

# ANNA UNIVERSITY TIRUCHIRAPPALLI

## Tiruchirappalli - 620024

### B.E. (PART TIME) ELECTRICAL AND ELECTRONICS ENGINEERING

#### Regulations 2007

#### Curriculum

#### SEMESTER I

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	<b>MA4101</b>	Mathematics I	3	0	0	100
2	<b>HS4101</b>	Physical Sciences	3	0	0	100
3	<b>CS4104</b>	Fundamentals of Computing	3	0	0	100
4	<b>EE4101</b>	Electrical Circuits	3	0	0	100
5	<b>EE4102</b>	Power Plant Engineering	3	0	0	100

#### SEMESTER II

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	<b>MA4151</b>	Mathematics II	3	0	0	100
2	<b>GE4151</b>	Environmental Science and Engineering	3	0	0	100
3	<b>EC4102</b>	Electronic Devices & Circuits	3	0	0	100
4	<b>EE4151</b>	Electromagnetic Theory	3	0	0	100
5	<b>EE4152</b>	Electrical Machines I	3	0	0	100

#### SEMESTER III

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	<b>EC4206</b>	Digital Systems Design	3	0	0	100
2	<b>EE4103</b>	Measurements & Instrumentation	3	0	0	100
3	<b>EE4201</b>	Transmission & Distribution	3	0	0	100
4	<b>EE4202</b>	Electrical Machines II	3	0	0	100
<b>Practical</b>						
5	<b>EE4203</b>	Electrical Machines Laboratory	0	0	3	100

### SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	EE4251	Control Systems	3	0	0	100
2	EE4252	Power Electronics	3	0	0	100
3	EE4253	Power System Analysis	3	0	0	100
4	EE4254	Design of Electrical Apparatus	3	0	0	100
<b>Practical</b>						
5	EE4255	Control and Instrumentation Laboratory	0	0	3	100

### SEMESTER V

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	EE4301	Solid State Drives	3	0	0	100
2	EE4302	Power System Operation & Control	3	0	0	100
3	EE4303	Microprocessor and Microcontroller	3	0	0	100
4	EE4304	High Voltage Engineering	3	0	0	100
<b>Practical</b>						
5	EE4305	Microprocessor and Microcontroller Laboratory	0	0	3	100

### SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	EE4351	Power System Protection & Switchgear	3	0	0	100
2	EE4352	Electric Energy Generation and Utilization	3	0	0	100
3	GE4351	Professional Ethics Human Values	3	0	0	100
4	E1****	Elective I	3	0	0	100
<b>Practical</b>						
5	EE4353	Power System Simulation Lab	0	0	3	100

## SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	<b>MG4251</b>	Total Quality Management	3	0	0	100
2	<b>EE4401</b>	Power Plant Instrumentation	3	0	0	100
3	<b>E2****</b>	Elective II	3	0	0	100
4	<b>E3****</b>	Elective III	3	0	0	100
<b>Practical</b>						
5	<b>EE4405</b>	Project	0	0	3	100

## LIST OF ELECTIVES

S.No.	Subject Code	Subject	L	T	P	Max. Marks
<b>Theory</b>						
1	<b>EE4001</b>	Fiber Optics and Laser Instruments	3	0	0	100
2	<b>CS4031</b>	Visual Languages and Applications	3	0	0	100
3	<b>EE4002</b>	Advanced Control System	3	0	0	100
4	<b>EE4003</b>	Tele Communication Switching and Networks	3	0	0	100
5	<b>EE4004</b>	Special Electrical Machines	3	0	0	100
6	<b>EE4005</b>	Bio-Medical Instrumentation	3	0	0	100
7	<b>CS4032</b>	Artificial Intelligence and Expert Systems	3	0	0	100
8	<b>CS4033</b>	Data Communication and Networks	3	0	0	100
9	<b>EE4006</b>	Power System Dynamics	3	0	0	100
10	<b>CS4034</b>	Computer Architecture	3	0	0	100
11	<b>CS4035</b>	Operating Systems	3	0	0	100
12	<b>EE4007</b>	Power System Transients	3	0	0	100
13	<b>CS4036</b>	Internetworking Technology	3	0	0	100
14	<b>EC4026</b>	Embedded System Design	3	0	0	100
15	<b>EC4027</b>	Mobile Communication	3	0	0	100



### **TEXT BOOK**

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty eighth Edition, Khanna Publishers, New Delhi, 2005.

### **REFERENCES**

1. Glyn James., "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education Ltd, New Delhi, 2004.
2. Venkataraman. M. K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw - Hill Publishing Company Limited, New Delhi, 2005.
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, "Engineering Mathematics", Fifth Edition, Vikas Publishing house Pvt. Ltd., New Delhi, 2006.

## HS4101 – PHYSICAL SCIENCES

L T P  
3 0 0

### UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS 9

**Properties of matter:** Stress - Strain - Hooke's Law - Types of moduli of elasticity - Torsional pendulum - Determination of Rigidity modulus of a wire -Bending of beams - Expression for bending moment - Measurement of Young's modulus by uniform and Non-uniform bending.

**Hydrodynamics:** Stream line flow - Turbulent flow - Poiseuille's formula for flow of liquid through a capillary tube - Determination of coefficient of viscosity of a liquid.

### UNIT II OPTICS AND PHOTOELASTICITY 9

**Interference:** Air Wedge - Testing of Flat surfaces - Michelson's Interferometer - Types of fringes - Applications: Wavelength determination - Thickness of a transparent medium.

**Optical Instruments:** Metallurgical microscope and Scanning electron microscope - Applications.

**Photo elasticity:** Theory of photo elasticity - Stress optic law - Isoclinic and Isochromatic fringes - Photoelastic bench and its use.

### UNIT III SEMICONDUCTING AND SUPERCONDUCTING MATERIALS 9

**Intrinsic Semiconductor:** Expressions for the carrier concentration -Calculation of density of holes and electrons - Fermi level and its variation with temperature - Determination of band gap energy.

**Extrinsic Semiconductors:** Carrier concentration in n-type and p-type semiconductors (no derivation - qualitative) - Variation of Fermi level with temperature and impurity concentration - Hall effect - Determination of Hall coefficient.

**Super Conductors:** SuperConductivity - Properties - Meissner effect - Type I and Type II Superconductors - High temperature Super conductors -Applications - Magnetic levitation - Josephson effect - SQUID

### UNIT IV WATER TREATMENT PROCESS 9

Hardness of water -  $\text{CaCO}_3$  equivalents - Ethylene Diamine Tetra-acetic Acid (EDTA) method of estimation of hardness - Troubles of boiler feed water -Demineralization - Zeolite process - Desalination - Reverse osmosis – Electro dialysis - Water conditioning (Colloidal, Phosphate, Calgon, Carbonate) -Treatment of domestic water (UV and ozone).

### UNIT V THERMODYNAMICS 9

Thermodynamic processes - First law of thermodynamics - Limitations - Second law of thermodynamics - Clausius and Kelvin statement - Entropy - Mathematical expressions - Changes in entropy for isothermal expansion - Reversible and irreversible processes - Free energy - Gibbs Helmholtz equation - Application and simple problems - Van't Hoff isotherm and isochore - Simple problems.

**Total : 45**

### **TEXT BOOKS**

1. Avadhanulu M.N. and Kshirsagar P.G., "A Text Book of Engineering Physics", S.Chand & Company Ltd., 7<sup>th</sup> Enlarged Revised Ed., 2005.
2. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2001.
3. P.C. Jain and Monika Jain, "Engineering Chemistry", 13<sup>th</sup> Edition, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2004.

### **REFERENCES**

1. Pillai S.O., "Solid State Physics", New Age International Publications, New Delhi, 6<sup>th</sup> Edition, 2005.
2. Arumugam M., "Engineering Physics", Anuradha Agencies, Kumbakonam, 2<sup>nd</sup> Edition, 2005.
3. Palanisamy P.K., "Physics for Engineers", Scitech Publications (India) Pvt. Ltd., Chennai, Second Edition, 2005.
4. J.C. Kuriakose and J. Rajaram, "Chemistry in Engineering and Technology", Vol.1 & 2, Tata McGraw Hill Publishing Company (P) Ltd., New Delhi, 1996.
5. B.K. Sharma, "Engineering Chemistry", Krishna Prakasam Media (P) Ltd., Meerut, 2001.

## EE4101 – ELECTRIC CIRCUITS

L	T	P
3	0	0

### UNIT I BASIC CIRCUIT CONCEPTS 9

Lumped circuits - Kirchoff's Laws - V-I relationships of R, L and C - independent sources - dependent sources - simple resistive circuits - network reduction -voltage division - current division - source transformation.

### UNIT II SINUSOIDAL STEADY STATE ANALYSIS 9

Phasor - sinusoidal steady state response - concepts of impedance and admittance - analysis of simple circuits - power and power factor - series resonance and parallel resonance - bandwidth and Q factor - Solution of three-phase balanced circuits - power measurements by two-wattmeter methods -solution of three-phase unbalanced circuits.

### UNIT III MESH-CURRENT AND NODE-VOLTAGE METHODS 9

Formation of matrix equations and analysis of complex circuits using mesh-current and nodal-voltage methods - mutual inductance - coefficient of coupling -ideal transformer.

### UNIT IV NETWORK THEOREMS AND APPLICATIONS 9

Superposition theorem - reciprocity theorem - compensation theorem -substitution theorem - maximum power transfer theorems - Thevenin's theorem -Norton's theorem and Millman's theorem with applications.

### UNIT V TRANSIENT ANALYSIS 9

Forced and free response of RL, RC and RLC circuits with D.C. and Sinusoidal excitations.

**Total : 45**

### TEXT BOOKS

1. Paranjothi S.R., " Electric Circuit Analysis ", New Age International Ltd., Delhi, 2nd Edition, 2000.

### REFERENCES

1. Hayt, W.H. Jr. and Kemmerly, J.E., " Engineering Circuit Analysis ", McGraw Hill International Editions, 1993.
2. Edminister, J.A., " Theory and Problems of Electric Circuits ", Schaum's outline series, McGraw Hill Book Company, 2nd Edition, 1983.
3. Sudhakar, A. and Shyam Mohan S.P., " Circuits and Network Analysis and Synthesis ", Tata McGraw Hill Publishing Co.Ltd., New Delhi, 1994.

## CS4104 FUNDAMENTALS OF COMPUTING

L	T	P
3	0	0

### UNIT I INTRODUCTION 9

Introduction - Characteristics of Computers - The Evolution of Computers -The Computer Generation - Classification of Computers - Basic Computer organization - Number Systems

### UNIT II COMPUTER ARITHMETIC AND SOFTWARE 9

Computer Codes - Computer Arithmetic - Binary Arithmetic - Addition - Subtraction - Multiplication - Division - Computer Software - Types of Software - Logical System Architecture - Software Development Steps

### UNIT III PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program - Purpose - Algorithm - Flowcharts -Pseudocode - Application Software Packages - Word Processing - Spreadsheet - Graphics - Personal Assistance.

### UNIT IV INTRODUCTION TO C 9

Overview of C - Constants, Variables and Data Types - Operators and Expression - Managing input and output Operators - Decision Making and Branching - Decision Making and Looping.

### UNIT V FUNCTIONS AND POINTERS 9

Arrays - Handling of Character Strings - User-Defined Functions - Structures and Unions - Pointers - The Preprocessor - Developing a C Program: Some Guidelines

**Total : 45**

### TEXT BOOKS

1. Pradeep K.Sinha and Priti Sinha, "Computer Fundamentals: Concepts, Systems and Applications", BPB Publications, 2003.
2. E.Balagurusamy, "Programming in ANSI C", TMH, New Delhi, 2002.

### REFERENCES

1. Allen B.Tucker et.al, "Fundamentals of Computing 1", TMH New Delhi, 1998.
2. V.Rajaraman, "Fundamentals of Computers", Prentice - Hall of India, 2002.
3. Herbert Schidt. "C Made Easy", McGraw Hill.



## SEMESTER II

### MA4151 – MATHEMATICS II

L	T	P
3	0	0

#### UNIT 1      **MULTIPLE INTEGRALS**      **9**

Double integration – Cartesian and Polar Co-ordinates – Change of order of integration – Area as a double integral – Change of variables between Cartesian and Polar Co-ordinates – Triple integration – Volume as a triple integral.

#### UNIT 2      **VECTOR CALCULUS**      **9**

Gradient – Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Problem solving using Green's theorem – Gauss divergence theorem and Stoke's theorem – Simple applications and verifications.

#### UNIT 3      **FOURIER SERIES AND TRANSFORMS**      **9**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Parseval's identity for series and transforms.

#### UNIT 4      **COMPLEX INTEGRATION**      **9**

Problems solving using Cauchy's integral theorem and integral formula – Taylor's and Laurent's expansions – Residues – Cauchy's residue theorem – Contour integration over unit circle – Semicircular contours with no pole on real axis.

#### UNIT 5      **LAPLACE TRANSFORMS**      **9**

Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Initial and final value theorems – Inverse Laplace transforms – Convolution theorem – Solution of Ordinary Differential Equations with constant coefficients using Laplace transforms.

**Total: 45**

#### **TEXT BOOK**

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty eighth Edition, Khanna Publishers, New Delhi, 2005.

#### **REFERENCES**

1. Glyn James., "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education Ltd, New Delhi, 2004.
2. Venkataraman, M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Veerarajan. T., "Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2005.
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, "Engineering Mathematics", Fifth Edition, Vikas Publishing house Pvt, Ltd., New Delhi, 2006.

**UNIT 1 INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 9**

Definition – scope and importance – Need for public Awareness – Forest resources – Use and over – exploitation – deforestation – case studies – Timber extraction – mining – dams and their effects 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 and 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 landslides – soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles – Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

**UNIT 2 ECOSYSTEMS AND BIODIVERSITY 9**

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 (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds – streams – lakes – rivers – oceans – estuaries) – Introduction to biodiversity – 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 wildlife – man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity – In-situ and Ex-situ conservation of biodiversity – Field study of common plants – insects – birds – Field study of simple ecosystems – pond – river – hill slopes, etc.

**UNIT 3 ENVIRONMENTAL POLLUTION 9**

Definition – Causes – effects and control measures of – (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil 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 – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT 9**

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 – Environment production 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.

## **UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT**

**9**

Population growth – variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

**Total: 45**

### **TEXT BOOKS**

1. Gilbert M.Masters, 'Introduction To Environmental Engineering And Science', Pearson Education Pvt., Ltd., Second Edition, Isbn 81-297-0277-0, 2004.
2. T.G. Jr. Miller, 'Environmental Science', Wadsworth Publishing Co.
3. Townsend C., Harper J And Michael Begon, 'Essentials Of Ecology', Blackwell Science.
4. R.K. Trivedi And P.K. Goel, 'Introduction To Air Pollution', Techno-Science Publications.

### **REFERENCES**

1. Bharucha Erach, 'The Biodiversity Of India', Mapin Publishing Pvt., Ltd., Ahmedabad India.
2. Trivedi R.K., 'Handbook Of Environmental Laws, Rules, Guidelines, Compliances And Standards', Vol. I And II, Enviro Media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., 'Environmental Management', W.B., Saudners Co., Philadelphia, USA, 1998.

## EC4102 – ELECTRONIC DEVICES AND CIRCUITS

L	T	P
3	0	0

### UNIT 1 DIODES AND BIPOLAR JUNCTION TRANSISTOR 9

PN junction – current equation – junction capacitance – breakdown characteristics – Varactor – tunnel – fast recovery – Schottky and zener diodes – Ebers – Moll equation – Input output characteristics – ‘h’ parameters – Low frequency and high frequency equivalent circuits – RF transistors.

### UNIT 2 POWER SEMICONDUCTOR DEVICES 9

Structure – Operation and characteristics of SCR – TRIAC – Power transistor – MOSFET – GTO – IGBT – Turn on and Turn off characteristics Switching losses.

### UNIT 3 AMPLIFIERS 9

Biasing circuits for transistors – FET and their analysis – Low frequency and high frequency equivalent circuits – CE – CC and CB amplifiers – FET amplifiers – frequency response – cascade and Darlington connections – analysis of Class A and B power amplifiers – complementary symmetry amplifiers – Class C power amplifiers.

### UNIT 4 DIFFERENTIAL AND TUNED AMPLIFIERS 9

Differential amplifiers – common mode and difference mode analysis – Drift compensation – FET input stages – Chopper stabilizer amplifiers – introduction to tuned amplifiers.

### UNIT 5 FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – voltage / current – series / shunt feedback – positive feedback – condition for oscillations – phase shift – Wien bridge – Hartley – Colpitts and crystal oscillators.

**Total: 45**

#### TEXT BOOKS:

1. Millman and Halkias, ‘Electronic Devices and Circuits’, Tata McGraw-Hill, 1991.
2. Albert Paul Malvino, ‘Electronics Principles’, Tata McGraw-Hill, 6<sup>th</sup> Edition, 1995.

#### REFERENCES:

1. David A.Bell, ‘Electronic Devices and Circuits’, 3<sup>rd</sup> Edition Prentice Hall of India, 1995.
2. Sze, S.M ‘Physics of Semiconductor Devices’, Wiley Eastern, 1981.
3. Boylestad and Nashelsky, ‘Electronic Devices and Circuit theory’, Prentice Hall of India, 6<sup>th</sup> Edition 1999.
4. Mothersheed, ‘Electronic Devices and Circuits’, Prentice Hall of India, 1999.
5. John D. Rydar, ‘Electronic Fundamentals and Applications Integrated and Discrete Systems’, 5<sup>th</sup> Edition, Prentice Hall of India, 1999.
6. David Neamen, ‘Semiconductor Physics and Devices – Basic Principles’, Tata McGraw-Hill, 1999.

**UNIT 1 CO-ORDINATE SYSTEMS AND ELECTROSTATICS 9**

Sources and effects of electromagnetic fields – Vector fields – Different co-ordinate systems – Divergence theorem – Stoke's theorem - Coulomb's Law – Electric field intensity – Field due to point and continuous charges – Gauss's law and application – Electrical potential – Electric field and equipotential plots – Electric field in free space – conductors – dielectric – Dielectric polarization – Electric field in multiple dielectrics – boundary conditions – Poisson's and Laplace's equations – Capacitance –energy density – Dielectric strength.

**UNIT 2 MAGNETOSTATICS 9**

Lorentz Law of force – magnetic field intensity – Biot-savart Law – Ampere's Law – Magnetic field due to straight conductors – circular loop – infinite sheet of current – Magnetic flux density (B) – B in free space – conductor – magnetic materials – Magnetization – Magnetic field in multiple media – Boundary conditions – Scalar and vector potential – Magnetic force – Torque – Inductance – Energy density – Magnetic circuits.

**UNIT 3 ELECTRO DYNAMIC FIELDS 9**

Faraday's laws – induced emf – Transformer and motional EMF – Maxwell's equations (differential and integral forms) – Displacement current – Relation between field theory and circuit theory.

**UNIT 4 ELECTROMAGNETIC WAVES 9**

Generation – Electro Magnetic Wave equations – Wave parameters – velocity – intrinsic impedance – propagation constant – Waves in free space – lossy and lossless dielectrics – conductors-skin depth – Poynting vector – Plane wave reflection and refraction.

**UNIT 5 FIELD COMPUTATION 9**

Problem formulation – Boundary conditions – Direct integration method – Method of images – Finite difference method – Finite element method.

**Total: 45****TEXT BOOKS**

1. John.D.Kraus, "Electromagnetics", McGraw Hill book Co., New York, Fourth Edition, 1991.
2. William, H.Hayt, 'Engineering Electromagnetics', Tata McGraw Hill, Edition, 2001.

**REFERENCES**

1. Joseph. A. Edminister, 'Theory and Problems of Electromagnetics', Second edition, Schaum Series, Tata McGraw Hill, 1993.
2. I.J. Nagrath, D.P. Kothari, 'Electromagnetics with Applications', McGraw Hill Publishing Co Ltd., Second Edition, 1997.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 1999.
4. Sadiku, 'Elements of Electromagnetics', Second edition, Oxford University Press, 1995.

## EE4152 – ELECTRICAL MACHINES I

L	T	P
3	0	0

### UNIT I INTRODUCTION 9

Electrical machine types – magnetic circuits – inductance – induced EMF and force – core losses – AC operation of magnetic circuits.

### UNIT II TRANSFORMERS 9

Construction – principle of operation – equivalent circuit – losses – testing – efficiency and voltage regulation – auto transformer – three phase connections – parallel operation of transformers – phase conversion – tap changing.

### UNIT III ELECTROMECHANICAL ENERGY CONVERSION 9

Energy in magnetic systems – field energy – co energy and mechanical force – single and multiple excited systems.

### UNIT IV BASIC CONCEPTS IN ROTATING MACHINES 9

Generated voltages in ac and dc machines – mmf of distributed windings – magnetic fields in rotating machines – rotating mmf waves – torque in ac and dc machines.

### UNIT V DC MACHINES 9

Construction – EMF and torque – circuit model – armature reaction – commutation – methods of excitation – characteristics of generators – characteristics of motors – starting and speed control – testing and efficiency – parallel operation.

**Total: 45**

### TEXT BOOK

1. Nagrath I. J and Kothari D.P. ‘Electric Machines’, Tata McGraw Hill, Publishing Company Ltd., 1990.

### REFERENCES

1. Fitzgerald. A.E., Charles Kingsley Jr, Stephen D.Umans, ‘Electric Machinery’, McGraw Hill Books Company, 1992.
2. Syed. A. Nassar, ‘Electric Machines and Power system’, Volume – I Electric Machines, McGraw Hill Inc., New York 1995.

## SEMESTER III

### EC4206 – DIGITAL SYSTEMS DESIGN

L	T	P
3	0	0

#### UNIT I NUMBER SYSTEM & BOOLEAN ALGEBRA 9

Review of number system – types and conversion – codes – Boolean algebra – De-Morgan's theorem – switching functions and simplification using K-maps & Quine McCluskey method.

#### UNIT II COMBINATIONAL CIRCUITS 9

Design of Logic gates – Design of adder – subtractor – comparators– code converters – encoders – decoders – multiplexers and demultiplexers – Function realization using gates & multiplexers.

#### UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops – SR, D, JK and T – Analysis of synchronous sequential circuits – design of synchronous sequential circuits – Counters – state diagram – state reduction – state assignment.

#### UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUIT 9

Analysis of asynchronous sequential machines – state assignment – asynchronous design problem.

#### UNIT V PROGRAMMABLE LOGIC DEVICES – MEMORY AND LOGIC FAMILIES 9

Memories – ROM – PROM – EPROM – PLA – PLD – FPGA – digital logic families – TTL – ECL – CMOS.

**Total: 45**

#### TEXT BOOKS

1. M. Morris Mano, 'Digital Logic and Computer Design', Prentice Hall of India, 2002.
2. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.

#### REFERENCES

1. Charles H.Roth, 'Fundamentals Logic Design', Jaico Publishing, IV edition, 2002.
2. Floyd, 'Digital Fundamentals', 8<sup>th</sup> edition, Pearson Education, 2003.
3. John F.Wakerly, 'Digital Design Principles and Practice', 3<sup>rd</sup> edition, Pearson Education, 2002.

## EE4103 – MEASUREMENTS AND INSTRUMENTATION

L	T	P
3	0	0

### UNIT I FUNCTIONAL ELEMENTS OF AN INSTRUMENT 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

### UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and types of analog and digital voltmeters – ammeters – multimeters – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve and measurements of iron loss – Instrument transformers – Instruments for measurement of frequency and phase.

### UNIT III COMPARISON METHODS OF MEASUREMENTS 9

D.C & A.C potentiometers – D.C & A.C bridges – transformer ratio bridges – self-balancing bridges – Interference & screening – Multiple earth and earth loops – Electrostatic and electromagnetic interference – Grounding techniques.

### UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders – digital plotters and printers – CRT display – digital CRO – LED – LCD & dot matrix display.

### UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive – capacitive & inductive transducers – Piezoelectric – optical and digital transducers – Elements of data acquisition system – A/D – D/A converters.

**Total: 45**

### TEXT BOOKS

1. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

### REFERENCES

1. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2003.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, 1995.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.

**UNIT I TRANSMISSION SYSTEMS 9**

Structure of electric power system – Various levels such as generation – transmission and distribution – HVDC and EHV AC transmission – comparison of economics of transmission – technical performance and reliability – application of HVDC transmission system – FACTS (qualitative treatment only) – TCSC – SVC – STATCOM – UPFC.

**UNIT II TRANSMISSION LINE PARAMETERS 9**

Parameters of single and three phase transmission lines with single and double circuits – Resistance – inductance and capacitance of solid – stranded and bundled conductors – Symmetrical and unsymmetrical spacing and transposition – application of self and mutual GMD – skin and proximity effects – interference with neighbouring communication circuits – Typical configuration – conductor types and electrical parameters of 400, 220, 110, 66 and 33 kV lines.

**UNIT III MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9**

Classification of lines – Short line – medium line and long line – equivalent circuits – attenuation constant – phase constant – surge impedance – transmission efficiency and voltage regulation – real and reactive power flow in lines – Power-angle diagram – surge-impedance loading – loadability limits based on thermal loading – angle and voltage stability considerations – shunt and series compensation – Ferranti effect and corona loss.

**UNIT IV INSULATORS AND CABLES 9**

Insulators – Types – voltage distribution in insulator string and grading – improvement of string efficiency – Underground cables – Constructional features of LT and HT cables – capacitance – dielectric stress and grading – thermal characteristics.

**UNIT V SUBSTATION – GROUNDING SYSTEM AND DISTRIBUTION SYSTEM 9**

Types of substations – bus-bar arrangements – substation bus schemes – single bus scheme – double bus with double breaker – double bus with single breaker – main and transfer bus – ring bus – breaker-and-a-half with two main buses – double bus-bar with bypass isolators – Resistance of grounding systems – Resistance of driven rods – resistance of grounding point electrode – grounding grids – design principles of substation grounding system – neutral grounding.

**Total: 45****TEXT BOOKS**

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.

**REFERENCES**

1. Luces M.Fualkenberry, Walter Coffey, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadi Saadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.
4. 'Tamil Nadu Electricity Board Handbook', 2003.

## EE4202 – ELECTRICAL MACHINES II

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### UNIT I SYNCHRONOUS GENERATOR 9

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – e.m.f, m.m.f, z.p.f and A.S.A methods – Synchronizing and parallel operation – Synchronizing torque – Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics – Capability curves.

### UNIT II SYNCHRONOUS MOTOR 9

Principle of operation – Torque equation – Operation on infinite bus bars – V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input – constant excitation and constant power developed.

### UNIT III THREE PHASE INDUCTION MOTOR 9

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics – Condition for maximum torque – Losses and efficiency – Load test – No load and blocked rotor tests – Circle diagram – Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

### UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting – Types of starters – Stator resistance and reactance – rotor resistance – autotransformer and star-delta starters – Speed control – Change of voltage – torque – number of poles and slip – Cascaded connection – Slip power recovery scheme.

### UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Special machines – Shaded pole induction motor – reluctance motor – repulsion motor – hysteresis motor – stepper motor and AC series motor.

**Total: 45**

#### TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.

#### REFERENCES

1. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.
2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons, 2002.

**EE4203 – ELECTRICAL MACHINES LABORATORY**

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1. Open circuit and load characteristics of separately excited and self excited D.C. generator.
2. Load test on D.C. shunt motor.
3. Load test on D.C. series motor.
4. Swinburne's test and speed control of D.C. shunt motor.
5. Load test on single phase transformer and open circuit and short circuit test on single phase transformer
6. Regulation of three phase alternator by EMF and MMF methods.
7. Load test on three phase induction motor.
8. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
9. Load test on single-phase induction motor.
10. Study of D.C. motor and induction motor starters.

**Total: 45**

# SEMESTER IV

## EE4251 – CONTROL SYSTEMS

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### UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

### UNIT II TIME RESPONSE 9

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feed back control.

### UNIT III FREQUENCY RESPONSE 9

Frequency response – Bode plot – Polar plot – Constant M and N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

### UNIT IV STABILITY OF CONTROL SYSTEM 9

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole – zero addition – Gain margin and phase margin – Nyquist stability criterion.

### UNIT V COMPENSATOR DESIGN 9

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots.

**Total: 45**

### TEXT BOOKS

1. K. Ogata, 'Modern Control Engineering', 4<sup>th</sup> edition, Pearson Education, New Delhi, 2003 / PHI.
2. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.

### REFERENCES

1. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi, 1995.
2. M. Gopal, 'Control Systems, Principles & Design', Tata McGraw Hill, New Delhi, 2002.
3. M.N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India, 2003.

## EE4252 – POWER ELECTRONICS

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### UNIT I POWER SEMI-CONDUCTOR DEVICES 9

Structure – operation and characteristics of SCR – TRIAC – power transistor – MOSFET and IGBT – Driver and snubber circuits for MOSFET – Turn-on and turn-off characteristics and switching losses.

### UNIT II PHASE-CONTROLLED CONVERTERS 9

2-pulse – 3-pulse and 6-pulse converters – Inverter operation of fully controlled converter – Effect of source inductance – Distortion and displacement factor – Ripple factor – Single phase AC voltage controllers.

### UNIT III DC TO DC CONVERTERS 9

Step-down and step-up choppers – Time ratio control and current limit control – Switching mode regulators – Buck, boost, buck-boost and cuk converter – Resonant switching based SMPS.

### UNIT IV INVERTERS 9

Single phase and three phase (both  $120^{\circ}$  mode and  $180^{\circ}$  mode) inverters – PWM techniques – Sinusoidal PWM – modified sinusoidal PWM and multiple PWM – Voltage and harmonic control – Series resonant inverter – Current source inverters.

### UNIT V APPLICATIONS 9

Uninterrupted power supply topologies – Flexible AC transmission systems – Shunt and series static VAR compensator – Unified power flow controller – HVDC Transmission.

**Total: 45**

### TEXT BOOKS

1. Muhammad H. Rashid, 'Power Electronics – Circuits, Devices and Applications', Pearson Education, Third edition, 2004 / PHI.
2. Ned Mohan, Tore. M. Undeland, William. P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003.

### REFERENCES

1. Cyril.W.Lander, 'Power Electronics', McGraw Hill International, Third edition, 1993.
2. Bimal K. Bose, 'Modern Power Electronics and AC Drives', Pearson Education, 2003.
3. Mr. Jaganathan, 'Introduction to Power Electronics', Prentice Hall of India, 2004.

## EE4253 – POWER SYSTEM ANALYSIS

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### **UNIT I THE POWER SYSTEM – AN OVERVIEW AND MODELLING 9**

Modern Power System – Basic Components of a power system – Per Phase Analysis Generator model – Transformer model – line model – The per unit system – Change of base.

### **UNIT II POWER FLOW ANALYSIS 9**

Introduction – Bus Classification – Bus admittance matrix – Solution of non – linear Algebraic equations – Gauss seidal method – Newon raphson method – Fast decoupled method – Flow charts and comparison of the three methods.

### **UNIT III FAULT ANALYSIS-BALANCED FAULT 9**

Introduction – Balanced three phase fault – short circuit capacity – systematic fault analysis using bus impedance matrix – algorithm for formation of he bus impedance matrix.

### **UNIT IV FAULT ANALYSIS – SYMMETRICAL COMPONENTS AND UNBALANCED FAULT 9**

Introduction – Fundamentals of symmetrical components – sequence impedances – sequence networks – single line to ground fault – line fault – Double line to ground fault – Unbalanced fault analysis using bus impedance matrix.

### **UNIT V POWER SYSTEM STABILITY 9**

Basic concepts and definitions – Rotor angle stability – Voltage stability – Mid Term and Long Term stability – Classification of stability – An elementary view of transient stability – Equal area criterion – Reponses to a short circuit fault- factors influencing transient stability – Numerical integration methods – Euler method – modified Euler method – Runge – Kutta methods.

**Total: 45**

### **TEXT BOOKS**

1. Hadi Saadat “ Power system analysis”, Tata McGraw Hill Publishing Company, New Delhi, 2002 (Unit I, II, III, IV)
2. P.Kundur, “Power System Stability and Control”, Tata McGraw Hill Publishing Company, New Delhi, 1994 (Unit V)

### **REFERENCES**

1. I.J.Nagrath and D.P.Kothari, ‘Modern Power System Analysis’, Tata McGraw-Hill publishing company, New Delhi, 1990.
2. M.A. Pai, ‘Computer Techniques in power system Analysis’, Tata McGraw – Hill publishing company, New Delhi, 2003.

**UNIT I MAGNETIC CIRCUITS AND COOLING OF ELECTRICAL MACHINES 9**

Concept of magnetic circuit – MMF calculation for various types of electrical machines – real and apparent flux density of rotating machines – leakage reactance calculation for transformers – induction and synchronous machine – thermal rating – continuous – short time and intermittent short time rating of electrical machines – direct and indirect cooling methods – cooling of turbo alternators.

**UNIT II D.C. MACHINES 9**

Constructional details – output equation – main dimensions – choice of specific loadings – choice of number of poles – armature design – design of field poles and field coil – design of commutator and brushes – losses and efficiency calculations.

**UNIT III TRANSFORMERS 9**

Constructional details of core and shell type transformers – output rating of single phase and three phase transformers – optimum design of transformers – design of core – yoke and windings for core and shell type transformers – equivalent circuit parameter from designed data – losses and efficiency calculations – design of tank and cooling tubes of transformers.

**UNIT IV THREE PHASE INDUCTION MOTORS 9**

Constructional details of squirrel cage and slip ring motors – output equation – main dimensions – choice of specific loadings – design of stator – design of squirrel cage and slip ring rotor – equivalent circuit parameters from designed data – losses and efficiency calculations.

**UNIT V SYNCHRONOUS MACHINES 9**

Constructional details of cylindrical pole and salient pole alternators – output equation – choice of specific loadings – main dimensions – short circuit ratio – design of stator and rotor of cylindrical pole and salient pole machines – design of field coil – performance calculation from designed data – introduction to computer aided design.

**Total: 45**

**TEXT BOOKS**

1. A.K. Sawhney, 'A Course in Electrical Machine Design', Dhanpat Rai and Sons, New Delhi, 1984.
2. S.K. Sen, 'Principles of Electrical Machine Design with Computer Programmes', Oxford and IBH Publishing Co.Pvt Ltd., New Delhi, 1987.

**REFERENCES**

1. R.K. Agarwal, 'Principles of Electrical Machine Design', S.K.Kataria and Sons, Delhi, 2002.
2. V.N. Mittle and A. Mittle, 'Design of Electrical Machines', Standard Publications and Distributors, Delhi, 2002.

## EE4255 – CONTROL AND INSTRUMENTATION LABORATORY

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### CONTROL LABORATORY

1. Determination of transfer function parameters of a DC servo motor.
2. Determination of transfer function parameters of AC servo motor.
3. Analog simulation of type-0 and type-1 system.
4. Digital simulation of linear systems.
5. Digital simulation of non-linear systems.
6. Design and implementation of compensators.
7. Design of P, PI and PID controllers.
8. Stability analysis of linear systems.
9. Closed loop control system.
10. Study of synchros.

### INSTRUMENTATION LABORATORY

1. Study of displacement and pressure transducers
2. AC bridges.
3. DC bridges.
4. Instrumentation amplifiers.
5. A/D and D/A converters.
6. Study of transients.
7. Calibration of single-phase energy meter.
8. Calibration of current transformer.

**Total: 45**



# EE4302 – POWER SYSTEM OPERATION AND CONTROL

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## UNIT I INTRODUCTION 9

System load variation – System load characteristics – Load curves: Daily, Weekly and Annual – Load-duration curve – Load factor – Diversity factor – Reserve requirements – Installed reserves – spinning reserves – Cold reserves – Hot reserves – Overview of system operation – Load forecasting – Unit commitment – Load dispatching – Overview of system control – Governor control – LFC – EDC – AVR – System voltage control – Security control

## UNIT II REAL POWER – FREQUENCY CONTROL 9

Fundamentals of speed governing mechanism and modeling – Speed-load characteristics – Load sharing between two synchronous machines in parallel – Concept of control area – LFC control of a single-area system – Static and dynamic analysis of uncontrolled and controlled cases – Economic Dispatch Control – Multi-area systems – Two-area system modeling – Static analysis – Uncontrolled case – Tie-line with frequency-bias control of two-area system derivation – state variable model

## UNIT III REACTIVE POWER–VOLTAGE CONTROL 9

Typical excitation system – Modeling – Static and dynamic analysis – Stability compensation – Generation and absorption of reactive power – Relation between voltage, active power and reactive power at a node – Method of voltage control – Injection of reactive power – Tap-changing transformer – Numerical problems – System level control using generator voltage magnitude setting – Tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss

## UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Statement of Unit Commitment (UC) problem – Constraints in UC – Spinning reserve – Thermal unit constraints – Hydro constraints – Fuel constraints and other constraints – UC solution methods – Priority-list methods – Forward dynamic programming approach – Numerical problems only in priority-list method using full-load average production cost – Incremental cost curve – co-ordination equations without loss and with loss – Solution by direct method and  $\lambda$ -iteration method (No derivation of loss coefficients) – Base point and participation factors – Economic dispatch controller added to LFC control

## UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Energy control centre – Functions – Monitoring – Data acquisition and control – System hardware configuration – SCADA and EMS functions – Network topology determination – State estimation – Security analysis and control – Various operating states – State transition diagram showing various state transitions and control strategies

**Total: 45**

### **TEXT BOOKS**

1. Olle I. Elgerd, "Electric Energy Systems Theory - An Introduction", Tata McGraw Hill, New Delhi, 2<sup>nd</sup> Edition, 2003
2. Allen J. Wood, Bruce F. Wollenberg, "Power Generation, Operation and Control", John Wiley & Sons, Inc., 2003
3. Kundur P, "Power System Stability & Control", Tata McGraw Hill Edition, 2006

### **REFERENCES**

1. Kothari D.P. and Nagrath I.J., "Modern Power System Analysis", 3<sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2003
2. Grigsby L.L., "The Electric Power Engineering, Hand Book", CRC Press & IEEE Press, 2001

## EE4303 – MICROPROCESSOR AND MICROCONTROLLER

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### **UNIT I 8085 MICROPROCESSOR 9**

8085 Architecture – Instruction Set – Addressing Modes – Timing Diagram – Assembly Language Programming – Counters – Time Delays – Interrupts – Memory Interfacing – Interfacing I/O devices

### **UNIT II PERIPHERALS INTERFACING OF 8085 9**

Interfacing Serial I/O (8251) – Parallel I/O (8255) – Keyboard and Display Controller (8279) – ADC/DAC Interfacing – Inter Integrated Circuits Interfacing (I<sup>2</sup>C Standard) – Bus – RS232C – RS485 – GPIB

### **UNIT III 8086 MICROPROCESSOR 9**

8086 Architecture – 8086 Addressing modes – Instruction Set – 8086 Assembly Language Programming – Interrupts

### **UNIT IV 8051 MICROCONTROLLER 9**

8051 Architecture – I/O Pins – Ports and Circuits – External Memory – Counters and Timers – Serial Data I/O – Interrupts – Interfacing to External Memory and 8255

### **UNIT V 8051 PROGRAMMING AND APPLICATIONS 9**

8051 Instruction Set – Addressing Modes – Assembly Language Programming – I/O Port Programming – Timer and Counter Programming – Serial Communication – Interrupt Programming – 8051 Interfacing – LCD, ADC, Sensors, Stepper Motors, Keyboard and DAC

**Total: 45**

### **TEXT BOOKS**

1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming and application with 8085”, 4<sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2000
2. John Uffenbeck, “The 80x86 Families, Design, Programming and Interfacing”, 3<sup>rd</sup> Edition, Pearson Education, 2002
3. Mohammed Ali Mazidi and Janice Gillispie Mazidi, “The 8051 Microcontroller and Embedded Systems”, Pearson Education-Asia, New Delhi, 2003

### **REFERENCES**

1. A.K. Ray, K.M.Burchandi, “Intel Microprocessors Architecture Programming and Interfacing”, McGraw Hill International Edition, 2000
2. Kenneth J Ayala, “The 8051 Microcontroller Architecture Programming and Application”, 2<sup>nd</sup> Edition, Penram International Publishers (India), New Delhi, 1996
3. Rafiqzaman M., “Microprocessors Theory and Applications: Intel and Motorola”, Prentice Hall of India, New Delhi, 2003

## EE4304 – HIGH VOLTAGE ENGINEERING

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### **UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9**

Causes of over voltages and its effect on power system – Lightning – Switching surges and temporary over voltages – Protection against over voltages

### **UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 9**

Gaseous breakdown in uniform and non-uniform fields – Corona discharge – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids – Breakdown mechanisms in solid and composite dielectrics

### **UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9**

Generation of High DC, AC, impulse voltages and currents – Tripping and control of impulse generators

### **UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9**

Measurement of High voltages and High currents – Digital techniques in high voltage measurement

### **UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9**

High voltage testing of electrical power apparatus – Power frequency, impulse voltage and DC testing – International and Indian standards – Insulation Coordination

**Total: 45**

### **TEXT BOOK**

1. Naidu M.S., Kamaraju V., “High Voltage Engineering”, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2004

### **REFERENCES**

1. Kuffel E., Zaengl W.S., “High Voltage Engineering Fundamentals”, Pergamon press, Oxford, London, 1986
2. Kuffel E., Abdullah M., “High Voltage Engineering”, Pergamon press, Oxford, 1970

## **EE4305 – MICROPROCESSOR AND MICROCONTROLLER LABORATORY**

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1. Programs for 8/16 Bit Arithmetic Operations (Using 8085)
2. Programs for Sorting and Searching (Using 8085, 8086)
3. Programs for String Manipulation Operations (Using 8086)
4. Programs for Digital Clock and Stop Watch (Using 8086)
5. Interfacing ADC and DAC
6. Parallel Communication between Two Microprocessor Kits using Mode 1 and Mode 2 of 8255
7. Interfacing and Programming 8279, 8259, and 8253
8. Serial Communication between Two Microprocessor Kits using 8251
9. Interfacing and Programming of Stepper Motor and DC Motor Speed control
10. Programming using Arithmetic, Logical and Bit Manipulation Instructions of 8051 Microcontroller
11. Programming and Verifying Timer, Interrupts and UART Operations in 8031 Microcontroller
12. Communication between 8051 Microcontroller kit and PC

**Total: 45**

## SEMESTER VI

### EE4351 – POWER SYSTEM PROTECTION AND SWITCHGEAR

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#### UNIT I INTRODUCTION 9

Principles and need for protective schemes – Nature and causes of faults – Types of faults – Fault current calculation using symmetrical components – Power system earthing – Zones of protection and essential qualities of protection – Protection scheme

#### UNIT II OPERATING PRINCIPLES AND RELAY CONSTRUCTIONS 9

Electromagnetic relays – Over current – Directional – Distance and differential – Under frequency relays – Static relays

#### UNIT III APPARATUS PROTECTION 9

Apparatus protection - Transformer – Generator – Motor – Protection of bus bars – Transmission lines – CTs and PTs and their applications in protection schemes

#### UNIT IV THEORY OF CIRCUIT INTERRUPTION 9

Physics of arc phenomena and arc interruption – Restriking voltage & Recovery voltage – Rate of rise of recovery voltage – Resistance switching – Current chopping – Interruption of capacitive current – DC circuit breaking

#### UNIT V CIRCUIT BREAKERS 9

Types of Circuit Breakers – Air blast – Air break – Oil, SF<sub>6</sub> and Vacuum circuit breakers – Comparative merits of different circuit breakers – Testing of circuit breakers

**Total: 45**

#### TEXT BOOKS

1. Ravindranath B, Chander N, “Power System Protection & Switchgear”, Wiley Eastern Ltd., 1977
2. Badri Ram, Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw Hill, 2001

#### REFERENCES

1. Sunil S. Rao, “Switchgear and Protection”, Khanna publishers, New Delhi, 1986
2. Wadhwa C.L., “Electrical Power Systems”, New Age International (P) Ltd., 2000
3. Soni M.L., Gupta P.L., Bhatnagar V.S., Chakrabarti A, “A Text Book on Power System Engineering”, Dhanpat Rai & Co., 1998
4. Paithankar Y.G. and Bhide S.R., “Fundamentals of Power System Protection”, Prentice Hall of India, New Delhi, 2003

**UNIT I GENERATION 9**

Generation of electrical power by conventional methods: A brief review – Generation from tidal, wind, MHD, geothermal and solar sources – Introduction to the concept of distributed generation – Effect on system operation

**UNIT II CONSERVATION 9**

Economics of generation – Definitions – Load curves – Number and size of units – Cost of electrical energy – Tariff – Need for electrical energy conservation – Methods – Energy efficient equipment – Energy management – Energy auditing – Economics of power factor improvement – Design for improvement of power factor using power capacitors – Power quality – Effect on conservation

**UNIT III ILLUMINATION, HEATING AND WELDING 9**

Nature of radiation – Definition – Laws – Photometry – Lighting calculations – Design of illumination systems (for residential, industrial, commercial, health care, street lightings, sports, administrative complexes) – Types of lamps – Energy efficiency lamps – Methods of heating – requirement of heating material – Design of heating element – Furnaces – Welding generator – Welding transformer and its characteristics

**UNIT IV ELECTRIC TRACTION 9**

Basic concept of Electric Traction – Requirements of an ideal traction system – Supply systems – Mechanics of train movement – Traction motors and control – Multiple units – Braking – Current collection systems – Recent trends in electric traction

**UNIT V DRIVES AND THEIR INDUSTRIAL APPLICATIONS 9**

Factors affecting selection of motor – Loads – Types – Characteristics – Steady state and transient characteristics – Load equalization – Industrial applications – Modern methods of speed control of industrial drives

**Total: 45****TEXT BOOKS**

1. Openshaw Taylor E., “Utilization of Electrical Energy in SI Units”, Orient Longman Pvt. Ltd, 2003
2. Wadhwa C.L., “Generation, Distribution and Utilization of Electrical Energy”, New Age International Pvt.Ltd, 2003

**REFERENCES**

1. Partab H., “Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai & Co, New Delhi, 2004
2. Gopal.K.Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House, New Delhi, 2002
3. Gupta B.R., “Generation of Electrical Energy”, Eurasia Publishing House (P) Ltd, New Delhi, 2003

## GE4351 – PROFESSIONAL ETHICS AND HUMAN VALUES

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### **UNIT I HUMAN VALUES 9**

Morals, Values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality

### **UNIT II ENGINEERING ETHICS 9**

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles – Theories about right action – Self-interest – Customs and religion – Uses of ethical theories.

### **UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study

### **UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9**

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The three mile island and Chernobyl case studies – Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property Rights (IPR) – Discrimination.

### **UNIT V GLOBAL ISSUES 9**

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as Managers – Consulting Engineers – Engineers as expert witnesses and advisors – Moral leadership – Sample code of ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE), India, etc.

**Total: 45**

### **TEXT BOOKS**

1. Mike Martin, Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

### **REFERENCES**

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint)
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000 (Indian Reprint)
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

## EE4353 – POWER SYSTEM SIMULATION LABORATORY

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1. Computation of parameters and Modeling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3. Load Flow Analysis I – Solution of Load Flow and Related Problems Using Gauss-Seidel Method
4. Load Flow Analysis II – Solution of Load Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods
5. Fault Analysis of AC Power System using PSCAD/EMTDC
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi-machine Power Systems
8. Electromagnetic Transients in Power Systems using EMTP
9. Load-Frequency Dynamics of Single-Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems
11. Modeling of FACTS devices using SIMULINK

**Total: 45**

# SEMESTER VII

## MG4251 – TOTAL QUALITY MANAGEMENT

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### **UNIT I INTRODUCTION**

**9**

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of total quality management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation.

### **UNIT II TQM PRINCIPLES**

**9**

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation – Empowerment – Teams – Recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDCA cycle – 5S–Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

### **UNIT III STATISTICAL PROCESS CONTROL (SPC)**

**9**

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

### **UNIT IV TQM TOOLS**

**9**

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA

### **UNIT V QUALITY SYSTEMS**

**9**

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality systems –Elements, implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept – Requirements and benefits

**Total: 45**

### **TEXT BOOK**

1. Dale H.Besterfield, et al., “Total Quality Management”, Pearson Education, Inc., (Indian reprint 2004).
2. Narayana V, Sreenivasan N.S, “Quality Management-Concepts and Tasks”, New Age International 1996.

### **REFERENCES**

1. James R.Evans, William M.Lindsay, “The Management and Control of Quality”, South-Western (Thomson Learning), 5<sup>th</sup> Edition, 2002
2. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.
3. Oakland.J.S. “Total Quality Management” Butterworth-Heinemann Ltd., Oxford. 1989.

## EE4401 – POWER PLANT INSTRUMENTATION

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### UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation – Hydro power- thermal power – Nuclear power- solar and wind power – Importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes - UP& I diagram of boiler – Cogeneration

### UNIT II MEASUREMENTS IN POWER PLANTS 9

Electrical measurements – Current- voltage – power – frequency – power factor etc. – Non electrical parameters – Flow of feed water – Fuel – Air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor

### UNIT III ANALYSERS IN POWER PLANTS 9

Flue gas oxygen analyzer – Analysis of impurities in feed water and steam – Dissolved oxygen analyzer – Chromatography – pH meter – Fuel analyzer – Pollution monitoring instruments

### UNIT IV CONTROL LOOPS IN BOILER 9

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler operation

### UNIT V TURBINE – MONITORING AND CONTROL 9

Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system

**Total: 45**

### TEXT BOOKS

1. Sam G. Dukelow, “The Control of Boilers”, Instrument Society of America, 1991
2. P.K. Nag, “Power Plant Engineering”, Tata McGraw Hill, 2001

### REFERENCES

1. S.M. Elonka and A.L. Kohal, “Standard Boiler Operations”, Tata McGraw Hill, New Delhi, 1994
2. R.K.Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1995
3. E.A.I. Wakil, “Power Plant Engineering”, Tata McGraw Hill, 1984

## ELECTIVES

### EE4001 – FIBER OPTICS AND LASER INSTRUMENTS

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#### **UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9**

Principles of light propagation through a fiber – Different types of fibers and their properties – Fiber characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fiber termination – Optical sources – Optical detectors

#### **UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 9**

Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain

#### **UNIT III LASER FUNDAMENTALS 9**

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers – Solid lasers – Liquid lasers – Semiconductor lasers

#### **UNIT IV INDUSTRIAL APPLICATION OF LASERS 9**

Laser for measurement of distance, length, velocity, acceleration, current, voltage and atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization

#### **UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9**

Holography – Basic principle – Methods – Helographic interferometry and application – Holography for non-destructive testing – Holographic components – Medical applications of lasers – Laser and tissue interactive – Laser instruments for surgery – Removal of tumours of vocal cards – Brain surgery – Plastic surgery – Gynaecology and oncology

**Total: 45**

#### **TEXT BOOKS**

1. Senior J.M., “Optical Fiber Communication – Principles and Practice”, Prentice Hall of India, 1985
2. Wilson J, J.F.B. Hawkes, “Introduction to Opto Electronics”, Prentice Hall of India, 2001

#### **REFERENCES**

1. Donald J. Sterling Jr, “Technicians Guide to Fiber Optics”, 3<sup>rd</sup> Edition, Vikas Publishing House, 2000
2. Keiser G., “Optical Fiber Communication”, McGraw Hill, 1995
3. Gupta, “Fiber Optics Communication”, Prentice Hall of India, 2004

## CS4031 – VISUAL LANGUAGES AND APPLICATIONS

**L T P**  
**3 0 0**

### **UNIT I FUNDAMENTALS OF WINDOWS AND MFC 9**

Messages – Windows programming – SDK style – Hungarian notation and windows data types – SDK programming in perspective – The benefits of C++ and MFC – MFC design philosophy – Document / View architecture – MFC class hierarchy – AFX functions. Application object – Frame window object – Message map – Drawing the lines – Curves – Ellipse – Polygons and other shapes – GDI pens – Brushes – GDI fonts – Deleting GDI objects and deselecting GDI objects – Getting input from the mouse: Client & Non-client – Area mouse messages – Mouse wheel – Cursor – Getting input from the keyboard – Input focus – Keystroke messages – Virtual key codes – Character & dead key messages

### **UNIT II RESOURCES AND CONTROLS 9**

Creating a menu – Loading and displaying a menu – Responding to menu commands – Command ranges – Updating the items in menu – update ranges – Keyboard accelerators – Creating menus programmatically – Modifying menus programmatically – The system menu – Owner draw menus – Cascading menus – Context menus – The C button class – C list box class – C static class – The font view application – C edit class – C combo box class – C scrollbar class – Model dialog boxes – Modeless dialog boxes

### **UNIT III DOCUMENT / VIEW ARCHITECTURE 9**

The inexistence function revisited – Document object – View object – Frame window object – Dynamic object creation. SDI document template – Command routing – Synchronizing multiple views of a document – Mid squares application – Supporting multiple document types – Alternatives to MDI – Splitter Windows: Dynamic splitter window – Static splitter windows – Creating & initializing a toolbar – Controlling the toolbar's visibility – Creating & initializing a status bar – Creating custom status bar panes – Status bar support in appwizard – Opening – closing and creating the files – Reading & Writing – C file derivatives – Serialization basics – Writing serializable classes

### **UNIT IV FUNDAMENTALS OF VISUAL BASIC 9**

Menu bar – Tool bar – Project explorer – Toolbox – Properties window – Form designer – Form layout – Intermediate window – Designing the user interface – Aligning the controls – Running the application – Visual development and event driven programming – Variables – Declaration – Types – Converting variable types – User defined data types – Lifetime of a variable – Constants – Arrays – Types of arrays – Procedures – Subroutines – Functions – Calling procedures. Text box controls – List box & Combo box controls – Scroll bar and slider controls – File controls

### **UNIT V DATABASE PROGRAMMING WITH VB 9**

Record sets – Data control – Data control properties – Methods – Visual data manager – Specifying indices with the visual data manager – Entering data with the visual data manager – Data bound list control – Data bound combo box – Data bound grid control – Mapping databases – Database object – Table def object – Query def object – Programming the active database objects – ADO object model – Establishing a connection – Executing SQL statements – Cursor types and locking mechanism – Manipulating the record set object – Simple record editing and updating

**Total: 45**

## **TEXT BOOKS**

1. Jeff Prosise, "Programming Windows With MFC", 2<sup>nd</sup> edition, WP Publishers & Distributors [P] Ltd, Reprinted 2002
2. Evangelos Petroustos, "Mastering Visual Basic 6.0", BPB Publications, 2002

## **REFENENCES**

1. Herbert Schildt, "MFC Programming from the Ground Up", 2<sup>nd</sup> edition, Tata McGraw Hill, reprinted 2002
2. John Paul Muller, "Visual C++ 6 From the Ground Up 2<sup>nd</sup> Edition", Tata McGraw Hill, Reprinted 2002
3. Curtis Smith & Micheal Amundsen, "Teach Yourself Database Programming with Visual Basic 6 in 21 days", Techmedia Pub, 1999.



## EE4003 – TELECOMMUNICATION SWITCHING AND NETWORKS

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### UNIT I MULTIPLEXING 9

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing : Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphasic, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings. SONET/SDH : SONET Multiplexing Overview, SONET Frame Formats, SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switched Ring, Bidirectional Line-Switched Ring

### UNIT II DIGITAL SWITCHING 9

Switching Functions, Space Division Switching, Time Division Switching, two-dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SSN07 signaling

### UNIT III NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT 9

Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management

### UNIT IV DIGITAL SUBSCRIBER ACCESS 9

ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services

### UNIT V TRAFFIC ANALYSIS 9

Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues

**Total: 45**

### TEXT BOOK

1. Bellamy John, "Digital Telephony", John Wiley & Sons, Inc. 3<sup>rd</sup> edn. 2000

### REFERENCE

1. Viswanathan. T., "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994

## EE4004 – SPECIAL ELECTRICAL MACHINES

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### UNIT I AC COMMUTATOR MOTORS 9

Principle of operation – Equivalent circuit – Phasor diagram – Performance of Repulsion motor and Universal motor

### UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Single and Multi stack configurations – Permanent Magnet Stepper motor – Hybrid stepper motor – Different modes of Excitation – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits

### UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Principle of operation – Torque prediction – Power controllers – Nonlinear analysis – Microprocessor based control – Characteristics – Computer control

### UNIT IV PERMANENT MAGNET MOTORS 9

Principle of operation – Types – Magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control of PMDC, PMSM, and BLDC motors

### UNIT V LINEAR MOTORS 9

Linear Induction motor (LIM) classification – Construction – Principle of operation – Concept of current sheet – Goodness factor – DC Linear motor (DCLM) types – Circuit equation – DCLM control applications – Linear Synchronous motor (LSM) – Types – Performance equations – Applications

**Total: 45**

### TEXT BOOK

1. Miller T J E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989

### REFERENCES

1. Taylor E O, “The performance and design of AC Commutator motors”, Sir Issac Pitman & Sons, London, 1998,
2. Kenjo T, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 1984
4. Naser A and Boldea L, “Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall Inc., New Jersey, 1987
5. Murphy J.M.D, “Power Electronics control of AC Drives”, Pergamon Press, 1988
6. Bose B.K, “Power Electronics and variable frequency drives”, Prentice Hall, New Jersey, 1987



## CS4032 – ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

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### UNIT I INTRODUCTION 9

AI – Intelligent agents – Perception – Natural language processing – Problem – Solving agents – Searching for solutions – Uniformed search strategies – Informed search strategies

### UNIT II KNOWLEDGE AND REASONING 9

Adversarial search – Optimal and imperfect decisions – Alpha, Beta pruning – Logical agents – Propositional logic – First order logic – Syntax and semantics – Using first order logic – Inference in first order logic

### UNIT III UNCERTAIN KNOWLEDGE AND REASONING 9

Uncertainty – Acting under uncertainty – Basic probability notation – Axioms of probability – Baye’s rule – Probabilistic reasoning – Making simple decisions

### UNIT IV PLANNING AND LEARNING 9

Planning – Planning problem – Partial order planning – Planning and acting in non-deterministic domains – Learning decision trees – Knowledge in learning – Neural networks – Reinforcement learning – Passive and active

### UNIT V EXPERT SYSTEMS 9

Definition – Features of an expert system – Organization – Characteristics – Prospector – Knowledge Representation in expert systems – Expert system tools – MYCIN – EMYCIN

**Total: 45**

### TEXT BOOKS

1. Stuart Russel and Peter Norvig, “Artificial Intelligence A Modern Approach”, Pearson Education / Prentice Hall of India, 2<sup>nd</sup> Edition, 2003
2. Donald A. Waterman, “A Guide to Expert Systems”, Pearson Education / Prentice Hall of India, 2003

### REFERENCES

1. George F. Luger, “Artificial Intelligence – Structures and Strategies for Complex Problem Solving”, 4<sup>th</sup> Edition, Pearson Education, 2002
2. Elain Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw-Hill, 2<sup>nd</sup> Edition, 1995
3. Janakiraman, K. Sarukesi, “Foundations of Artificial Intelligence and Expert Systems”, Macmillan Series in Computer Science, 2001
4. W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, 2003

**UNIT I DATA COMMUNICATION 9**

Introduction – Networks – Protocols and standards – Standards organizations – Line configurations – Topology – Transmission mode – Categories of networks – Inter networks – OSI model – Functions of the layers – Encoding and modulating – Digital-to-digital conversion – Analog-to-digital conversion – Digital-to-analog conversion – Analog-to-analog conversion – Transmission media – Guided media – Unguided media – Transmission impairment – Performance

**UNIT II ERROR CONTROL AND DATA LINK PROTOCOLS 9**

Error detection and correction – Types of errors – Detection – Vertical Redundancy Check (VRC) – Longitudinal Redundancy Check (LRC) – Cyclic Redundancy Check (CRC) – Check sum – Error correction – Data link control – Line discipline – Flow control – Error control – Data link protocols – Asynchronous protocols – Synchronous protocols – Character oriented protocols – BIT oriented protocols – Link access procedures

**UNIT III NETWORKS AND SWITCHING 9**

LAN – Project 802 – Ethernet – Token bus – Token ring – FDDI – MAN – IEEE 802.6 (DQDB) – SMDS – Switching: Circuit switching, Packet switching, Message switching

**UNIT IV X.25, FRAME RELAY, ATM AND SONET/ SDH 9**

X.25 – X.25 Layers – Frame relay: Introduction – Frame relay operation – Frame relay layers – Congestion control – Leaky bucket algorithm – Traffic control – ATM – Design goals – ATM architecture – ATM layers – ATM applications – SONET / SDH – Synchronous transport signals – Physical configuration – SONET layers – Applications

**UNIT V NETWORKING DEVICES AND TCP / IP PROTOCOL SUITE 9**

Networking and internetworking devices – Repeaters – Bridges – Gateways – Other devices – Routing algorithms – Distance vector routing – Link state routing – TCP / IP protocol suite – Overview of TCP/IP. Network layers – Addressing – Subnetting – Other protocols and network layers – Application layer – Domain Name System (DNS) – Telnet – File Transfer Protocol (FTP) – Trivial File Transfer Protocol (TFTP) – Simple Mail Transfer Protocol (SMTP) – Simple Network Management Protocol (SNMP)

**Total: 45****TEXT BOOK**

1. Behrouz A. Forouzan, “Data Communication and Networking”, 2<sup>nd</sup> Edition, Tata McGraw Hill, 2000

**REFERENCES**

1. William Stallings, “Data and Computer Communication”, 8<sup>th</sup> Edition, Pearson Education / Prentice Hall of India, 2003
2. Andrew Tannenbaum S, “Computer Networks”, Pearson Education / Prentice Hall of India, 4<sup>th</sup> Edition, 2003
3. Andrew Tannenbaum S, “Computer Networks”, Pearson Education / Prentice Hall of India, 4<sup>th</sup> Edition, 2003

## EE4006 – POWER SYSTEM DYNAMICS

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### UNIT I INTRODUCTION 9

Concept and importance of stability in power system operation and design – Distinction between transient and dynamic stability – Complexity of stability problem in large system – Need for reduced models – Stability of interconnected systems

### UNIT II MACHINE MODELLING 9

Park's transformation – Flux linkage equations – Current space model – Per unit conversion – Normalizing the equations – equivalent circuit – Flux linkage state space model – Sub transient and transient inductances and time constants – Simplified models (one axis and constant flux linkage) – Steady state equations and phasor diagrams

### UNIT III MACHINE CONTROLLERS 9

Exciter and voltage regulators – Function of excitation systems – Types of excitation systems – Typical excitation system configuration – Block diagram and state space representation of IEEE type-1 excitation system – Saturation function – Stabilizing circuit – Function of speed governing systems – Block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines

### UNIT IV TRANSIENT STABILITY 9

State equation for multimachine simulation with one axis model – transient stability simulation of multimachine power system with one axis machine model including excitation system and speed governing system using R-K method of fourth order (Gill's technique) – power system stabilizer

### UNIT V SMALL SIGNAL STABILITY 9

System response to small disturbances – Linear model of the unregulated synchronous machine and its modes of oscillation – Regulated synchronous machine – Linearization of the load equation for the one machine problem – Simplified linear model – Effect of excitation on small-signal stability – Approximate system representation – Supplementary stabilizing signals – Dynamic performance measure, small signal performance measures

**Total: 45**

### TEXT BOOKS

1. P.Kundur, "Power System Stability and Control", McGraw Hill Inc., USA, 1994.
2. P.M. Anderson and A.A.Fouad, "Power System Control and Stability", Galgotia Publications, New Delhi, 2003

### REFERENCE

1. M.A.Pai and W.Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002

## CS4034 – COMPUTER ARCHITECTURE

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### **UNIT I BASIC STRUCTURE OF COMPUTERS 9**

Functional Units – Basic Operational Concepts – Bus Structures – Software Performance – Memory Locations and Addresses – Memory Operations – Instruction and Instruction Sequencing – Addressing Modes – Assembly Language – Basic I/O Operations – Stacks and Queues

### **UNIT II ARITHMETIC UNIT 9**

Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast Multiplication – Integer Division – Floating-Point Numbers and Operations

### **UNIT III BASIC PROCESSING UNIT 9**

Fundamental Concepts – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired Control – Microprogrammed Control – Pipelining – Basic Concepts – Data Hazards – Instruction Hazards – Influence on Instruction Sets – Data Path and Control Consideration – Superscalar Operation – Performance Considerations

### **UNIT IV I/O ORGANIZATION 9**

Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces (PCI – SCSI – USB)

### **UNIT V MEMORY SYSTEM 9**

Memory Concepts – Semiconductor RAMs – ROMs – Speed, Size and Cost – Cache Memories – Performance Considerations – Virtual Memories – Memory Management Requirements – Secondary Storage

**Total: 45**

### **TEXT BOOK**

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5<sup>th</sup> Edition, McGraw Hill, 2002

### **REFERENCES**

1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, 6<sup>th</sup> Edition, Pearson Education, 2003
2. David A Patterson, John L. Hennessy, “Computer Organization and Design The hardware / software interface”, 2<sup>nd</sup> Edition, Morgan Kaufmann, 2002
3. John P Hayes, “Computer Architecture and Organization”, 3<sup>rd</sup> Edition, McGraw Hill, 1998

## CS4035 – OPERATING SYSTEMS

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### **UNIT I FUNDAMENTALS 9**

Concepts – Mainframe systems – Desktop systems – Multiprocessor systems – Distributed systems – Clustered systems – Real time systems – Handheld systems – Hardware protection – System components – Operating system services – System calls – System programs

### **UNIT II PROCESS MANAGEMENT 9**

Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication – Threads – Overview – Threading issues – CPU scheduling – Basic concepts – Scheduling criteria – Scheduling algorithms – Multiple processor scheduling – Real time scheduling – The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors

### **UNIT III DEADLOCKS 9**

System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlocks

### **UNIT IV MEMORY AND FILE MANAGEMENT 9**

Storage management – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging – Virtual memory – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing – File concept – Access methods – Directory structure – File system mounting – File sharing – Protection

### **UNIT V FILE AND I/O SYSTEMS 9**

File system structure – File system implementation – Directory implementation – Allocation methods – Free – Space management – Kernel I/O subsystems – Disk structure – Disk scheduling – Disk management – Swap-Space management – Case Study – The Linux system – Windows

**Total: 45**

### **TEXT BOOK**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, John Wiley & Sons, 6<sup>th</sup> Edition, 2003

### **REFERENCES**

1. Harvey M. Deitel, “Operating Systems”, 2<sup>nd</sup> Edition, Pearson Education, 2002
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall of India, 2003
3. William Stallings, “Operating System”, 4<sup>th</sup> Edition, Prentice Hall of India, 2003

## EE4007 – POWER SYSTEM TRANSIENTS

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### **UNIT I SWITCHING TRANSIENTS 9**

Source of transients – Various types of power systems transients – Effect of transients on power systems – importance of study of transients in planning – Circuit closing transients – RL circuit with sine wave drive – Double frequency transients – Observations in RLC circuit and basic transforms of the RLC circuit – Resistance switching – Equivalent circuit for the resistance switching problems – equivalent circuit for interrupting the resistor current

### **UNIT II LOAD SWITCHING 9**

Equivalent circuit – Waveforms for transient voltage across the load switch – normal and abnormal switching transients – Current suppression – Current chopping – Effective equivalent circuit – Capacitance switching – Effect of source regulation – Capacitance switching with a restrike – With multiple restrikes – Illustration for multiple restriking transients – Ferro resonance

### **UNIT III LIGHTNING TRANSIENTS 9**

Causes of over voltage – Lightning phenomenon – Charge formation in the clouds – Rate of charging of thunder clouds – Mechanisms of lightning strokes – Characteristics of lightning strokes – Factors contributing to good line design – Protection afforded by ground wires – Tower footing resistance – Interaction between lightning and power system – Mathematical model for lightning

### **UNIT IV TRAVELLING WAVES ON TRANSMISSION LINE AND TRANSIENTS 9**

Computation of transients – Transient response of systems with series and shunt lumped parameters and distributed lines – Travelling wave concept – Step response – Bewely's lattice diagram – Standing waves and natural frequencies – Reflection and refraction of travelling waves

### **UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9**

The short line and kilometric fault – Distribution of voltage in a power system – Line dropping and load rejection – Voltage transients on closing and reclosing lines – Over voltage induced by faults – Switching surges on integrated system – EMTP for transient computation

**Total: 45**

### **TEXT BOOKS**

1. Allan Greenwood, "Electrical Transients in Power Systems", Wiley Interscience, New York, 2<sup>nd</sup> Edition 1991
2. R.D.Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Limited, 1986

### **REFERENCE**

1. M.S.Naidu and V.Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2000

## CS4036 – INTERNETWORKING TECHNOLOGY

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### UNIT I COMPUTER NETWORKS 9

Introduction to networks – Network topology – Types of networks – Network architecture – Layering – Design issues – Client / Server model – Protocols – Bridges – Routers – Repeaters – Switches

### UNIT II BASICS OF INTERNETWORKING 9

Introduction to internetworking – Internetworking concepts and architectural model – Internet addressing – Domain Name System (DNS) – Address Resolution Protocol (ARP) – Reverse Address Resolution Protocol (RARP)

### UNIT III INTERNET PROTOCOL AND ITS ROUTING 9

Introduction to IP protocol – Virtual networks – Concept of unreliable delivery – Connectionless delivery system – Purpose on internet protocol – Internet data gram – Data gram options – Introduction to routing – IP data gram – Direct and indirect delivery – Table driven IP routing – Next hop routing

### UNIT IV TRANSMISSION CONTROL PROTOCOL 9

Introduction to TCP – Properties of reliable delivery service – TCP protocol – TCP segment format – TCP connection – TCP state machine – Silly window syndrome

### UNIT V INTERNETWORKING APPLICATIONS 9

Simple Mail Transfer Protocol (SMTP) – Post Office Protocol (POP) – File Transfer Protocol (FTP) – Telnet – Simple Network Management Protocol (SNMP) – Internet security and firewall design

**Total: 45**

### TEXT BOOKS

1. Douglas E. Comer, “Internetworking with TCP/IP Volume 1”, 3<sup>rd</sup> Edition, Prentice Hall, 2001
2. Andrew S. Tananbaum, “Computer Networks”, 4<sup>th</sup> Edition, Prentice Hall of India / Pearson Education, 2003

### REFERENCES

1. Bechrouz A. Forouzan, “TCP/IP Protocol Suite”, 2<sup>nd</sup> Edition, Tata McGraw Hill, 2000
2. William Stallings, “Data and Computer Communications”, 7<sup>th</sup> Edition, Prentice Hall of India / Pearson Education, 2003

## EC4026 – EMBEDDED SYSTEM DESIGN

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### UNIT I REAL TIME CONCEPTS 9

Basic computer architecture – Terminologies – Real time design issues – Examples – Input and output and other devices – Language features

### UNIT II REAL TIME SPECIFICATION AND DESIGN TECHNIQUES 9

Natural languages – Mathematical specification – Flow charts – Structured charts – Pseudo code and programming design languages – Finite state automata – Data flow diagrams – Petri nets – Warnier Orr notation – State charts – Polled loop systems – Phase / state driven code – Coroutines – Interrupt – Driven systems – Foreground/background system – Full featured real time operating systems

### UNIT III INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits

### UNIT IV DEVICES AND BUSES FOR DEVICES NETWORK 9

I/O Devices – Device I/O Types and Examples – Synchronous – Iso-synchronous and Asynchronous Communications from Serial Devices – Examples of Internal Serial – Communication Devices – UART and HDLC – Parallel Port Devices – Sophisticated interfacing features in Devices/Ports – Timer and Counting Devices – ‘12C’, ‘USB’, ‘CAN’ and advanced I/O Serial high speed buses – ISA, PCI, PCI-X, cPCI and advanced buses

### UNIT V EMBEDDED PROGRAMMING IN C, C++ 9

Programming in assembly language (ALP) vs. High Level Language – C Program Elements, Macros and functions – Use of Pointers – NULL Pointers – Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers – Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ – Objected Oriented Programming – Embedded Programming in C++ – ‘C’ Program compilers – Cross compiler – Optimization of memory codes

**Total: 45**

### TEXT BOOKS

1. Rajkamal, “Embedded Systems Architecture”, Programming and Design, Tata McGraw Hill, 2003
2. Philip A.Laplante, “Real time system design and analysis”, An Engineer’s handbook

### REFERENCES

1. Steve Heath, “Embedded Systems Design”, 2<sup>nd</sup> Edition, 2003, Newnes,
2. David E.Simon, “An Embedded Software Primer”, Pearson Education Asia, 2000
3. C.M.Krishna and Kang G Shin, “Real time systems”, Tata McGraw Hill, 1997
4. Stuart Bennelt, “Real time computer control and introduction”, Pearson Education, 2003

## EC4027 – MOBILE COMMUNICATION

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### **UNIT I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9**

Introduction to wireless communication: Evolution of Mobile Communications – Mobile radio systems – Examples – Trends in cellular radio and personal communications – Cellular concept – Frequency reuse – Channel assignment hand off – Interference and system capacity – Tracking and grade of service – improving coverage and capacity in cellular systems

### **UNIT II MOBILE RADIO PROPAGATION 9**

Free space propagation model – Reflection – Diffraction – Scattering – Link budget design – Outdoor propagation models – Indoor propagation models – Small scale multi-path propagation – Impulse model – Small scale multi-path measurements – Parameters of mobile multi-path channels – Types of small scale fading

### **UNIT III MODULATION TECHNIQUES AND EQUALIZATION 9**

Modulation techniques – Minimum shift keying – Gaussian MSK – M-ary QAM – Performance of MSK modulation in slow-flat fading channels – Equalization – Survey of equalization techniques – Linear equalization – Non-linear equalization – Algorithms for adaptive equalization – Diversity Techniques – RAKE receiver

### **UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES 9**

Coding – Vocoder – Linear predictive coders – Selection of speech coders for mobile communication – GSM coders – Multiple access techniques – FDMA – TDMA – CDMA – SDMA – Capacity of cellular CDMA

### **UNIT V WIRELESS SYSTEMS AND STANDARDS 9**

Second generation and third generation wireless network and standards – WLL – Bluetooth – GSM – IS- 95 and DECT

**Total: 45**

### **TEXT BOOK**

1. Rappaport T.S., “Wireless Communications: Principles and Practice”, 2<sup>nd</sup> Edition, Prentice Hall of India/Pearson Education, Third Indian Reprint 2003

### **REFERENCES**

1. Blake R., “Wireless Communication Technology”, Thomson Delmar, 2003
2. Lee W.C.Y., “Mobile Communications Engineering: Theory and Applications”, 2<sup>nd</sup> Edition, McGraw Hill International, 1998
3. Stephen G.Wilson, “Digital Modulation and Coding”, Pearson Education, 2003