising and sales promotion.

Scope and objective of Human Resource Management – manpower recruitment analysis – recruitment and training – job analysis – job evaluation – wages and incentives.

Decision making – Introduction and definition – techniques of decision making – decision making process – under certainty, uncertainty and risk (problems not included).

Network analysis – CPM and PERT (analysis of simple networks).

Text Books

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. O. P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, Delhi, 2003.
3. P. Kotler, *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall, New Jersey, 2001
4. Venkata Ratnam C.S & Srivastva B.K, *Personnel Management and Human Resources*, Tata McGraw Hill.
5. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
6. K.K.Dewett, Modern Economic Theory
7. Ishwar.C.Dhingra, The Indian Economy (Resources Planning development and Problem)

Reference Books

1. Koontz H, O'Donnel C & Weihrich H, Essentials of Management, McGraw Hill.
2. Satya Raju R & Parthasarathy A, Management: Text & Cases, Prentice Hall.
3. Ramaswamy V.S & Namakumari S, Marketing Management *:* Planning, Implementation and Control,

Internal assessment:

Assignments		=	**15 Marks**
Economics:Assignments should help students to appreciate necessity of economics in Engineering Management:Individual documentation of best management practices by various organizations			
2 Tests	2x15	=	30 Marks
Regularity		=	5
Total		=	50 Marks

University examination Pattern:

(Part A and Part B should be written on separate answer books)

Part A

Q I - 4 short type questions of 5 marks each , 2 from module I and II
Q II - 2 questions A and B of 15 marks each , 2 from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks each , 2 from module II with choice to answer any one

Part B

Q I - 4 short type questions of 5 marks each , 2 from module III and IV
Q II - 2 questions A and B of 15 marks each , 2 from module III with choice to answer any one
Q III - 2 questions A and B of 15 marks each , 2 from module IV with choice to answer any one

EE04 602: MICROPROCESSORS AND MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the architecture and programming of different microprocessors.
Interfacing the microprocessor with the peripherals for a specific application
Understanding the architecture, programming and interfacing of basic microcontrollers.

Module 1 (14 hours)
Architecture of Intel 8086/8088 processors – Memory Segmentation – Addressing nodes – Introduction set – Assembly language programming – Assembler directives – Basic concepts of modular programming – minimum node configuration of 8086 – Interrupt system of 8086 – maximum node – Queue station and lock facility – Multi processor Configuration – Co Processor – loosely coupled and closely coupled configurations – 8087 numeric data processor - 8089 Input Output Processor

Module 2 (Hours 12)
Interfacing – Programmable Peripheral Interface (8255) – Serial communication – Programmable communication interface(8251) – Programmable timer (8253) – DMA controller (8257) – Interrupt controller (8259) – key board and display interface (8279) – Data acquisition system – interfacing of A/D and D/A converters.

Module 3 (Hours 12)
Advancements in microprocessor Architecture – 80386 processor Architecture – real addressing mode – protected virtual addressing mode – 80286 Bus Interface – Instruction set - features – Introduction to Pentium processors – Special features – (Basic Concepts only) – hyper threading Technology.

Module 4 (Hours 14)
Micro controllers – overview of 8051 Microprocessor – Architecture – Basic Assembly language Programming concepts – Arithmetic and Logic Operators – Jump and CALL instructions – interfacing memory to 8051 – 8051 micro controller design – Application

Text Books

1. Lio Y C & Gibson.C.A Micro computer Systems – 8086/8088 family
2. Gaonker R.S Micro Processor Architecture – Programming and Application
3. Brey B.B The Intel Microprocessor system – Architecture, Programming and interfacing
4. Ayaila K.J, The 8051, Micro controller – Architecture – Programming and Application

Reference Books

1. Hall DV Microprocessor & Interfacing
2. Ray A.K & Bhun chandi K.W. Advanced microprocessor and peripherals
3. Avter System – Microprocessor and Application
4. Mohammed Ali Ma and Janva Githspie

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
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 603: CONTROL SYSTEMS I

3 hours lecture and 1 hour tutorial per week

Objective:

Representation of a classical control system problem in state space.
Analysis of a generalized control system problem in time domain and frequency domain.
Design of a controller for a particular application.

Module I: State space analysis and stability of systems (14 hours)

Concept of state – Definition and explanation of the terms State, state variables, State vector and State space – comparison with transfer function approach - State equations for typical electrical and mechanical and electromechanical systems - Representation for linear time varying and time invariant systems
Solution of state equation for typical test inputs - Zero state and zero input response –State transition matrix –Properties –Transfer function from state model- Transfer function decomposition for different state models- State diagrams
Concept of stability - Bounded input bounded output stability.

Module 2: System models – Discrete time (12 hours)

Sample data control systems – sampling process – Mathematical analysis of the sampling process – Data reconstruction and hold circuits – Zero and first order hold – z-transform – Inverse z-transform – Solution of difference equations – Pulse transfer function – System time response - Discrete time state equations– z-transform decomposition – Discrete time state models. Stability in the z-plane – Bilinear transformation and the w-plane - Routh's stability criterion for discrete data systems – Jury's stability test.

Module 3: Time and frequency domain analysis (12 Hours)

Root locus method – Construction of root locus – Effect of poles and zeros and their locations on the root locus – Extension to discrete data systems.
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 – Nichol's chart.
Extension of frequency response methods to discrete-data systems.

Module 4: Design using conventional methods (12 Hours)

Cascade compensation – PI, PD and PID control – Lead, lag and lag-lead compensation using RC networks – Design of lead, lag and lead-lag compensators using Frequency response and root locus methods – Design of discrete-data systems using frequency response and root locus methods – Effect of sampling period on time response. Introduction to CS Tool box in MATLAB.

Text Books

1. K. Ogata : Modern control engineering, Prentice Hall
2. K. Ogata : Discrete-time control systems, Prentice Hall
3. Kuo : Automatic control systems, Prentice Hal
4. Kuo : Analysis and synthesis of sampled data systems,

References:

1. Nagarath and Gopal : Control system engineering, Wiley Eastern, Prentice Hall
2. Sushil Das Gupta : Control System , Khanna Publishers
3.Gibson and Tutter : Control system components, Mc Graw Hall

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
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 604: POWER SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Objective:

Development of a power system model.
Analyzing the power system model under normal and abnormal conditions.

Module 1(12 Hours)
Representation of power systems – one line diagrams , impedance and reactance diagrams ,per unit and percent quantities , primitive networks , y-bus matrix formulation by singular transformation and Direct determination , z-bus matrices – Building algorithm.

Load flow studies : problem formulation ,classification of buses , Gauss –Siedal method, Newton - Raphson method and fast decoupled load flow method.

Module 2 (14 Hours)
Economic load dispatch : system constraints , economic dispatch of thermal plants neglecting line losses , optimum load dispatch including transmission line losses , exact transmission loss formula , automatic load dispatching .
Speed governing mechanism : speed governing of turbo generator , load sharing and governor characteristics , transfer function model , load frequency Control ,Automatic voltage regulation

Module 3 (12 Hours)
Short circuit studies : Faults on power systems , three phase to ground faults, SLG , DLG , LL faults, Sequence impedance and sequence networks ., symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator , Faults on power systems ,fault analysis using z-bus , faults through impedance , short circuit capacity of a bus and circuit breaker rating .

Module 4(14 Hours)
Power system stability studies : steady state , dynamic and transient stability , electrical stiffness, Swing equation, inertia constant , equal area criterion, Step by step method of solution of swing equation , factors affecting stability.
Voltage stability problem , causes and improvement methods
.

Text books
1. Stevenson Jr : Elements of power system analysis: Tata Mc Graw Hill.
2. J.Nagrath & D.P.Kothari: Modern Power systwem analysis: Tata Mc Graw Hill.

References

1.O.I. Elgard : Electric energy system theory- an introduction : Tata Mc Graw Hill.
2. B.F.Wollenberg: Power System Engineering
3. B .R.Gupta :Power system analysis and design: Wheeler Publishing & Co.NewDelhi.

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
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 605 : ELECTRICAL MACHINE DESIGN

3 hours lecture and 1 hour tutorial per week

Objective:

Design of electrical machines and transformers for the given specifications.

Module I (14 Hours)

DC Machines: Output equation - Main dimensions - Choice of specific electric and magnetic loadings - Choice of speed and number of poles – Design of armature conductors, slots and winding - Design of air-gap, field system, commutator, interpoles, compensating winding and brushes - Carter's coefficient - Real and apparent flux density – Design examples.

Module II (14 Hours)

Transformers: Single phase and three phase power transformers - Output equation - Main dimensions - Choice of specific electric and magnetic loadings- Design of core, LV winding, HV winding, tank and cooling tubes - Prediction of no load current, forces on winding during short circuit, leakage reactance and equivalent circuit based on design data – Design examples - Design principles of current transformers - Temperature rise calculations -Continuous and intermittent rating.

Module III (12 Hours)
Alternators: Salient pole and Turbo alternators - Output equation - Main dimensions - Choice of specific electric and magnetic loadings - Choice of speed and number of poles – Design of armature conductors, slots and winding - Design of air-gap, field system and damper winding – Prediction of open circuit characteristics and regulation of the alternator based on design data-Design examples.

Module IV (12 Hours)
Induction Machines: Output equation - Main dimensions - Choice of specific electric and magnetic loadings – Design of Stator and rotor windings, Stator and rotor slots and air-gap of slip ring and squirrel cage motors - Calculation of rotor bar and end ring currents in cage rotor- Calculation of equivalent circuit parameters and prediction of magnetising current based on design data - Design examples.

Text Book

Sawhney A.K : Electrical Machine Design, Dhanpath Rai &Sons

Reference Books

1. Clayton and Hancock : Performance and design of dc machines, ELBS.
2. Say M.G. : Performance and design of AC machines, Pitman, ELBS.
3. Bhattacharya ,. Electrical Machine Design,

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 606: ELECTRICAL ENGINEERING DRAWING

1 hour lecture and 3 hours drawing per week

Objective:

1. **To make the students to be able to plan and draw different views of electrical machines and transformers**
2. **To make the students to draw different types of windings used in electrical machines.**
3. **Introduction to auto cad in electrical engineering drawing**

Module I (10 Hours)

DC Windings

Simplex lap and wave dc armature windings.

AC Windings

Mush and concentric type single layer three phase ac armature windings.
Simplex lap and wave, integral and fractional slot, double layer three phase ac armature windings.

Introduction to AUTOCAD- Developed winding diagrams(Auto Cad not included for Examination)

Module II (14 Hours)

Transformers:

1.Sectional plan and elevation of a transformer limb with windings.
2.Sectional plan and elevation of the core assembly of a power transformer .
3.Sectional plan and elevation of a distribution transformer tank with its accessories .
4. Sketches of capacitor and oil filled type transformer bushings.
5.Layout and single line diagram of a distribution transformer.

Substation Layouts:

1.Layouts and single line diagrams of outdoor and indoor substations .
2.Layout of a 220KV substation.
3.Layout of a captive power substation.
4.Single line diagram of a distribution centre.

Module III (12 Hours)

DC Machines:

1.Sectional front and side elevation of armature with commutator of a dc machine.
2.Sectional front and side elevation of the yoke and pole assembly with field winding of a dc machine.
3.Sectional front and side elevation of an assembled dc Machine.

Module IV(16 hours)

Alternators:

1.Sectional front and side elevation of a water wheel rotor assembly with winding.
2.Sectional front and side elevation of a salient pole alternator.
3.Sectional front and side elevation of a Turbo alternator
4.Sketches of the methods of pole fixing and slot details of Turbo and Water wheel alternators**.**

Induction motors:

1. Sectional front and side elevation of a slip ring induction motor.
2. Sectional front and side elevation of a squirrel cage induction motor.

Text Book

1.Narang K.L.: A Text Book of Electrical Engineering Drawing, Tech India Publications
2. C.R.Dargan ,Electrical Drawing and Estimation ,New Asian Publishers

Reference Books

1. Bhattacharya S.K. :Electrical Engineering Drawing, Wiley Eastern.
2. Clayton and Hancock : Performance and design of dc machines, ELBS.
3. Sawhney: Electrical Machine Design, Dhanpath Rai &Sons.
4. Say M.G. : Performance and design of AC machines, Pitman, ELBS.

Sessional work assessment

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

University examination pattern

Q I - 2 questions A and B of 25 marks from module I with choice to answer any one.

Q II - 2 questions A and B of 25 marks from module II with choice to answer any one.

Q III - 1 question of 50 marks from module III or module IV .(No choice)

EE04 607(P): ELECTRICAL MACHINES LABORATORY – II

3 Hours Laboratory per Week

Objectives

Conduct various tests on different ac machines and study the performance characteristics.

1. No load and Blocked rotor tests on a 3 Ø squirrel cage Induction motors and slip ring Induction motors.
    1. Conduct no load blocked rotor tests on both types of M/C s.
    2. Determine the equivalent circuit parameters and draw the equivalent circuit.
    3. Draw the circle diagram and there from predetermine the performance characteristics.

2. Load tests on 3 Ø squirrel cage and slip ring Induction motors.
    1. Conduct the brake test on both types of machines.
    2. Obtain and plot the various performance characteristics.
    3. Find the KVAR required to improve the power factor to 0.95 at various loads.

3. Performance of Induction machine as a generator and motor.
    1. To operate the given 3 Ø Induction machine coupled with a DC machine as
        a) An Induction motor
        b) An Induction generator working in supply mains.

    2. To conduct load test in both generating and motoring modes and plot the following characteristics on the same graph – efficiency, line current, power factor and slip as a function of output power.

    3. Plot output vs slip and obtain hysteresis, power and corresponding torque.

4. Pole changing as a method of speed control and load test on pole changing induction motor .
    1. To study the different modes of operation of a 3 Ø pole changing Induction motor.
    2. Perform load test and obtain the performance characteristics and compare the results obtained for different pole combinations at different load condition.

5. Speed control of 3 Ø Induction motor by variable frequency method..
    1. Plot speed vs frequency characteristics of a 3 Ø cage Induction motor under variable frequency method of speed control, under no load and constant load conditions.
    2.Plot the different load and load conditions parameters.

6. Alternator
    1.Slip test on Salient pole alternator.

    Objectives

1.Conduct the slip test on 3 Ø salient pole alternator to obtain direct axis and quadrature axis reactance.
2.Predetermine the regulation at different loads and power factors and to derive the power vs torque angle diagram

7. V curves of a 3 Ø synchronous machine.

    Objectives

    1.Synchronise a 3 phase alternator to the supply mains using Dark or Bright lamp method.
    2.Plot the V curves and inverted V curves as a generator and motor under no load condition

8. Voltage regulation of a 3 alternator
9.Single Phase Induction Motor

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

EE04 608 (P) : MINI PROJECT

3 hours per week per week

Objective:

The mini project is aimed at improving the professional competency of the students, touching those areas which otherwise are not covered in the normal course. The work practice here will help student to develop the ability to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research

The project work can be modeling /design project, experimental project or computer simulation project in the topics of electrical and electronics engineering interest. It can be allotted as a group project with group consisting of three to five students.

The assessment of all the mini projects should be done at the end of the semester by a committee consisting of three or four faculty members specialized in the various fields of Electrical Engineering. The students shall present their project work before the committee for about 20 to 30 minutes duration. The complete project report is to be submitted to the department through the guide at the end of the sixth semester. The committee will fix the group average marks for the various projects. The project guides will award the marks for the individual students in a project group maintaining the group average. The Head of the Department will certify the copies and shall retain one copy in the Department.

Sessional work assessment	
Design & development	= 20
Testing and installation	= 15
Regularity	= 05
Report	= 10
Total marks	= 50

UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

SEVENTH SEMESTER

OF
BACHELOR OF TECHNOLOGY
IN
ELECTRICAL & ELECTRONICS ENGG.

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL ENGINEERING

SEVENTH SEMESTER

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 701	Power Electronics	3	1	-	50	3	100
EE04 702	Digital Signal Processing	3	1	-	50	3	100
EE04 703	Control Systems II	3	1	-	50	3	100
EE04 704	Power Systems III	3	1	-	50	3	100
EE04 705	Elective I	3	1	-	50	3	100
EE04 706	Advanced Electrical Engineering Lab	-	-	3	50	3	100
EE04 707(P)	Seminar	-	-	3	50	3	-
EE04 708(P)	Project	-	-	4	50	3	-
	TOTAL	**15**	**5**	**10**	**400**		**600**

Elective I

EE04 705(A)	Software Engineering
EE04 705(B)	Numerical Analysis & Optimization Technique
EE04 705(C)	High Voltage Engineering
EE04 705(D)	Digital System Design
EE04 705(E)	Advanced Microprocessors & Microcontrollers
EE04 705(F)	Electrical Machine Modelling & Analysis

SEVENTH SEMESTER

EE 04 701: POWER ELECTRONICS

3 hours lecture and 1 hour tutorial per week

Objective:

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

Module-I (14 hours)

Silicon Controlled Rectifier-structure- V-I Characteristics- Two transistor analogy- turn-on Characteristics-gate – gate triggering circuits-turn on characteristics- turn-off characteristics-methods of turning off-device specifications and ratings-series and parallel connection of SCRs-structure and characteristics of GTO thyristors, power diodes, power transistors, power MOSFET and IGBT-working of TRIAC

Module-II (13 hours)

Phase control using SCR-single phase half wave and half controlled converters with R and RL loads- single phase 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.

Module III (13 hours)

Choppers-step down chopper-principle operation-classes of chopper-Jone's chopper and Morgan's chopper-voltage commutated and current commutated choppers- step up chopper-single phase to single phase cycloconverters- principle of operation-single phase ac regulator-R and RL loads.

Module-IV (13 hours)

Switching regulators-buck regulators-boost regulators- buck- boost regulators-cuk regulators- switched mode power supply-principle of operation and analysis- comparison with linear power supply-basic circuit operation-different configurations characteristics and applications

Text Book

1. H. Rashid : Power Electronics , 3rd edition Pearsons Educations
2. Ashfaq Ahmed : Power Electronics for Technology, Pearson Education

References

1. Singh MD & Khandhandani KB: Power Electronics, Mc Graw Hill
2. Dubey.G.K. Thyristorised Power Controllers,
3. Bimbhra: Power Electronics,
4. Ned Mohan et-al : Power Electronics , John Wiley
5. P C Sen : Power electronics , Mc Graw Hill

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

EE 04 702: DIGITAL SIGNAL PROCESSING

3 hours lecture and 1 hour tutorial per week

Objective:

Understand the concepts of signals and systems.
Studying the various methods for the analysis of digital systems.
Design a digital filter for the given specifications.

Module-1 (12 hours)

Introduction to signals and systems- classification of signals- basic operations on signals-elementary signals-concept of systems-properties of systems- stability invert ability-time invariance—linearity-causality-time domain description- convolution-impulse response-representation of Linear Time Invariant systems-differential equation and difference equation representation of LTI systems.

Module II (15 hours)

Fourier transform-existence of fourier integral-FT theorems-energy spectral density and power spectral density-frequency response of LTI systems- correlation theory of deterministic signals. Properties of DFT-linear convolution using DFT-Circular convolution -overlap-add method-overlap save method- FFT-decimation in time and frequency algorithms-Butterfly structure.

Module III (12 hours)
Basic filter structure direct form I&II- lattice-ladder structure- parameler quantization effects-
DSP chips- Architecture of DSP Processor-TMS-320 Applications.

Module IV (15 hours)
Digital filer design techniques-design of IIR filler from analog filter-Butterworth and chebyshev filler-design examples-Impulse invariant and bilinear transformation methods- FIR filler design-design of FIR filter using windows- comparison of FIR&IIR filters- finite word length effects in digital filter.

Text books

1. Oppenheim A.V willsky A.S & Nawah S.H. signals and systems, Tatta Mc Graw Hill.
2. Oppenheim A. V& Sehafex R.W-Discrete time signal processing prentice Hall of India
3. Dr. D. Ganash Rao & Satish Tunga-Signals &Systems- A computer based approach - Sangure Technical Publishers Bangolore.

Reference books

1 Proakins J.G. & Manolakins D.G.:Digital signal processing- principles
Algorithms- Applications Prentice Hall of India.
2 Rabiner L.R, Gold B, Theory and Applications of Digital signal processing,
Prentice Hall of India
3 Mitva S.K-Digital signal processing-A Computer Based approach-Tata McGraw Hill

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

EE 04 703: CONTROL SYSTEMS II

3 hours lecture and 1 hour tutorial per week

Objective:

Analysis of non-linear systems using various methods.
Concept of optimal control problem and its solution.
Closed-loop control of non-linear systems.

Module:1 Non-linear systems (12 hours)
Characteristics of non-linear systems – Types of nonlinearities – Phase plane analysis – Construction – Singular points – Classification of singular points.
Describing function analysis – Definition – Describing functions of common non- linearities – Stability analysis – Amplitude and frequency of limit cycle using DF.

Module: 2 Liapunov methods (10hours)
Liapunov stability – Definition of stability, Asymptotic stability and instability – Liapunov second method – Liapunov stability analysis of LTIV continuous time and discrete time systems,methods of construction of Liapunov function for non linear sytems ,Popov's criterion, variable gradient method

Module: 3 Controllability, Observability and optimal control (16 hours)
Concept and criteria for controllability and observability – Transfer function and controllability/ observability – State feed back – Design- for continuous and discrete systems- via pole-placement, state feedback with integral control, state observers.
Introduction to optimal control –transfer function and state variable approaches, state regulator problem, infinite time regulator problem, quadratic regulator problem - Solution of the reduced matrix Riccati equation.

Module: 4 Robust Control and Robotics (14 hours)
Robust control systems- introduction- sensitivity-analysis of Robustness- system with uncertain parameters-design of Robust PID controlled systems.
Introduction to Robotics- The direct Kinematics problem- The inverse Kinematics solution.

Text Book

1. K. Ogata : Modern control engineering, Prentice Hall
2. Nagarath and Gopal : Control system engineering, Wiley Eastern
3. B. C. Kuo : Automatic control systems, Prentice Hall
4. K. Ogata : Discrete-time control systems, Prentice Hall
5. Donald E. Kirk : Optimal control theory, Prentice Hall
6. K.S.Fu, R.C.Gonzalez, C.S.G.Lee : Robotics, Control, Sensing & Intelligence, McGrawhill

References

1. Richard .c. Dorf and R.H. Bishop : Modern control system, Addison Wesly
2. M.N.Bandyopadhyay : Control Engineering Theory and Practice, Prentice Hall

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
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 704: POWER SYSTEMS III

3 hours lecture and 1 hour tutorial per week

Objective:

Studying the various protection schemes and principle of operations of various circuit breakers and relays.
Understanding the utilization fundamentals with reference to traction and heating.
Understanding advanced power system control using SCADA and FACTS.

Module 1 (13 hours)
Circuit Breakers : Principles of operation, different types and their operations, ABCB, oil CB, SF6, vacuum CB, circuit breaker ratings, cause of over voltages, surges and traveling waves, voltage waves on transmission line, reflection and attenuation, protection against lightning, earth wires, lightning diverters, surge absorbers, arcing ground, neutral earthing , basic concepts of insulation levels and their selection, BIL, coordination of insulation.

Module 2 (13 hours)
Protective Relays: Protective zones, requirement of protective relaying, different types of relays and their applications, generalized theory of relays, protection scheme for generator, transformers, lines and busbars, static relays, amplitude and phase comparators, block diagrams of static relays, microprocessor based protective relaying- overcurrent & impedance relays.

Module 3 (13 hours)
Electric Traction: Systems of traction, speed time curve, mechanics of traction, braking, power supply, systems of current collection.

Electric Heating : Advantage of electric heating, resistance and induction arc furnaces, construction and field of application, high frequency power supply and the principle and application of dielectric heating - .

Module 4 (13 hours)
Introduction to SCADA systems - block diagram -communication between various control centres -three level control systems - functions and features.
. Introduction to HVDC transmission – kinds of DC links – comparison with HVAC systems – PQ problems - introduction to FACTS – FACTS controllers – SVC - STATCOM - UPFC

Text Books

1 Sunil S Rao :Switch gear protections ; Khanna Publishers(11th edition)

2. Soni, Gupta & Bhatnagar :A course in Electrical Power ; Dhanpat Rai & Sons.

References:

1. A.R.Van.C.Warrington :Protective Relays Vol 1 & 2 ; Chappman & Hall
2. Ravindranath M. Chander:Power System Protection and Switchgear.
3. G. T. Haydt :Electric Power Quality.
4. Badriram : D.N Viswakarma : Power system protection & switchgear .Tata McGraw Hill
5. Narain .G. Hingorani:Understanding FACTS. IEEE PRESS.

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
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 705A: SOFTWARE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Objective:

Software Engineering concepts such as different models, design and testing
operating system concepts.
case study of Unix and windows OS.

Module 1:- Software Engineering concepts.

Software Process models – waterfall model, spiral model, Co Como model – Software specification, Design and implementation – Software validation, Evolution – Software prototyping – Design – Verification and validation – Software testing, software project management (concepts only, no detailed study required).

Module 2:- Operating system concepts

Review of operating system strategies – Resource process, Threads, objects – operating system organization, process management – scheduling mechanisms, synchronization interfacing and coordinating process – Semaphores – dead load memory management – dynamic relocation – virtual memory, paging, segmentation

Module 3:- File management

File management – Files, memory mapped files – directories and their implementation – protection and security – Policy mechanism – authentication, Authorisation.

Module 4:- Case study

Case study of Unix kernel Microsoft windows NT– Case study of software development in Unix environment (Examples like Network software for Hospitals, Railway Reservation)

Text book

1. Ian Sommerville, *Software Engineering*, Pearson Education Asia

References:-

1. Gory J Nutt, Operating systems, modern perspective, Addison Wesley
3. A S Tanenbaum, Modern Operating Systems, Prentice Hall

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
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

EE 04 705 (B): NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES

3 hours lecture and 1 hour tutorial per week

Objective

This paper is intended to impart knowledge in

1. **Finding the numerical solution of algebraic and transcendental equations**
2. **Finding the solution of system of linear algebraic equations and**
3. **Finding the numerical solution of ordinary and partial differential equations.**
4. **Different optimization techniques.**

Module I (14 Hours)

Numerical Analysis - Errors in numerical calculations - sources of errors - significant digits - Numerical solution of polynomial and transidental equations - Bisection method - Regula falsi method - Newton - Raphson method - Fixed point method of iteration - Rates of convergence of these methods - solution of system of algebraic equations - Exact methods - Guass elimination - Crout's triangularization method - Iterative methods - Guass-Jacobi and Guass siedal method - Relaxation method.

Polynomial interpolation - Lagrange interpolation polynomial - Divided differences- Newton divided difference interpolation polynomial - finite differences - operators Δ,δ,V, E - Gregory Newton forward and backward difference interpolation polynomials- central differences - sterlings interpolation formula.

Module II(14 Hours)

Numerical differentiation - Differentiation formula in the case of equally spaced points - Numerical integration - Trapezoidal and Simpsons rules - Compounded rules - errors of interpolation and integration formulae - Numerical solution of ordinary differential equations - single step methods - Taylor series - Eulers and Modified Eulers methods - Picard's iteration method - Runga-Kutta methods (Second ,third and forth order formulae, third and forth order derivations not required) Multi step method - Milne's predictor and corrector formulae.

Module III(12 Hours)

Optimization Methods - Systems of linear equation and inequalities - Basic concepts of linear vector spaces - Mathematical formulation of linear programming problem - Theory of simplex method - Simplex algorithm - Charnes M method - Two phase technique - Duality - Dual simplex method.

Module IV(12 Hours)

Transportation, Assignment and routing problems - Dynamic programming - (Introduction and mathematical formulation only) Belman's optimality principle.

Text Book

1.Dr .M.K.Venkataraman, Numerical Methods in Science and Engineering, National Publishing Company.
2.Kanti Swarup, Gupta and Manmohan, Introduction to Linear Programming, Tata McGraw Hill.

Reference Books

1.S.S. Sastry, Numerical Analysis ,Prentice Hall of India.
2.Gerald, Applied Numerical Analysis, Addison Wesley.
3.Kandaswamy.P,Thilakavathy.K,Gunavathy.K,Numerical Methods,S Chand & Co
4. Hadley G, Linear Programming, Addison Wesley.
5. Dr.M.K.Venkataraman,Linear Programming, National Publishing Company.
6. Garwin .W.W, Introduction to Linear Programming ,McGraw Hill.

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 705(C) : HIGH VOLTAGE ENGINEERING

3 hours lecture and 1 hour tutorial per week

Objective :

1.To study the break down mechanisms in Electrical insulators .
2.To study the generation and measurement of high AC, DC and Impulse voltages.
3.Testing of high voltage equipments

Module 1 (13 Hrs.)
Breakdown mechanisms in solids , liquids, vacuum , gases & gas mixtures- breakdown in uniform fields- breakdown in composite dielectrics - partial discharge , penning effect, time lag & paschen's law. Townsends criterion.

Module 2 (13 Hrs.)

Generation of High Voltages and Currents
D.C.Voltages : voltage doubler, cascade circuits, electrostatic machines, voltage stabilization.
A.C. Voltages : Cascade transformers, series resonance circuits.
Impulse Voltages : Single stage and multistage circuits, wave shaping, tripping and control of impulse generators, synchronization with oscilloscope, generation of switching surge voltage, generation of impulse currents.

Module 3 (13 Hrs.)
Measurement of High Voltages and Currents : D.C.,A.C. and impulse voltages and currents, CRO, electrostatic generating and peak voltmeters, sphere gaps, factors affecting measurements, potential dividers(capacitive and resistive) ,series impedance ammeters, Ragowski coils, magnetic links, Hall effect generators, PT's (magnetic and capacitive types) and CT's.

Module 4 (13 Hrs.)
Dielectric loss measurements:- Schering's bridge- inductively coupled ratio arm bridge.
Partial discharge measurement technologies. radio interference measurements.
Over voltage phenomenon -travelling waves- line equations ,wave transmission , reflection & attenuation, lightning phenomenon. -Switching surges- protection against surges. Testing of circuit breakers and generators.

Text book

1. High Voltage Engineering : Naidu M.S & Kamaraju V. Tata Mc Graw Hill
2. An introduction to high voltage engineering: Ray Prentice hall of India

REFERENCES

1. Travelling Waves on Transmission : Bewley L.V.Lines Dover Publishers
2. High Voltage Engineering : Kuffel. and Abdulla M.Pergman Press
3. H. V. Technology : Alston L. L. OxfordUniversity Press
4. H. V. Technique : Craggs J. D & Meed J. M Butterworths
5. An Introduction to H.V. : Dieter Kind Wiley Ltd Experimental Technique
6. Discharge Detection in H.V. : Kreuger Haywood, London Equipment
7. Power System Transients and High Voltage Principles : B. Thapar etal Capital Pub.
8. IEEE Standard Technique for High Voltage Testing : IEEE John Wiley and Sons.
9. Indian Standards :
   IS : 2070 – 1962 IS : 2070 – 1962

IS : 2544 – 1963	IS : 2079 – 1962
IS : 2099 – 1962	IS : 2026 – 1962
IS : 166 – 1962	IS : 5959 – 1970
IS : 1544 – 1964, 1970	IS : 7098 – 1973
IS : 3070 – 1965	IS : 4004 - 1967
IS : 6209 – 1971	IS : 4950 – 1968

British Standards : B5 : 3659,B5 : 3070, B5 : 2914-1957
IEC Publications : No, 99-1, Part1-1970

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
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

EE 705(D): DIGITAL SYSTEM DESIGN

(3 hours lecture and 1 hour tutorial per week)

Objectives:

With this paper, the students should be able to design, simulate and implement a typical sequential digital system in FPGA/CPLD and propose proper testing strategy.

Module 1 (13 Hours)

Finite State Machine Design: The Concept of State Machine - Timing in State Machine - FSM Design Procedure - ASM notation - Moore and Mealy Machine Design - Examples of Moore and Mealy Machines - Finite State Machine Word Problems.

Module 2 (13 Hours)

Asynchonous Design: Asynchronous ASM - Asynchronous System - Design Principles - Problem of Asynchronous Circuits _ Hazards - Critical Races - Examples

Module 3 (13 Hours)

Designing with programmable Devices: Programmable LSI Techniques - PLA, Logic Cell Array and Atifuse FPGAs - Designing with FPGAs - Large PAL Structures - XILINK 4000 series

Module 4 (13 Hours)

Hardware Description Languages: Introduction to VHDL - Behavioral Modeling - Transport vs Inertial Delay - Simulation Deltas - Sequential Processing - Process Statement - Signal Assignment vs Variable

Assignment - Sequential Statements - Data Types - Subprograms and Packages - Predefined Attrbutes - Configurations - Subprogram Overloading - VHDL synthesis - Design Examples

Textbooks recommended

1. David J. Comer "Digital Logic and State machine Design" Saunders College publishing
2. Randy H. Katz, "Contemporary Logic Design", Benjamin/Cummings Publishing Co. 1995
3. Geoff Bostock, "FPGAs and programmable LSI", Butterworth Heinemann, 1996
4. Douglas L. Perry, "VHDL", McGraw Hill, 1999
5. Charles S. Roth, "Fundamentals of Logic Design", Jaico Publishing House, 1999

References

1. Zoran Salacic, "Digital System Design and prototyping using Field Programmable Logic", Kluwer Academic Publishers
2. Stephen Brown and Zvonoko Vranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw Hill
3. J. Bhasker, "A VHDL primer", Addison-Wesley 3rd Ed. , 2000
4. Z.Navabi, "VHDL: Analysis and Modeling of Digital Systems", McGraw Hill, 1998

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
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 705(E): ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

3 hours lecture and 1 hour tutorial per week

OBJECTIVE:

To introduce the student with knowledge about architecture, interfacing and programming with 80386 and 80196. With this paper, the student should be able to design microprocessor / micro controller based system (both hardware and software) for any relevant application.

Module I (14 hours)

Evolution of 16 and 32 bit Processor – Salient features of advanced processors – 80386 processor – Architecture – Programming model – memory management unit – Descriptors-Selectors – description table and TSS – real and protection mode – Memory Paging- Addressing modes and Instruction sets – Interrupt systems of 80386 in PVAM – switching to PVAM – Intel Pentium Processors – Architecture and special features of Pentium processors – Branch Prediction Logic – Super scalar Architecture – Special Pentium registers – Memory management – Basic concepts of cache, pipelining-

Module II (14 hours)

Evolution of 16 bit microcontrollers – 80196microcontroller – modes of operation – Interrupt status – Times – High speed Inputs – Analog Interface – PWM output – Serial ports – Input Output expansion methods– memory expansion-serial port expansion- application – examples – 80196 micro controller Architecture- Register set of 80196 – General features of 80196 – Addressing modes -special function registers – Minimum configuration-

Module III (12 hours)

Micro controllers and Embedded systems -PIC Micro controllers – features – Architecture – Programming considerations – On Chip Peripherals – Programming examples – Atmel micro controllers – features – architecture – Programming considerations- On Chip Peripherals-Programming examples – Real time controls – concepts and issues

Module IV (12 hours)

Development tools – Programmers – Compilers –Assemblers- Debuggers – Simulators – Emulators – External interface design – LCD, Key pad - Practical design examples

Text Books

1. Advanced Microprocessors and Peripherals – A.K.Ray Bharchendi – Tata Mc Graw Hill
2. Microprocessor and Micro controller Applications – A.P. Godse & D.A Godse,
3. PIC Microcontrollers – John B Peatman, Pearson Education

Reference Books

1. Dr.B.P.Singh : Microprocessors and Microcontrollers
2. Brey B.R :The Intel Microprocessor system – Architecture, Programming and Interfacing

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

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 705 (F) : ELECTRICAL MACHINE MODELLING & ANALYSIS

3 hours lecture and 1 hour tutorial per week

Objective:

To provide the basic ideas of mathematical modelling and analysis of electrical machines.

Module I: Modeling and analysis of DC machines (15 hours)

Introducton to generalized machine theory-diagramatic representation of genaralized machine-formation of emf eqations-expression s for power and torque-representation of D C machines .

Electrodynamical equations and their solution - a spring and plunger system - rotational motion system - mutually coupled coils - Lagrange's equation - application of Lagrange's equation to electromechanical systems - solution of electrodynamical equations by Euler's method and Runge-Kutta method - linearisation of the dynamic equations and small signal stability - *the primitive 4 winding commutator machine*- the commutator primitive machine - the brush axis and its significance - self and mutually induced voltages in the stationary and commutator windings - speed e.m.f induced in commutator winding - rotational inductance coefficients - sign of speed e.m.f terms in the voltage equation - the complete voltage equation of primitive 4 winding commutator machine - the torque equation - *DC Machines* - analysis of simple DC machines using the primitive machine equations - analysis of cross-field DC machines using the primitive machine equations

Module II: Modeling and analysis of induction motors (13 hours)

Representation of Induction machine using Generalised machine theory - Formation of general equations - *The three phase induction motor* - equivalent two phase machine by m.m.f equivalence - equivalent two phase machine currents from three phase machine currents - power invariant phase transformation - voltage transformation - voltage and torque equations of the equivalent two phase machine - commutator transformation and its interpretation - transformed equations - different reference frames for induction motor analysis - choice of reference frame- nonlinearities in machine equations - equations under steady state - solution of large signal transients in an induction machine - linearised equations of induction machine in current variables and flux linkage variables - small signal stability - eigen values - transfer function formulation - application of large signal and small signal equations

Module III: Modeling and analysis of synchronous machines (13 hours)

Modelling and analysis of synchronous machines - Synchronous machine representation using generalised machine theory - general equations - three phase to two phase transformation - voltage and torque equations in stator, rotor and air-gap field reference frames - commutator transformation and transformed equations - parks transformation - suitability of reference frame Vs kind of analysis to be carried out - steady state analysis - large signal transient analysis - linearisation and eigen value analysis - general equations for small oscillations - small oscillation equations in state variable form - damping and synchronizing torques in small oscillation stability analysis - application of small oscillation models in power system dynamics

Module IV: Dynamical analysis of interconnected machines (11 hours)

Machine interconnection matrices - transformation of voltage and torque equations using interconnection matrix - large signal transient analysis using transformed equations - small signal model using transformed equations - the DC generator/DC motor system - the alternator/synchronous motor system - the Ward-Leonard system - hunting analysis of interconnected machines - selection of proper reference frames for individual machines in an interconnected system

Text Books

1. Dr.P.S.Bhimbra, Generalised machine Theory, Khanna Publishers.

2. Sengupta D.P. & Lynn J.B., *Electrical Machine Dynamics*, The Macmillan Press Ltd

Reference books

1. .Jones C.V., *The Unified Theory of Electrical Machines*, Butterworth
2. Woodson & Melcher, *Electromechanical Dynamics*, John Wiley
3. Kraus P.C., *Analysis of Electrical Machines*, McGraw Hill Book Company
4. Boldia I. & Nasar S.A., *Electrical Machine Dynamics*, The Macmillan Press Ltd.

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 each, 2 from each module
Q II - 2 questions of 15marks each from module I with choice to answer any one
Q III - 2 questions of 15marks each from module II with choice to answer any one
Q IV - 2 questions of 15marks each from module III with choice to answer any one
Q V - 2 questions of 15marks each from module IV with choice to answer any one

EE 04 706(P):ADVANCED ELECTRICAL ENGINEERING LAB

3 hours practical per week

Objective:

To conduct experiments based on machines , power electronic equipments ,micro processors and micro controllers .

(Ten experiments from the following topics listed will scheduled for the laboratory depending upon the availability of equipments, components, etc.)

1. Determination of transfer function of DC motor (a) armature control (b) Field control
2. Study and experiments on (a) DC servo motor (b) AC servo motor
3. Experiments on synchros (a) characteristics (b) data transmission (c) error detection (d) differential synchro.
4. Design and experimental determination of frequency response of lead, lag and lead-lag networks.
5. Magnetic Amplifiers – Characteristics and control circuits
6. Performance evaluation of fullwave thyristor rectifier with RL load with and without freewheeling diode.
7. Study of 8086 microprocessor and MASM.
8. Implementation of simple programs using MASM.
9. Implement a calculator program using 8086.
10. Implement an 8086 program for checking a password using dos interrupt.
11. Implement a timer program that performs down from an input count.
12. Study of 8051/8031 micro controller and implementation of simple programs.
13. Interfacing an ADC with 8051 micro controller to read an analogue signal.
14. Experiments on sphere gaps.
15. Relay Characterestics
16. Study and experiments using PID controller.

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

EE04 707(P) : SEMINAR

3 hours per week

Objective:

To assess the debating capability of the student to present a seminar on a technical topic. Also to train a student to face the audience and freely present his ideas without fear thus creating in him self-confidence and courage that are essential for an Engineer.

Individual students should be asked to choose a topic in a field of their interest but in Electrical & Electronics Engineering preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes. A committee consisting of at least three faculty members (preferably specialized in different fields of engineering) shall assess the presentation of the seminars and award the marks to the students based on the merits of the topic of presentation. Each student shall submit two copies of a write up of his seminar talk. One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other will be kept in the Departmental Library

Sessional work assessment
Relevance & literature :10
Presentation : 25
Report : 10
Participation :5
Total marks : 50

EE04 708(P) : PROJECT WORK

Objective

The project is aimed at improving the professional competency by touching the areas which otherwise is not covered in theory or laboratory classes. There is a greater realization of the importance of the application of ideas to build a solution to complement the learning process. The work practice will help the students to develop ability to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

4 hours per week

The project work can be a design project -experimental project -investigation or computer oriented on any of the topics of electrical or electronics interest -it can be allotted as a group project consisting of a maximum number of five students -the topic of the project for any student should be different from his/her mini project The interim assessment of all the projects should be done at the end of the seventh semester by a committee consisting of three or four faculty members specialized in the various fields of electrical engineering -the students shall present their project work before the committee for about 20 to 30 minutes duration -the complete project report is not expected at the end of the seventh semester -however a three to four page abstract based on the work done should be submitted by the students to the assessing committee -the group average marks for the various projects will be fixed by the committee –the project guides will award the marks for the individual students in a project group main- taining the group average

Sessional work assessment	
Presentation	: 30 .
Report	: 20
Total marks	: 50

UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

EIGHTH SEMESTER

OF
BACHELOR OF TECHNOLOGY
IN
ELECTRICAL & ELECTRONICS ENGG.

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

EE: ELECTRICAL ENGINEERING

EIGHTH SEMESTER

Code	Subject	Hours/ Week			Sessional Marks	University Exam	
		L	T	P/D		Hrs	Marks
EE04 801	Electrical System Design And Estimation	3	1	-	50	3	100
EE04 802	Industrial Drives	3	1	-	50	3	100
EE04 803	Instrumentation Systems	3	1	-	50	3	100
EE04 804	Elective II	3	1	-	50	3	100
EE04 805	Elective III	3	1	-	50	3	100
EE04 806(P)	System Simulation Lab	-	-	3	50	3	100
EE04 807(P)	Project Work	-	-	7	100	3	-
EE04 808(P)	Viva Voce	-	-	-	-	3	100
	TOTAL	**15**	**5**	**10**	**400**		**700**
Aggregate marks for 8 semesters = 8300					**3000**		**5300**

Elective II

EE04 804(A)	VLSI Design
EE04 804(B)	Soft Computing
EE04 804(C)	Industrial Robotics
EE04 804(D)	Organizational Behaviour

Elective III

EE04 805(A)	Advanced Topics on Power Systems
EE04 805(B)	Switched mode Power Converters
EE04 805(C)	Biomedical Instrumentation
EE04 805(D)	Synthesis of Feedback systems

EIGHTH SEMESTER

EE04 801 : ELECTRICAL SYSTEM DESIGN & ESTIMATION

3 hours lecture and 1 hour tutorial per week

Objective:

To study the design and estimation of different electrical installations
(IS Codes duly signed by the teacher may be allowed in the examination)

Module I (13 hours)

Role of national electrical code in the design of electrical installation - electrical symbols and diagrams - design considerations of electrical installations - electric supply systems - protection and protective devices for electric installation against overload - short circuit and earth fault - electric services in building - service connections - service mains - reception and distribution of main supply - sub- circuits - neutral and earth wire - earth bus - guideline for installation of fittings - design and selection of busbars and busbar chambers - design, selection, layout, drawing and location of distribution boards and panel boards - control and switch gears - criteria for selection of HT and LT underground cables

Module II (13 hours)

Design of illumination schemes - various types of light sources - different types of lighting arrangement - energy efficiency in lamps and illumination - design considerations of good lighting schemes - design of lighting schemes for various purposes - lighting calculations - design of flood lighting and street lighting - electrical aspects and considerations for lifts, escalator services and standby generators - design and safety aspects of electrical installations for residential buildings, commercial buildings, hospitals, hotels, recreational and assembly buildings and cinema theatre

Module III (13 hours)

Electrical installations of high rise buildings - design - schematic diagram - layout - estimation and testing of rising main - main supply board and distribution boards for high rise buildings including air conditioners and lifts with provision for standby generators and its protection - lightning protection - electrical system design - estimation and costing of commercial buildings - design considerations and estimation of electrical installations in small Industries

Module IV (13 hours)

Selection of EHV and HV power and distribution transformers and switchgears - case studies - design - layout - schematic diagram - (a) 16 MVA - 110/11KV outdoor substation having one or two incoming and 8 or less outgoing - (b) 11KV/415V outdoor substations upto 630KVA - (c) 11KV/415V indoor substation upto 630KVA - design of earthing system - earthmat design - design of plate and pipe earthing - shielding of electrical system

Text Books

1. Raina & Battacharya, Electrical System Design, Estimation & Costing, Wiley Eastern
2. Gupta J.B., Electrica Installating, Estimating & Costing, Kataria & Sons

Reference books

1. ISI, National Electric Code, Bureau of Indian Standard Publications
2. Cinema Regulation (Rules) & Act
3. IEEE Standards, IEEE
4. Relevant Indian Standard Specifications, IS Publications.

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
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

EE04 802: INDUSTRIAL DRIVES

3 hours lecture and 1 hour tutorial per week

Objective:

Understanding the basic principle and operation of drives.
Analysis and design of an electric drive for a given application.

Module I (13 hours)

Basic principle of Electric Drives – Block diagram – Parts of Electrical Drives – Dynamics of electric drive – torque equation -speed torque conventions – loads with rotational and translational motion – components of load torques – nature and classification of load torques – load equalization – control of electrical drives – closed loop speed control – current limit control – closed loop torque control – speed sensing current sensing – phase locked loop control

Module II (13 hours)

Dc motor drives – basic equations – constant torque and constant power control – fully controlled and half controlled converter fed DC drives – continuous and discontinuous operation – two quadrant operation – three phase controlled rectifier fed dc drives – dual converter fed control – chopper fed DC drives – closed loop control scheme for control below and above base speed – solar powered drives – solar powered pump drives – battery powered vehicles - braking of dc drives

Module III (13 hours)

Three phase induction motor drives – AC Voltage controlled drives – variable frequency control -V/f control- VSI fed induction motor drive – operation with field weakening – CSI controlled induction motor drives – slip power recovery scheme – rotor frequency control – single phase induction motor drives – PWM Drives

Module IV (13 hours)

Synchronous motor drives – synchronous motor variable speed drives – methods of control- VSI and CSI fed drives – variable frequency control – self controlled synchronous motor drives – brushless dc motor drives - μp controlled DC and AC drives – block diagrams and flow charts- Energy conservation in electrical drives.

Text Books

1. Dubey G.K : Fundamentals of Electric Drives
2. R.Krishnan : Electric Motor Drives – Modeling Analysis & control – Pearson Education

References

1. Vedam Subramaniam : Thyrister control of Electric Drives –
2. Sen PC Thyrister DC Drives

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

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 803: INSTRUMENTATION SYSTEMS

3 hours lecture & 1 hour tutorial per week

Objective:

Understand the sensing mechanism for various physical parameters.
Manipulation of the sensed signal for human visual perception.
Development of an instrumentation system for a particular application

Module -1 (12 hrs)
Transducers
Definition -Different types of transducers -criteria for selection –General characteristics -Dynamic characteristics -Calibration -Transducers for measurement of displacement, velocity, acceleration, speed ,angular rotation, altitude ,flow, liquid level, force, torque, humidity and moisture, pressure, strain and temperature Hall effect transducers and applications.

Module -2 (12 hrs)
Signal conditioning, data transmission, telemetry and digital instruments
Signal conditioning -Instrumentation amplifiers -Differential amplifier- Transducer bridges -null type and deflection bridges -Ac bridges using push- pull transducers. Data transmission and telemetry -Methods of data transmission -General telemetry systems -Sampling process

Digital instruments-operating principle of DVM using successive approximation - V IF conversion and integrating principles- counters- Digital methods of frequency, phase, time & period measurements.

Module -3 (12 hrs)
Display methods, recorders, experiments and statistical analysis
Display methods and devices -Different types of display -Display system building blocks -Recorders -Galvanometric recorders -Pen driving system –Servo recorders -Magnetic recorders -Digital recorders.
Experiments and statistical analysis -Performance of experiment -The record of experiment -Accuracy and precision. Classification of errors -The characteristics of experimental data -Description of dispensed data -Type of probability distribution - Probability error -combination of variances -combined error -Guarantee errors.

Module -4 (16 hrs)
Instrumentation Systems
Basic measuring systems -Analog and digital data acquisition systems -Generalized
input-output configuration of measuring systems -Dynamic characteristics - mathematical models -The concept of transfer function (with special reference to measuring systems) – procedure for developing transfer function – response to various types of inputs – Classification of instruments based on their order & dynamic and frequency response studies.
Introduction to the recent developments in the process instrumentation – PLC development of ladder logic designs for simple applications – introduction to SCADA system

Text Books :

1. Earnest O Doblin : Measurement system application and design, McGraw Hill
2. A.K. Sawhney : A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and sons
3. Joseph J Carr : Elements of Electronic instrumentation and Measurement – Pearson Education

References

1. William David Cooper : Electronic Instrumentation and Measurement Techniques, Prentice Hall, India
2. Ernet C. Doblin : Measurement System Application and Design, Mc Graw Hill International Editions
3. K.B.Klaassan : Electronic Measurement and Instrumentation Cambridge University Press
4. John P Bentley : Principles of Measurement Systems – Pearson Education

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
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 804(A): VLSI DESIGN

Objective:

Design of high-performance, low power and cost effective systems demands knowledge of all aspects digital design from application algorithms to fabrication and packaging. The VLSI design is system design and this course imparts those skills to the students and will be invaluable to every future VLSI design Engineer and Manager.

Module 1 (10 hours)

Overview Of VLSI Design Methodology: VLSI design process -. Architectural design -Logical design - Physical design -Layout styles -Full custom -Semi custom approaches. .

VLSI Fabrication Techniques : .An overview of wafer fabrication –Wafer Processing -Oxidation - Patterning -Diffusion -Ion Implantation -Deposition –Silicon gate nMOS process -CMOS processes - nWel1 -PWell -Twin tub -Silicon on insulator-CMOS process (enhancements -Interconnect -Circuit elements. (5)

Module 2 (12 Hours)

. **Basic Electrical Properties Of MOS And CMOS Circuits:** nMOS enhancement transistor -PMOS enhancement transistor -Threshold voltage - Threshold voltage equations -MOS device equations -Basic DC equations -Second order effects - MOS modules -Small signal AC characteristics -nMOS inverter - Steered input to an nMOS inverter -Depletion mode and enhancement mode pull ups –CMOS inverter -DC characteristics -Inverter delay -Pass transistor -Transmission gate. (12)

Module 3 (Hours 8)

Layout Design Rules: Need for design rules -Mead conway design rules for the.silicon gate nMOS process -CMOS nwell-Pwel1 design rules -Simple layout examples - Sheet resistance -Area capacitance - Wiring capacitance -Drive large capacitive loads. (8)

Module 4 (Hours 12)

. Logic Design : Switch logic -Pass transistor and transmission gate -Gate logic - Inverter -Two input NAND gate -NOR gate -Other forms of CMOS logic –Dynamic CMOS logic -Clocked CMOS logic - Precharged domino CMOS logic -Structured design -Simple combinational logic design examples –Parity generator -Multiplexers –Clocked sequential circuits -Two phase clocking -Charge storage –Dynamic register element -nMOS and CMOS -Dynamic shift register -Semi static register - JK flip flop circuit. (12)

Text Books:

1.Douglas A PuckJ1ell and Kamran Eshranghian, "Basic VLSI Design", Prentice Hail of India, New Delhi, 3rd Edition, 1994.

2.Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A systemPerspective", Addision-Wesley, 2nd Edition, 1993.

3. Amar Mukherjee, "Introduction to nMOS and CMOS VLSI System Design", Prentice Hall, USA, 1986.

1 References;-

1. Caver Mead and LyTUl Conway, "introduction to VLSI Systems", Addision-Wesley, USA, 1980.

2. Eugene D Fabricus, "Introduction to VLSI Design", McGraw Hill International Edition, 1990.

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

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

EE04 804(B): SOFT COMPUTING

3 hours lecture and 1 hour tutorial per week

Objective

To acquaint the students with important soft computing methodologies-neural networks, fuzzy logic, genetic algorithms, and genetic programming.

Module I (12 hours)

Artificial intelligence systems– Neural networks, fuzzy logic, genetic algorithms. Artificial neural networks: Biological neural networks, model of an artificial neuron, Activation functions, architectures, characteristics-learning methods, brief history of ANN research-Early ANN architectures (basics only)- McCulloch & Pitts model, Perceptron, ADALINE, MADALINE

Module II (14 hours)

Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, hidden layer, output layer computations, calculation of error, training of ANN, BP algorithm, momentum and learning rate, Selection of various parameters in BP networks.

Variations in standard BP algorithms- Adaptive learning rate BP, resilient BP, Levenberg-Marquardt, and conjugate gradient BP algorithms (basic principle only)- Applications of ANN

Module III (13 hours)

Fuzzy Logic–Crisp & fuzzy sets – fuzzy relations – fuzzy conditional statements – fuzzy rules – fuzzy algorithm. Fuzzy logic controller – fuzzification interface – knowledge base – decision making logic – defuzzification interface – design of fuzzy logic controller –case studies.

Module IV (13 hours)

Genetic algorithms – basic concepts, encoding, fitness function, reproduction-Roulette wheel, Boltzmann, tournament, rank, and steady state selections, Elitism. Inheritance operators, Crossover-different types, Mutation, Bit-wise operators, Generational cycle, Convergence of GA, Applications of GA – case studies. Introduction to genetic programming- basic concepts

Text Books

1. R. Rajasekaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications,* Prentice Hall of India, New Delhi, 2003
2. L. Fausett, *Fundamentals of Neural Networks*, Prentice Hall, Upper Saddle River, N.J, 1994.

Reference Books

1. D. E. Goldberg, *Genetic Algorithms in Search, Optimisation, and Machine Learning*, Addison-Wesley, Reading, MA, 1989
2. M. T. Hagan, H. B. Demuth, and M. H. Beale, *Neural Network Design*, PWS Publishing, Boston, MA, 1996.
3. T. Ross, Fuzzy Logic with Engineering Applications, Tata McGraw Hill, New Delhi, 1995
4. J. R. Koza, *Genetic Programming: On the Programming of Computers by Natural Selection*, MIT Press, Cambridge, 1992.
5. B. Yegnanarayana, *Artificial Neural Networks*. Prentice Hall of India, New Delhi, 1999

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 804(C) : INDUSTRIAL ROBOTICS

3 hours lecture and 1-hour tutorial per week

Objective:

The course introduces the students to industrial robotics and automation.

Module I (15hours)

Automation and Robotics - Robotics in Science Fiction - A Brief History of Robotics - The Robot and Its Peripherals-Robot Activation and Feedback Components - Position Sensors - Velocity Sensors - Actuators - Power Transmissions Systems - Robot Joint Control Design- Introduction to Manipulator Kinematics - Homogeneous Transformations and Robot Kinematics -Manipulator Path Control - Robot Dynamics - Configuration of a Robot Controller .

Module II (15hours)

Types of End Effectors - Mechanical Grippers - Other Types of Grippers - Tools as End Effectors - The Robot/End Effector Interface - Considerations in Gripper Selection and Design - Sensors in Robotics - Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor-Based Systems - Uses of Sensors in Robotics - Introduction to Machine Vision - The Sensing and Digitizing Function in Machine Vision - Image Processing and Analysis - Training and Vision System - Robotic Applications.

Module III (15hours)

Methods of Robot Programming - Leadthrough Programming Methods - A Robot Program as a Path in Space - Motion Interpolation - WAIT, SIGNAL, and DELAY Commands - Branching - apabilities and Limitations of Leatlthrough Methods - The Textual Robot Languages - enerations of Robot Programming Languages - Robot Language Structure - Constants, Variables, and Other Data Objects - Motion Commands - End Effector and Sensor Commands - Computations and perations - Program Control and Subroutines - Communications and Data Processing - Monitor Mode Commands.

Module IV(15hours)

Introduction to robot intelligence and task planning- state space search-problem reduction-use of predicate logic-means –end analysis-problem-solving –robot learning-robot task planning-expert systems and knowledge learning.

Text Books

1. Mikell P.Groover -et al, Industrial robotics, technology programming and applications, McGraw-Hill
2. K.S.Fu, R.C.Gonzalez, C.S.G.Lee : Robotics, Control, Sensing & Intelligence, McGrawhill

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 804 (D) ORGANISATIONAL BEHAVIOUR

3 hours lecture and 1 hour tutorial per week

Objective:

To develop positive attitude, leadership qualities, effective organizing skills and to attain proficiency in communication skills

Module I (12 Hours)

Nature of Organisation - Organisational Goals - Definition of Organisational Behavior – Nature of people – Personality – Perception – Learning and behavior modification – Attitudes and Values.

Module II (14 Hours)

Motivation – Theories of Motivation – Need theory – Hygiene theory – Theory X and Y – Expectancy model – ERG Theory – Job Design and Motivation.

Communication – Dynamics of Communication – Process and Forms of Communication – Barriers in Communication – Managing Communication.

Module III (13 Hours)

Interpersonal Behavior – Group and Group Dynamics – Group Behavior – Group Effectiveness.

Leadership – Theories of Leadership – Triat Theory – Behavioral Theory – Situational and Contigency model – Leadership Styles.

Module IV (13 Hours)

Organisational Change – Nature and Factors – Resistance to Change – Organisational Effectiveness – Approach to measure Organisational Effectiveness.

Organisational Development – Concept of Organisational Development –Organisational Development Interventions - Values and Organisational Development.

Text Book

1.Organisational Behavior – Uma Sekharan , Tata McGraw Hill Publishing Company Ltd.

2.Organisational Behavior – L M Prasad, Sulthan Chand & Sons, New Delhi.

References:-

1. Schermerhorn J.R. Jr., Hunt J.G. & Osborn R.N., "*Managing Organizational Behavior*", John Willy
2. Luthans, Organisational Behavior, McGraw Hill International
3. Kieth Davis : Human Relations at Work, McGraw Hill,Inc

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.

* Case study is beyond the scope of this paper.

EE04 805(A) ADVANCED TOPICS IN POWER SYSTEMS

3 hours lecture and 1 hour tutorial per week

Objective:

To study the system optimization, system security, state estimation and fault analysis.

Module 1 (13 hours)

Power system optimization -unit commitment -priority list and dynamic programming methods -optimal load flow solution -optimal scheduling of hydrothermal system.

Module 2 (13 hours)

Power system, security -Factors affecting security -state transition diagram - Contingency analysis using network sensitivity method and ac power flow method - Collecting the generation dispatch using sensitivity methods.

Module 3(13 hours)

State Estimation -least square estimation -basic solution, sequential form of solution - static state estimation -tracking state estimation.

Module 4(13 hours)

Fault Analysis: [Z_{BUS}] building algorithm -sequence matrices -symmetrical and unsymmetrical short-circuit_ana1ysis of 1arge power systems -phase shift in sequence quantities due to transformers.

Text books

1 B.R. Gupta, "Power System Analysis and Design",(3rd Edition), A.H. Wheeler & Co.Ltd. New Delhi, 1998.

2 J. Wood, B.F. Wollenberg, "Power Generation, Operation and Control", John -Wiley & Sons, New York, 1984.

References

1. I.J. Nagarath, D.P. Kothari, " Power System Engineering", Tata McGraw-Hill publishing Co. Ltd., New Delhi 1994.
2. J.Arrillaga, C.P. Arnold, B.J. Harker, "Computer Modelling of Electric Power Systems".
3. A.K. Mahalanabis, D.P. Kothari, S.I. Ahson, "Computer Aided Power System .Aiialysis & Control" Tata McGraw-Hill, New Delhi, 1988.
4. Hadi A. Sadat, "Power System Analysis", McGraw-Hill Co. Ltd. , India, 2000.
5. O.I. Elgard, "Electric Energy System Theory: An Introduction", 2nd Edition, McGraw-Hill, New York, 1982.

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
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 805(B) SWITCHED MODE POWER CONVERTERS

3 hours lecture and 1 hour tutorial per week

Objective:

To get basic principle, working and analysis of different converters.

Module I (Hours 13)

DC to DC converters without Galvanic Isolation – Linear Power Supplies – Overview of Switching Power Supplies – Introduction to DC to DC switched mode converters -Step down converters – continuous conduction mode – boundary between continuous and discontinuous conduction - discontinuous conduction mode – output Voltage ripple -Step up converter – continuous conduction mode- boundary between continuous and discontinuous conduction - discontinuous conduction mode – Buck Boost converter – continuous conduction mode - boundary between continuous and discontinuous conduction - output voltage ripple -Cuk dc– dc converter – full bridge dc– dc converter – PWM with bipolar and unipolar voltage switching – dc– dc converter comparison

Module II (Hours 13)

Switching DC Power supplies with isolation – dc – dc converters with electrical isolation – fly back converters – double ended fly back converter- forward converters- double ended forward converter- push pull converters-half bridge converters-full bridge converters

Voltage Mode control of SMPS-loop gain and stability consideration-shaping the error amplitude frequency response- error amplitude transfer function – transconductance error amplitudes.

Current mode control of SMPS-current mode control advantages-current mode vs. voltage mode-current mode deficiencies-slope compensation.

Module III (Hours 13)

Switched mode dc-ac converters-basic concepts of switched mode converters-PWM switching scheme-square wave switching scheme-single and three phase inverters –switching utilization-ripple in the inverter output-effect of blanking time on voltage in PWM inverters-square wave pulse switching- programmed harmonic elimination switching – current regulated modulation- single phase switched mode rectifier and its control.

Module IV (Hours 13)

Introduction to modelling of switching mode power supplies –state space averaging- state space averaged models-equivalent circuits and small signal transfer function for basic converters. Introduction to resonant converters- classification of resonant converters-basic resonant circuit concepts-load resonant converters-resonant DC link inverters with zero voltage switching – high frequency link integral half cycle converters.

Text Books

1.Power Electronics- ConvertersApplications and Design :Mohan Undeland Robbins -2nd edition-John Wiley and sons

2. Switching Power Supply Design : Abraham Pressman –McGraw Hill

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
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 on

EE 04 805(C): BIOMEDICAL INSTRUMENTATION

3 hours lecture and 1 hour tutorial per week

Objective

This course gives a brief introduction to human physiology and presents various instrumentation systems for measurement and analysis of physiological parameters.

Module I (11 Hours)

Development of Biomedical Instrumentation, biometrics, Man-instrument system-components-block diagram, Physiological systems of the body (brief discussion), Problems encountered in biomedical measurements.

Sources of bioelectric potentials – resting and action potentials –propagation of action potentials- bioelectric potentials- examples (ECG, EEG, EMG, ERG, EOG, EGG, etc.)

Bio potential electrodes–theory-microelectrodes- skin surface electrodes- needle electrodes- biochemical transducers- transducers for biomedical applications.

Module II (14 Hours)

Heart and cardiovascular system (brief discussion), electro-conduction system of the heart. Electrocardiography- Electrodes and leads-Einthoven triangle, ECG readout devices, ECG machine-block diagram.

Measurement of Blood Pressure –direct and indirect measurements – oscillometric measurement, ultrasonic method, Measurement of blood flow and cardiac output, Plethysmography– photoelectric, impedance, and capacitance plethysmographs, Measurement of heart sounds-phonocardiography

Module III (15 Hours)

Electroencephalogram- anatomy of nervous system (brief discussion)- neuronal communication- EEG measurement. Muscle response - Electromyogram (EMG) - Nerve Conduction velocity measurements - Electromyogram measurements.

Physiology of respiratory system (brief discussion), Respiratory parameters-spirometer, pneumograph, body plethysmographs, gas exchange and distribution, Respiratory therapy equipment.

Cardiac pacemakers – internal and external pacemakers, defibrillator, artificial heart valves, heart lung machine

Module IV (12 Hours)

X-rays- principle of generation, uses of X-rays -diagnostic still picture, fluoroscopy, angiography, tomograms, Endoscopy, Diathermy. Basic principle of computed tomography,

magnetic resonance imaging system and nuclear medicine system-radiation therapy. Ultrasonic imaging system- introduction and basic principle.

Instruments for clinical laboratory – tests on blood cells – Chemical tests – Electrical safety – Physiological effects of electric current – shock hazards from electrical equipment – methods of accident prevention.

Introduction to expert system and hospital management, Introduction to telemedicine.

Text Books

1. L. Cromwell, F. J. Weibell, and L. A. Pfeiffer, *Biomedical Instrumentation and Measurements*, Pearson Education, Delhi, 1990
2. J. J. Carr and J. M. Brown, *Introduction to Biomedical Equipment Technology*, 4th ed., Pearson Education, Delhi, 2001

Reference Books

1. J. G. Webster, *Medical Instrumentation Application and Design*, 3rd ed., John Wiley & Sons, N.Y., 1998
2. R. S. Khandpur, *Handbook of Biomedical Instrumentation*, 2nd ed., Tata McGraw Hill, New Delhi, 2003

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
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 on

EE04 805(D) SYNTHESIS OF FEEDBACK SYSTEMS

3 hours lecture and 1 hour tutorial per week

Objective:

To introduce concept of elementary circuit synthesis

Module I (Hours 15)

Introduction to feedback theory - Plant identification-representations-condition for linear electrical analogue- analogue of gyroscope-model of transducer Foundations of linear feedback theory-fundamental feedback equation-subjective nature of feedback-return difference-bilinear theorem and its exceptions-null return difference Introduction to properties of feedback-cost of feedback-systems with multiple inputs-effect of feedback on nonlinear system-classification of reasons for using feedback-effect of feedback on system response-positive feedback-loop shaping for stability -single order systems-extension to higher order systems.

Module II (Hours18)

Design of feedback systems with single degree of freedom configuration - Distinction between the feedback problem, the filter problem and the control problem- introduction to single degree of freedom feedback control design- Design for simultaneous achievement of error constant and phase margin by means of lag compensation, lead compensation – optimization of loop transmission function – correlation between system Frequency Response and Time Response – Relation between the Loop Transmission L and the System Transfer Function T – Synthesis from Pole-Zero Specifications of T(s) – Realization of Any combination of *Kv*, Bandwidth, and Overshoot with a pair of Poles and One Zero – Increase of velocity Constant by Lag Compensation – Comparison of Lead and Lag Compensation Having the Same *Kv*, Bandwidth, and Overshoot – Determination of the Loop Transmission L(s); Validity of Canceling Plant Dynamics – Relative Merits of the Open – Loop Frequency Response Method and the T(s) Pole-Zero Method – The Price That Is Paid for a Dominant Type T *(s)* – T(s) Pole – Zero – Method for Complicated Dominant Pole – Zero patterns – Design of High-order System .

Module III (Hours14)

Design of feedback control systems for independent control of transmission and sensitivity functions - Configuration with two Degrees of Freedom – Root Locus synthesis to control System Sensitivity to Variations in plant Gain Factor – Root Locus s-Plane Synthesis for General plant Parameter Variations – Location of the Far – Off Poles of L – Sensitivity of the dominant Zeros of T(s) – Feasibility of Root Locus Sensitivity Design in High – Order Systems – Philosophy of the Frequency Response Approach to the sensitivity problems – Realization of Sensitivity Specifications – Frequency response Method – Cost of Feed Back, and Comparison of two-Degree-of-Freedom Structures – The problem of the Far-Off poles – Design for Multiple Inputs – Design for Disturbance Attenuation Accompanied by plant parameter Variation – Analytical specification of the Sensitivity Function – Achievable Benefits of Feedback in Two-Degree-of-Freedom Structure

Module IV (Hours14)

Fundamental properties and Limitations of the Loop Transmission Function- Resistance integral theorem - Mathematical Background - Resistance Integral Theorem and the Equality of Positive and Negative Feedback Areas - Real or Imaginary Part Sufficiency - Relation between Loop Transmission Lag Angle and Optimum Loop Transmission Function - Specification of F (s) from Its Real and Imaginary Parts in Different Frequency Ranges - The Ideal Bode Characteristic - A Different Kind of Optimum - Minimum Phase Functions - Conditionally Stable Systems - Maximum Rate at Which $|L(j\omega)|$ May Be Decreased for Conditionally Stable Systems - Loop Transmissions for Systems with Time Delay -- Conditionally Stable

Systems with Pure Time Delay - Systems with Unstable Loop Transmissions - Systems with Combined Positive and Negative Feedback- Zero-Sensitivity Systems – Advanced topics in Linear system theory to multi loop systems -time varying plants – Application of Linear techniques to NL systems.

Text Books :

1. Horowitz, Synthesis of Systems, Academic Press.
2. John C, Analytical Techniques for NL control system, English University Press, London.

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 806 (P): SIMULATION LAB

3 hours practical per week

Objective:

Simulation study using MATLAB, PSPICE and Power system packages.

(Ten experiments from the following topics listed will be scheduled for the laboratory depending upon the availability of equipments, components, etc.)

1. MATLAB-I experiments using MATLAB
2. MATLAB-II experiments using MATLAB tool box
3. PSPICE simulation of single phase and three phase diode bridge rectifiers
4. PSPICE simulation of three face thyristor bridge rectifier
5. PSPICE simulation of full bridge bipolar switching DC-AC convertor
6. PSPICE simulation of buck DC-DC convertor with RL load
7. Experiments on PLC based DC servo motor trainer system
8. Experiments on PLC based AC servo motor trainer system
9. Power flow analysis of the system with the given single line diagram, using the given power flow analysis package
10. Fault analysis of the system with the given single line diagram, using the given power flow analysis package. Obtain the sub transient fault currents for three-phase short circuit with ground, DLFG and LLG faults at any bus.
11. Transient stability analysis of the system with the given single line diagram using the given package. The disturbance is three phase to ground solid short circuit fault at t=0. The fault is cleared at time t=5 cycles by permanently removing the fault line.
12. Power Quality study of the given system using Power System Package.
13. Generate a square wave, a saw tooth wave and a triangular wave using 8051 μc.
14. Generate a sine wave using 8051 μc.

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

EE04 807(P) PROJECT WORK

7 hours per week

Objective

The project is aimed at improving the professional competency by touching the areas which otherwise is not covered in theory or laboratory classes. There is a greater realization of the importance of the application of ideas to build a solution to complement the learning process. The work practice will help the students to develop ability to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The project work started in the seventh semester will continue. Students should complete the project work in this semester and present it before the assessing committee.

The assessment committee as constituted in the seventh semester, will assess the various projects & fix the group average marks. The guides will award the marks for the individual students in a project group maintaining the group average. Each group will submit copies of completed project report signed by the guide to the department. The Head of the Department will certify the copies and return them to the students. One copy will be kept in the Department Library

Sessional work assessment

Presentation : 60 Report : 40 Total marks : 100

EE04 808(P) : VIVA VOCE

There is only University examination for this. Examiners will be appointed by the University for conducting the viva voce. The viva voce exam will be based on the subjects studied for the B. Tech course, mini project, project and seminar reports of student .The relative weightages would be as follows

Sessional work assessment	
Subjects	: 50
Mini project	: 10
Project	: 30
Seminar	: 10
Total marks	: 100