SCHEME AND SYLLABI

FOR

THIRD TO EIGHTH SEMESTERS

OF

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

FROM 2009 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM
Scheme for Electrical and Electronics Engineering (EEE) Branch for 3rd to 8th Semesters

### 3rd Semester

<table>
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<tr>
<th>Code</th>
<th>Subject</th>
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### 4th Semester

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### 5th Semester

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Syllabus-B.Tech Electrical & Electronics Engg.
### 6th Semester

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<tr>
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<th>Subject</th>
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### Elective I

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

### 7th Semester

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8th Semester

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Electives for 7th and 8th Semesters

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

GLOBAL ELECTIVES

ME09 L23     Industrial Safety
CS09 L24     Computer Based Numerical Methods
IC09 L23     Bio-Informatics
PE09 L24     Industrial Psychology
PE09 L25     Entrepreneurship
CH09 L23     Nanomaterial and Nanotechnology
BM09 L23     Operation Research

Syllabus-B.Tech Electrical & Electronics Engg. 4
EN09 301: Engineering Mathematics III
(Common for all branches)

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objective
This course provides a quick overview of the concepts and results in complex analysis that may be useful in engineering. Also it gives an introduction to linear algebra and Fourier transform which are wealths of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (13 hours)

Module II: Functions of a Complex Variable (14 hours)

Module III: Linear Algebra (13 hours) - Proofs not required

Module IV: Fourier Transforms (14 hours)

Text Books

Module I:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:
Erwin Kreysig, Advanced Engineering Mathematics, 8e, John Wiley and Sons, Inc.
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:
Bernaed Kolman, David R Hill, Introductory Linear Algebra, An Applied First Course, Pearson Education.
Sections: 6.1, 6.2, 6.3, 6.4, 6.7, 6.8, Appendix.B.1

Module IV:
Sections: 9.1, 9.3, 9.5
Reference books
5. Howard Anton, Chris Rorres, Elementary Linear Algebra, Applications Version, 9e, John Wiley and Sons.
6. Anthony Croft, Robert Davison, Martin Hargreaves, Engineering Mathematics, 3e, Pearson Education.

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EN09 302: Humanities and Communication Skills
(Common for all branches)

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

Objectives

- To identify the most critical issues that confronted particular periods and locations in history
- To identify stages in the development of science and technology
- To understand the purpose and process of communication
- To produce documents reflecting different types of communication such as technical descriptions, proposals, and reports
- To develop a positive attitude and self-confidence in the workplace and
- To develop appropriate social and business ethics.

Module I (14 hours)
Humanities, Science and Technology: Importance of humanities to technology, education and society- Impact of science and technology on the development of modern civilization.
Contributions of ancient civilization: Chinese, Indian, Egyptian and Greek.
Cultural, Industrial, Transportation and Communication revolutions.
Advances in modern India: Achievements in information, communication and space technologies.

Module II (16 hours)
Concept of communication: The speaker/writer and the listener/reader, medium of communication, barriers to communication, accuracy, brevity, clarity and appropriateness
Reading comprehension: Reading at various speeds, different kinds of text for different purposes, reading between lines.
Listening comprehension: Comprehending material delivered at fast speed and spoken material, intelligent listening in interviews
Speaking: Achieving desired clarity and fluency, manipulating paralinguistic features of speaking, task oriented, interpersonal, informal and semi formal speaking, making a short classroom presentation.
Group discussion: Use of persuasive strategies, being polite and firm, handling questions and taking in criticisms on self, turn-taking strategies and effective intervention, use of body language.

Module III (16 hours)
Written Communication : Note making and taking, summarizing, notes and memos, developing notes into text, organization of ideas, cohesion and coherence, paragraph writing, ordering information in space and time, description and argument, comparison and contrast, narrating events chronologically. Writing a rough draft, editing, proof reading, final draft and styling text.

Module IV (14 hours)

Syllabus-B.Tech Electrical & Electronics Engg. 7
Human relations and Professional ethics: Art of dealing with people, empathy and sympathy, hearing and listening. Tension and stress, Methods to handle stress
Responsibilities and rights of engineers- collegiality and loyalty – Respect for authority – Confidentiality – conflicts of interest – Professional rights, Rights of information, Social responsibility.
Senses of ethics – variety of moral issues – Moral dilemma – Moral autonomy – Attributes of an ethical personality – right action – self interest

Reference Books
2. Jayashree Suresh and B S Raghavan, Professional Ethics, S Chand and Company Ltd, 2005
3. Subrayappa, History of Science in India, National Academy of Science, India
6. Jovan van Emden and Lucinda Becker, Effective Communication for Arts and Humanities Students, Palgrave macmillam, 2009
9. Larson E, History of Inventions, Thompson Press India Ltd.
11. Encyclopedia Britannica, History of Science, History of Technology

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

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

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

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

Maximum Total Marks: 70
EE09 303 ELECTRIC CIRCUIT THEORY

Teaching scheme

4 hours lecture and 1 hour tutorial per week

Credits: 5

Objectives

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

Module I (18 hours)

Steady state ac analysis – resonance – series resonance & parallel resonance – bandwidth, quality factor.
Review of 3-phase systems – active, reactive and apparent power in balanced and unbalanced load – 3 wire star & delta, 4 wire star – measurement of power and power factor – 1, 2 & 3 wattmeter methods – neutral shift – symmetrical components – analysis of unbalanced systems using symmetrical components.

Module II (18 hours)


Module III (18 hours)

Symmetrical two port reactive networks as filters – classification – characteristics of filter networks – characteristic impedance, attenuation and phase constant in pass band and stop band, cut off frequency – constant-k filters – low pass, high pass, band pass, band stop – Τ & Π section – m-derived filters – low pass and high pass – Τ & Π section.

Module IV (18 hours)

Network Synthesis – positive real functions and Hurwitz polynomial – synthesis of one port networks with two kinds of elements - LC immittance function – RC impedance/RL admittance
function – RL impedance/RC admittance function – properties – Foster form I & II – Cauer form I & II.

**Text Books**
1. Valkenberg, *Network Analysis*, Prentice-Hall of India
2. K.S. Suresh Kumar, *Electric Circuits & Networks*, Pearson Education
3. Roy Choudhury, *Networks & Systems*, New Age International publishers

**Reference Books**
3. B.C. Kuo, *Network analysis & synthesis* – Wiley-India
5. Richard C. Dorf & J.A. Svoboda, *Introduction to electric circuits*, Wiley-India

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

**University Examination Pattern**

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

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

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

*Maximum Total Marks: 70*
EE09 304 ELECTROMAGNETIC FIELD THEORY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (13 hours)
**Electric Field** - Co-ordinate transformation, Vector fields, Divergence Theorem – Stokes Theorem, Static Electric field : Electric flux, Gauss’s law, Electric scalar potential, Electric dipole moment, Electric field polarization, condition at boundary between dielectrics, method of images, Capacitance of isolated sphere, Capacitance between co-axial cylinder, Capacitance between parallel wires, Energy density in static field – Solution of Laplace’s and Poisson’s equation in electrostatics

Module II (12 hours)
**Magnetic Field** - Steady magnetic field, Conduction current, Conduction current density, Biot-Savart’s Law and Ampere’s Law, Vector potential Concept of inductance, Inductance of solenoid, Toroid Concept of resistance, magnetic moment, Torque on a loop, transmission lines Electromagnetic induction – Faraday’s law.

Module III (15 hours)
**Maxwell’s Equations** - Continuity equation, Displacement current, Maxwell’s equation, Plane waves, Poynting vector and Poynting’s theorem, solutions for free space condition, wave equation for a conducting medium, Harmonically varying field, wave polarization, linear, elliptic and circular polarization

Module IV (14 hours)

Text Books

Reference Books
**Internal Continuous Assessment (Maximum Marks-30)**

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

**University Examination Pattern**

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

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

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

*Maximum Total Marks: 70*
EE09 305 Analog Electronics

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To familiarize basic electronic elements and its characteristic
- To study linear and non linear applications of Opamp

Module I: Diode and transistor (14 hours)
Diode: Diode as a circuit element - Load line - Piecewise linear model - Single phase half wave and full wave rectifier circuits - Voltage regulation - Ripple factor - Rectifier efficiency - Transformer utilization factor - Bridge rectifier - Rectifier filters - Diode clipping circuits - Single level and two level clippers - Clamping circuits - Zener Voltage Regulators
BJT: Operating point of a BJT – DC Biasing - Bias stability - Thermal runaway - AC Concepts – Role of capacitors in amplifiers – Common Emitter AC Equivalent Circuit - Amplifier gain and impedance calculations- h parameter model of a BJT - Common Emitter and Emitter follower analysis and comparison using hybrid equivalent circuit - Considerations in cascading transistor amplifiers- Class B and Class AB - Power amplifiers using BJT
FET: Biasing a JFET and MOSFET - Small signal model - CS and CD amplifiers

Module II: Frequency response of amplifiers and feedback concepts (12 hours)
Feedback: - Concepts – negative and positive feed back – loop gain- advantages of negative feed back -Feedback Connection Types - Practical Feedback Circuits

Module III: Op amp basics and linear applications (13 hours)
Operational amplifier - Ideal op amp properties - Properties of practical opamps - Internally compensated and externally compensated opamps - Analysis of opamp circuits using ideal opamp model – Open loop and Closed loop Configuration-Concept of virtual short and its relation to negative feedback
Linear Op Amp Circuits: Non inverting amplifier -Voltage follower - Inverting amplifier - Summing amplifier - Subtracting circuits - Voltage to current converter for floating and grounded loads - Opamp integrator - Opamp differentiator – Precision rectifiers
Oscillators : Basics - stability and positive feed back- bark hausen’s criterion – phase shift oscillators- wein bridge oscillators – crystal oscillators.

Module IV: Non linear IC applications using Opamp (15 hours)
Signal Generators: Square, triangle and ramp generator circuits using opamps - Effect of slew rate on waveform generation- monostable circuits- Principles of VCO circuits.
Comparator Circuits: Zero Crossing Detector- Regenerative comparator circuits
Active filters –Types- Characteristics- Frequency Response of different types of filters- Order and cut off frequency -Butterworth low pass filter –First order and second order filter design - Sallen and Key second order LP filter - - Butterworth high pass filters - Second order wide band and narrow band filters.

Syllabus-B.Tech Electrical & Electronics Engg.
Timer IC 555: Functional diagram- astable and monostable modes

Text Books
2. A. V. Boylestad and Nashelsky, *Electronic Devices and Circuits*, Prentice Hall of India

Reference Books
2. Theodore F. Bogart Jr., *Electronic Devices and Circuits*,
3. Coughlin and Driscoll, *Operational amplifiers and Linear Integrated Circuits*,

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

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE 09 306 MECHANICAL ENGINEERING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basics of the application of dynamics, heat transfer, fluid mechanics, and hydraulic machines.

(Steam table and Psychometric chart are permitted for the examination.)

Module 1 (13 Hrs.)
Engineering application of thermodynamics - Steam power cycle-Rankine cycle, thermal efficiency, methods of improvement of thermal efficiency - regenerative and reheat. Mollier diagram.
Gas turbine cycle- thermal efficiency, Brayton cycle, methods of improvement of thermal efficiency - regenerative, intercooler and reheat.
Refrigeration-vapour compression refrigeration system, air cycle refrigeration system - bell column cycle, simple air craft refrigeration system-psychometric chart. (Simple numerical problems).

Module 2 (14 Hrs.)

Module 3 (13 Hrs.)
Fluid dynamics Continuity equation, one dimensional flow along a streamline - Euler’s momentum equation, Bernoulli’s equation. Flow measuring instruments-Venturimeter, orifice meter, nozzle meter, notches and weirs, Pitot tubes (simple numerical problems).

Module 4 (14 Hrs.)
Main Parts of a Centrifugal Pump, Work Done by the Centrifugal Pump (or by Impeller) on Water, Definitions of Heads and Efficiencies of a Centrifugal Pump, velocity diagram, Multistage Centrifugal Pumps, Specific Speed of a Centrifugal Pump, Priming of a Centrifugal Pump, Characteristic Curves of Centrifugal Pumps, Cavitation, Maximum Suction Lift (or Suction Height), Net Positive Suction Head (NPSH): Positive displacement pumps- Reciprocating pumps main parts, discharge work done and power required to drive a slip in a reciprocating pump simple (simple problems only).
Turbines, Definitions of Heads and Efficiencies of a Turbine, Classification of Hydraulic Turbines, Pelton Wheel, main parts, Velocity Triangles and Work Done for Pelton Wheel, Radial Flow Reaction Turbines-Francis turbine, main parts, Velocity Triangles and Work Done by water on runner, Degree of Reactions, draft tube, specific speed, Characteristic Curves (simple problems only)

Reference Books
1. Modi & Seth, Fluid Mechanics and Hydraulic machine,
3. Dr.R.K.Bensal, Fluid Mechanics and Hydraulic machine, Laxmi Publications (P) Ltd.
4. Domkundwar & Kothandaraman, Thermal engineering, Dhanpat rai & co. (P) Ltd.
5. P.K.Nag, Engineering thermodynamics, McGraw Hill

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE 09 307(P) BASIC ELECTRICAL ENGINEERING LAB

Teaching Scheme
3 hours practical per week

Credits: 2

Objectives

• Implementation of basic electrical circuits and verification of basic theorems

1. Study of PMMC/MI voltmeter/ammeter, dynamometer type wattmeter, clip on ammeter, analog/digital multimeters and static energy meters.
2. Determination of V-I characteristics of a) wire wound rheostat and b) incandescent lamps in series & parallel.
4. Verification of Kirchoff’s laws in DC circuit
5. Verification of Superposition theorem in DC circuit
6. Verification of Thevenin’s theorem in DC circuit
7. Verification of Reciprocity theorem in DC circuit
8. Determination of impedance, admittance, power factor and real/reactive/apparent power drawn in RLC series/parallel circuits.
9. Single phase power measurement using a) dynamometer type wattmeter b) 3 ammeters method and c) 3 voltmeters method in an RL load.
10. 3-phase power measurement using one wattmeter and two wattmeters.
11. Power factor improvement in an RL circuit

Internal Continuous Assessment (Maximum Marks-50)

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

Semester End Examination (Maximum Marks-50)

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EE09 308(P) ANALOG ELECTRONICS LABORATORY

Teaching Scheme
2 hours per week

Credits: 2

Objectives
- To familiarize the various instruments used in electronics lab
- To familiarize and conduct experiments on various analog electronic circuits
- To introduce the concept of electronic circuit simulation

2. Rectifiers and filters with and without shunt capacitors- Characteristics full wave rectifier- Ripple factor, Rectification efficiency, and % regulation.
3. Second order LP and BP/notch filters using single OPAMP
4. RC coupled amplifier using BJT in CE configuration- Measurement of gain, input and output impedance and frequency response
5. FET amplifier- Measurement of voltage gain, current gain, input and output impedance
6. Characteristics of clipping and clamping circuits using diodes. Characteristics of voltage regulators- Design and testing of: zener regulator with emitter follower output
7. Characteristics of voltage regulators- Design and testing of: a) simple zener voltage regulator b) zener regulator with emitter follower output
8. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator, differentiator, comparator.
9. Phase shift and Wein’s Bridge oscillator with amplitude stabilization using OPAMPs.
10. Waveform generation – Square, triangular and sawtooth wave form generation using OPAMPs.

11. IC 555 Applications
12. PLL IC 565/566 Frequency multiplying, FSK demodulation

13. Introduction to circuit simulation-simulation of OPAMP and other analog IC circuits.

Internal Continuous Assessment (Maximum Marks-50)
60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class
Objectives

The objective of this course is to inculcate the students an adequate understanding of the basic concepts of probability theory to make them develop an interest in the area which may find useful to pursue their studies. Also it is intended to stimulate the students understanding of the Z-transform. A study of some important partial differential equations is also included to make the student get acquainted with the basics of PDE.

Module I: Probability Distributions (13 hours)

Module II: Z Transforms (14 hours)

Module III: Series Solutions of Differential Equations (14 hours)

Module IV: Partial Differential Equations (13 hours)
Introduction – Solutions of equations of the form F(p,q) =0 ; F(x,p,q) =0 ; F(y,p,q) =0 ; F(z,p,q) =0 ; F_1(x,q) = F_2(y,q) ; Clairaut’s form, z = px + qv + F(p,q) ; Lagrange’s form, Pp + Qq = R – Classification of Linear PDE’s – Derivation of one dimensional wave equation and one dimensional heat equation – Solution of these equation by the method of separation of variables – D’Alembert’s solution of one dimensional wave equation.
Text Books

**Module I:**
Richard A Johnson, CB Gupta, *Miller and Freund’s Probability and statistics for Engineers, 7e*, Pearson Education - Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

**Module II:**
P Ramesh Babu, R Ananda Natarajan, *Signals and Systems*, 2e, Scitech Publications. Sections: 10.1, 10.2, 10.3, 10.4, 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 10.5.8, 10.5.12, 10.5.13, 10.6, 10.10

**Module III:**

**Module IV:**

**Reference books**

**Internal Continuous Assessment (Maximum Marks-30)**

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
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*Maximum Total Marks: 70*
EN09 402: Environmental Science
(Common for all branches)

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

Objectives
- To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues and create awareness among the students to address these issues and conserve the environment in a better way.

Module I (8 hours)
The Multidisciplinary nature of environmental science, Definition-scope and importance-need for public awareness. Natural resources, Renewable and non-renewable resources:
Natural resources and associated problems-forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their defects on forests and tribal people.-
water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.- Food resources: World food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.- Energy resources: Growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, Land resources: Land as a resource, land degradation, man induced land slides, soil erosion and desertification.

Module II (8 hours)
Ecosystems-Concept of an ecosystem-structure and function of an ecosystem — producers, consumers, decomposers-energy flow in the ecosystem-Ecological succession- Food chains, food webs and Ecological pyramids-Introduction, types, characteristics features, structure and function of the following ecosystem-Forest ecosystem- Grassland ecosystem –Desert ecosystem-Aquatic ecosystem(ponds, streams, lakes, rivers, oceans, estuaries)
Biodiversity and its consideration
Introduction- Definition: genetic, species and ecosystem diversity-Biogeographical; classification of India — value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values Biodiversity at Global, national, and local level-India at mega — diversity nation— Hot spot of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man, wild life conflicts —Endangered and endemic species of India-Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Module III (10 hours)
Environmental pollution
Definition-Causes, effects and control measures of Air pollution-m Water pollution — soil pollution-Marine pollution-Noise pollution-Thermal pollution-Nuclear hazards-Solid waste management:
Causes, effects and control measures of urban and industrial wastes-Role of an individual in
Module IV (10 hours)
Environment and sustainable development-Sustainable use of natural resources-Conversion of renewable energy resources into other forms-case studies-Problems related to energy and Energy auditing-Water conservation, rain water harvesting, water shed management-case studies-Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust-Waste land reclamation-Consumerism and waste products-Reduce, reuse and recycling of products-Value education.

Text Books

Reference Books.
1. Raghavan Nambiar, K Text book of Environmental Studies, Nallpat Publishers, Kochi
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, Email: mapin@icenet.net
4. Down to Earth, Centre for Science and Environment
5. Hawkins, R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay

Internal Continuous Assessment (Maximum Marks-30)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as Report of field work, literature survey, seminar etc.
10% - Regularity in the class

Note: Field work can be Visit to a local area to document environmental assets-river/forest/grass land/mountain or Visit to local polluted site-urban/rural/industrial/agricultural etc. or Study of common plants, insects, birds etc. or Study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources, management of wastes etc.

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 403 SIGNALS AND SYSTEMS

Teaching scheme

4 hours lecture and 1 hour tutorial per week

Credits: 5

Objective

• Understand the concepts of signals and systems

Module 1 (18 hours)


Module II (22 hours)


Steady state solution of electric circuits with non-sinusoidal periodic inputs using Fourier series – effective values of voltages and currents – power due to non-sinusoidal voltages and currents. [R.B. 4]


Module III (16 hours)


Module IV (16 hours)

conditions – zero input response and zero state response - system function – poles and zeros – basic concept of BIBO stability.

Text Books

Reference Books
4. Roy Choudhury, *Networks & Systems*, New Age International publishers

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

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 404 DC MACHINES & TRANSFORMERS

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Objectives

- Understanding the basic working principles of electrical machines
- Analysing the performance of electrical machines
- Conducting the performance analysis of a given electrical machine

Module 1 (12 hours)


Module II (12 hours)


Module III (14 hours)


Module IV (14 hours)

### Text Books
1. Clayton & Hancock, *Performance & Design of DC machines*, ELBS

### Reference Books

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

### University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 405 DIGITAL ELECTRONICS

Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

• Creation of awareness about the basic principles of digital electronics.
• Study of the logic design techniques.
• Understanding the concepts behind the hardware implementation of a digital computer.

Module I (14 Hours)
Logic Families

Module II (13 Hours)
Combinational Circuits
Ideal Logic Gates-Truth Tables of basic gates- Number Systems-Binary Numbers-Hexadecimal Numbers-Complements- Signed and unsigned numbers-one’s complement and two’s complement-Arithmetic operations of Binary and Hexadecimal Numbers-Binary codes - Boolean Functions-CANonical and Standard forms-Simplification of Boolean Functions by Karnaugh Map up to five variable map-NAND, NOR implementation –Multilevel NAND and NOR circuits-Code Converters — Adders-Subtractors-BCD Adder-Magnitude Comparator-Decoders and Encoders-Multiplexers and Demultiplexers Implementation of Combinational Logic by using Multiplexers, ROM, PLA and PAL

Module III (13 Hours)
Sequential Circuits and Memories

Module IV (14 Hours)
Computer Organization fundamentals- basic micro computer elements- data bus- control bus-address bus - arithmetic logic units- program counter- flag- instructions- single and multibyte
instructions- basic micro computer operations – Introduction to 8085 microprocessor – Architecture – Basic Programming concepts. Introduction to VHDL-structural modeling with simple examples.

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

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

*Maximum Total Marks: 70*
EE09 406 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
• Understanding the basic working principle of electrical measuring instruments
• To design and calibrate an electrical measuring instruments
• Develop an instrumentation system for a particular application

Module I (14 hours)
Indicating Instruments: principle- Types of controls (spring and gravity controls) and Types of Damping (eddy current, air friction), Moving coil instruments - Permanent magnet, dynamometer type meters, Moving iron instruments – attraction and repulsion type, Dynamometer wattmeter – principles and torque equation – Classification of errors - errors in indicating instruments and compensation, Current transformers and Potential transformers – Phasor diagram – ratio and phase angle errors – use of instrument transformers with wattmeter

Module II (14 hours)
Watt meters and Energy Meters: Principle of working of ampere hour meter (AH mercury motor meter), single and three phase energy meters (principles and torque equation) – errors and compensation, static wattmeter’s and energy meters - principle and block diagram, power factor meters (Dynamometer type –single and three phase), vibrating reed frequency meter.
AC bridges: Measurements of inductance using Maxwell and Anderson bridges – measurements of capacitance using Schering Bridge
Magnetic measurements: Measurement of flux, magnetizing force and permeability – Hibbert’s magnetic standard – flux meter – Hall Effect gauss meter

Module III (14 hours)
Transducers: Definition - different types of transducers – criteria for selection –general characteristics –dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications
Module IV (12 hours)
Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications)

Text Books
1. Earnest O Doblin, Measurement system application and design, McGraw Hill
2. A.K. Sawhney, A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai and sons

References
1. William David Cooper, Electronic Instrumentation and Measurement Techniques, Prentice Hall, India
2. K.B. Klaassan, Electronic Measurements and Instrumentation, Cambridge University Press
3. John Bentley, Principles of Measurements Systems, Pearson Education

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 407(P): Mechanical Engineering Lab

Teaching scheme
3 hours practical per week

Credits: 2

Objectives
- To strengthen the knowledge on principles of fluid mechanics and hydraulic machineries through experiments.
- To equip the students to carry out experiments, and to train them to analyse, report and infer the results.
- To acquaint the students with the measurement of various mechanical parameters.

1. Study of plumbing tools and pipe fittings
2. Study of discharge measuring instruments
3. Measurement of pressure and velocity
4. Calibration of venturimeter, orifice meter, notches and weirs, nozzle meters, and rotameters
5. Pipe friction – minor losses in pipes - verification of Bernoulli’s theorem
6. Performance of turbines – operating characteristics: Pelton and Francis turbine
7. Performance of pumps: Centrifugal and Reciprocating pumps
8. Study of heat transfer equipments
9. Measurement of thermal conductivity of a metal rod
10. Performance studies on a shell and tube heat exchanger
11. Study of systems of petrol and diesel engines
12. Constant speed performance characteristics of petrol and diesel engines.

Reference Books

2. J. P. Holman, Experimental methods for Engineers, McGraw Hill
3. D. G. Shepherd, Principles of Turbo Machinery, Mc Millan
5. P. L. Bellani, Thermal Engineering, Khanna Publishers

Internal Continuous Assessment (Maximum Marks-50)
60%- Laboratory practical and record
30%- Test/s
10%- Regularity in the class
Objective

- Calibration of various electrical measuring instruments
- Measurement of different physical parameters using transducers

MEASUREMENTS LAB
1. a) Calibration of single phase energy meter by direct loading
   b) Calibration of single phase static energy meter
2. Calibration of single phase energy meter by phantom loading with and without phase shifting transformer
3. Calibration of 3 phase energy meter a) phantom loading b) using phase shifting transformer
4. Measurement of self and mutual inductance a) air cored coil b) iron cored coil
5. a) Determination of B-H curve
   b) Determination of hysteresis loop using six point method
6. Calibration of ammeter, voltmeter and wattmeter using vernier potentiometer

INSTRUMENTATION LAB
1. Measurement of resistance using Wheatstone’s Bridge and Kelvin Double bridge
2. Extension of range of wattmeter using CT & PT
3. Measurement of displacement using LVDT
4. Measurement of current/voltage using Hall effect transducer
5. Thermocouple based ON–OFF controller
6. Measurement of physical quantities – strain, torque and angle
7. Measurement of temperature by RTD method

Internal Continuous Assessment (Maximum Marks-50)
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

Semester End Examination (Maximum Marks-50)
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record
EE09 501 Synchronous and Induction Machines

Teaching scheme

4 hours lecture and 1 hour tutorial per week

Credits: 5

Objectives

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

Module I (18 hours)

Module II (20 hours)

Module III (18 hours)

Module IV (16 hours)

Text Books

Reference Books

Internal Continuous Assessment *(Maximum Marks-30)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
University Examination Pattern

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

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

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

Maximum Total Marks: 70

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**EE09 502 ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION**

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

**Module I (14 Hrs)**

**Module II (13 Hrs)**
Overhead Transmission Systems: Arrangement of conductors, calculation of sag and tension, transmission line supports and their location, economic span, choice of transmission voltage, line insulation types, string efficiency, impulse ratio, arcing horns and rings, failure of insulation.  
Corona: Disruptive critical voltage, advantages and disadvantages of corona
Module III (14 Hrs)
Distribution systems – classification and arrangement of distribution systems – Voltage drop calculations in radial and ring mains – comparison of different systems - DC, AC - single phase, three phase 3 wire - 4 wire systems

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

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

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

Reference Books

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
Objective

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

Module 1 (13 Hrs)
Principle of Automatic control - Open loop and closed loop systems – examples

Module II (14 Hrs)

Module III(14 Hrs)

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

Module IV (13 Hrs)

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

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

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

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

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

Maximum Total Marks: 70
EE09 504 POWER ELECTRONICS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

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

Module 1 (13 Hrs)
Silicon Controlled Rectifier-structure- V-I Characteristics- Two transistor analogy- turn-on
methods – gate triggering circuits-turn on characteristics- turn-off characteristics-methods of
commutation - series and parallel connection of SCRs-structure and characteristics of GTO
thyristors, power diodes, power transistors, power MOSFET and IGBT-working of TRIAC-DIAC.
Comparison of Power Semiconductor devices.

Module II (14 Hrs)
Phase control using SCR-single phase half wave converters with R and RL loads- single
phase half controlled and fully controlled bridge converter with R and RL loads- output
voltage and waveforms-principle of discontinuous operation- fully controlled and half controlled 3 phase bridge converter- output voltage and waveforms- dual converter- Inverters-single phase series and parallel inverters-single phase bridge inverter- 3 phase bridge inverter-120° and 180° operation-PWM inverters using single pulse, multiple pulse and SPWM techniques.

Module III( 13 Hrs)
Choppers-step down chopper-principle of operation-classes of chopper - step up chopper-Four quadrant operation of a chopper with motor load- single phase to single phase cycloconverters- principle of operation-single phase ac regulator-R and RL loads.

Module IV (14 Hrs)
Switching regulators-buck regulators-boost regulators- buck boost regulators- cuk regulators- Principle of operation- Continuous Conduction Mode-Output voltage equation-switched mode power supply- push pull converter - principle of operation and analysis-comparison with linear power supply-. Applications (block diagram approach) –induction cooking- electronic ballast- ups

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<tbody>
<tr>
<td>1. Singh MD &amp; Khanchandani KB, Power Electronics, Mc Graw Hill</td>
</tr>
<tr>
<td>2. Dubey.G.K., Thyristorised Power Controllers,</td>
</tr>
<tr>
<td>3. Ashfaq Ahmed, Power Electronics for Technology, Pearson Education</td>
</tr>
<tr>
<td>4. P.S. Bimbhra, Power Electronics</td>
</tr>
</tbody>
</table>

Internal Continuous Assessment (Maximum Marks-30)

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 505: DIGITAL SYSTEM DESIGN

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (14 hours)
Hardware description languages-HDL based digital design-VHDL hardware description language- Program structure-Types, constants and arrays-Functions and procedures-libraries and packages-structural design elements-data flow design elements- behavioral design elements-time dimension-simulation-test benches-VHDL features for sequential logic design.

Module II (13 hours)
Combinational logic design-analysis procedure-design procedure-documentation-block diagram-gate symbols-signal names and active levels-bubble-to- bubble logic design.
signal namings in HDL programs-schematic structures. Circuit timing- timing diagrams-
propagation delay- timing specifications.
Design using VHDL-decoders-encoders-tri state devices-multiplexer-parity generators-
comparators- adders- subtractors and ALUs —combinational multiplexers.

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

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

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**Text Books**

**Reference Books**
1. Ian Grout, *Digital Systems Design with FPGAs*, Elsevier.
2. Volnei A Pedroni *Digital Electronics and Design with VHDL*, Elsevier
3. R Padmanabhan, B Bala Tripura Sundari, *Design through Verilog HDL*, Wiley India
4. David Money Harris and Sarah L Harris, *Digital Design and Computer Architecture*,
Elsevier
Education, Delhi, 2002
McGraw Hill
**Objectives**
- To study the properties of various materials used in Electrical Engineering
- Selection of proper material for a particular application

**Module 1 (9 hours)**
**Conducting materials:** Review of metallic conduction on the basis of free electron theory - Fermi-Dirac distribution - Variation of conductivity with temperature and composition - Contact potential - Materials for electric resistances, brushes of electrical machines, lamp filaments, fuses and solders.

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

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

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**University Examination Pattern**

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

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

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

Maximum Total Marks: 70

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**EE09 506 ELECTRICAL MATERIAL SCIENCE**

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

**Credits:** 3

**Module 1 (9 hours)**
**Conducting materials:** Review of metallic conduction on the basis of free electron theory - Fermi-Dirac distribution - Variation of conductivity with temperature and composition - Contact potential - Materials for electric resistances, brushes of electrical machines, lamp filaments, fuses and solders.

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

Module II (9 hours)
Dielectrics: Dielectric polarization under static fields - Derivation of the expression for electronic polarization in monatomic gases - Expressions for electronic, ionic and dipolar polarizations in polyatomic gases - Derivation of expression for polarization in solids and liquids - Clausius - Mosotti relation - Behaviour of dielectrics in alternating fields - Complex dielectric constant - Dipolar relaxation - Dielectric loss - Ferro electricity - Main features - Domain theory and explanation of hysteresis curve - (qualitative explanations only)

Module III (9 hours)
Dielectric breakdown: Mechanism of breakdown in gases, liquids and solids - Factors influencing dielectric strength - Capacitor materials.
Insulating materials: Good insulator properties and classification on temperature basis - Common insulator materials used in electrical apparatus - Inorganic materials (Mica, glass, porcelain, asbestos) - Organic materials (Paper, rubber, cotton silk fibre, wood, plastics, bakelite) - Resins and varnishes - Liquid insulators (transformer oil) - Gaseous insulators (air, SF6, and hydrogen) - Ageing of insulators.

Module IV (9 Hrs)

Text Books

Reference Books

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

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

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

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

Maximum Total Marks: 70

EE09 507(P) ELECTRICAL MACHINES LAB I

Teaching Scheme
3 hours per week

Credits: 2

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

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

Objectives:
- a) Predetermine the OCC at different speeds
- b) Determine the critical field resistance
- c) Obtain maximum voltage built up with given shunt field resistance
- c) Obtain critical speed for a given shunt field resistance
2. Load test on DC shunt generator
   **Objectives:**
   a) Determine the external & internal characteristics
   b) Deduce the armature reaction curve

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

4. Perform Swinburne’s test on a DC shunt machine
   **Objectives:**
   Predetermine the armature current and percentage efficiency when the machine operates as a motor and as a generator for various load conditions and plot efficiency Vs output curves.

5. Hopkinson’s test on a pair of DC machines
   **Objectives:**
   Determination of the efficiency of the given dc shunt machine working as a motor and generator under various load conditions.

6. Retardation test on a DC machine
   **Objectives:**
   a) Separation of hysteresis, eddy current, friction & windage losses
   b) Find the moment of inertia of the rotating system

7. No load test at different excitations on a DC shunt motor
   **Objectives:**
   a) Separation of hysteresis, eddy current, friction & windage losses
   b) Plot the losses vs. speed curves

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

9. Load test on the single phase transformer
   **Objectives:**
   a) Determination of the efficiency at different load conditions and unity power factor
   b) Determination of the regulation at different load conditions and unity power factor
   c) Plot efficient vs. output & regulation Vs output curves
10. Separation of losses in a single phase transformer

**Objectives:**
Separate the hysteresis & eddy current losses at different voltages & different frequencies keeping V/f constant & plot losses vs. frequency curves. Hence
- i) Separate the hysteresis & eddy current losses at normal voltage & different frequencies & plot losses vs. frequency curves
- ii) Separate the hysteresis & eddy current losses at normal frequency & different voltages & plot losses vs. voltage curves.

11. Sumpner’s test

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

12. Scott connection of the single phase transformers

**Objectives:**
Determine the efficiency at different load conditions when
- a) Main transformer alone loaded
- b) Teaser transformer alone loaded
- c) both transformers loaded under balanced conditions
- d) both transformers loaded under unbalanced conditions
Plot efficiency vs. output curves for each case.

**Internal Continuous Assessment (Maximum Marks-50)**
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

**Semester End Examination (Maximum Marks-50)**
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record

**Teaching Scheme**
- 3 hours per week

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

1. Design of Half adder and half subtractor circuits with NAND gates using mode control.
2. Design and realization of ripple counter using JK flip-flop.
3. Design and realization of Johnson & Ring Counter using a) JK Flip Flop b) Shift Register
4. Synchronous UP/DOWN Counter design and realization.
5. Implementation of multiplexer and demultiplexer using gates.
6. Logic circuit implementation using multiplexer IC.
7. VHDL implementation of adder circuit and three bit counter.
8. VHDL simulation of adder circuit and counter.
9. 8085 simple programming addition, data transfer, multiplication.
10. 8085 interfacing – waveform generation-square wave generation, saw-tooth wave and triangular wave.

**Internal Continuous Assessment (Maximum Marks-50)**

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

**Semester End Examination (Maximum Marks-50)**

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

**EE09 601 MICROPROCESSORS AND MICROCONTROLLERS**

**Teaching scheme**

4 hours lecture and 1 hour tutorial per week

**Credits:** 5

**Objectives**

- Understanding the architecture and programming of 8086 microprocessor.
- Interfacing the microprocessor with the peripherals for a specific application.
- Understanding the architecture, programming and interfacing of basic microcontrollers.

**Module I (Architecture of 8086 and Pentium) (16Hours)**

Types and priority – Interrupt vector table – Software interrupts – Non maskable interrupts. Direct memory access - Introduction to Pentium microprocessor – Special features - Pentium registers – Pentium memory management

Module II (Assembly Language Programming) (20 Hours)

Module III (Interfacing with 8086) (18hours)

Module IV (Microcontroller 8051) (18 Hours)

Text Books

Reference Books
2. Brey B.B., The Intel Microprocessor system – Architecture, programming and Interfacing
3. Hall D.V., Microprocessor and Interfacing , Tata McGraw Hill
4. Dr. K. Uma RAo, Dr. Andhe Pallavi, The 8051 Microcontroller, Sanguine Technical Publishers
EE 09 602: Engineering Economics and Principles of Management  
(Common for AI, EE, BM, and IC)

Teaching scheme  
3 hours lecture and 1 hour tutorial per week

Credits: 4

Section 1: Engineering Economics

Objective
Impart fundamental economic principles that can assist engineers to make more efficient and economical decisions.

Module1 (14 Hrs)
Economic reasoning, Circular Flow in an economy, Law of supply and demand, Economic efficiency. Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Private and

Module II (13 Hrs)

Text books


Internal Continuous Assessment (Maximum Marks-15)

- 60% - Tests (minimum 2)
- 30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
- 10% - Regularity in the class
University Examination Pattern – for Section 1
Note: Section 1 and Section 2 are to be answered in separate answer books

PART A: Short answer questions (one/two sentences) 2 x 2 marks = 4 marks
1 x 1 mark = 1 mark
All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

PART B: Analytical/Problem solving questions 2 x 5 marks = 10 marks
Candidates have to answer two questions out of three. There should be at least one question from each module and not more than two questions from any module.

PART C: Descriptive/Analytical/Problem solving questions 2 x 10 marks = 20 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 35

Section 2: Principles of Management

Objective

- To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams

Module I (13 hours)
Principles of management – Evolution of management theory and functions of management
Organizational structure – Principle and types. Decision making – Strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree
Human resource management – Basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations

Module II (14 hours)
**Internal Continuous Assessment (Maximum Marks-15)**

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

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**References**

2. Lucy C Morse and Daniel L Babcock, *Managing engineering and technology*, Pearson Prentice Hall
8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India

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**University Examination Pattern – for Section 2**

*Note: Section 1 and Section 2 are to be answered in separate answer books*

**PART A:** Short answer questions (one/two sentences)  
2 x 2 marks = 4 marks  
1 x 1 mark = 1 mark

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

**PART B:** Analytical/Problem solving questions  
2 x 5 marks = 10 marks

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

**PART C:** Descriptive/Analytical/Problem solving questions  
2 x 10 marks = 20 marks

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

*Maximum Total Marks: 35*
EE09 603 MODERN CONTROL THEORY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give an overview of system analysis and design based on state space techniques for linear and non-linear systems.

Module I (12 Hours)
State Space Analysis - Concept of State, state variables, state vector and state space - comparison with transfer function approach - state models for typical electrical, mechanical and electro-mechanical systems - state space representation of linear time-invariant systems - phase variable form - Diagonalisation - Diagonal and Jordan canonical forms - Transfer function from state model - State transition matrix - properties - Continuous and Discrete time state model - Introduction to CS tool box in Matlab.

Module II (15 Hours)
Non-linear Systems - Introduction - Characteristics of non-linear systems - Types of non-linearities - Phase plane analysis - Construction of phase trajectory - Isocline method - Singular points - Classification of singular points - Describing function Analysis - Basis of Describing function approach - Definition - Describing functions of common non-linearities namely dead zone, saturation, ideal relay, combined dead zone and saturation, relay with hysteresis - Application of describing function for the stability analysis - Amplitude and frequency of limit cycle using DF.

Module III (13 Hours)

Module IV (14 Hours)
Controllability and Observability - Concept and criteria for controllability and observability - Transfer function and controllability/observability - State Feedback - Design for continuous and discrete systems via pole placement.

Introduction to optimal control - Formulation of the optimal control problem - Typical optimal control performance measures - Optimal control based on Quadratic performance measures - Infinite time regulator problem - Solution of reduced matrix Ricatti equation.
Text Books

Reference Books
5. A. Anand Kumar, *Control Systems*, PHI

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 604 ELECTRIC DRIVES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

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

Module I (13 Hours)

Module II (12 Hours)
Dc motor drives – basic equations – constant torque and constant power control – fully controlled converter fed DC drives – continuous and discontinuous operation – three phase controlled rectifier fed dc drives – Four quadrant operation of drive using dual converter- Chopper fed dc drives- closed loop control scheme for control below and above base speed

Module III (15 Hours)

Module IV (14 Hours)
Synchronous motor drives – Cylindrical rotor motors - Salient pole motors - Reluctance motors - Permanent Magnet ac motor drives-sinusoidal PMAC-Brushless DC (Trapezoidal PMAC) motor drives – Switched reluctance motors-closed loop control of synchronous motors - Stepper motor control.
Traction: Important features of traction drives-Conventional DC and AC traction drives – DC & AC traction using PWM VSI SCIM drives

Text Books
1. Dubey G. K., Fundamentals of Electric Drives
2. M. H. Rashid, Power Electronics Circuits, Devices and Applications, Prentice Hall of India

Reference Books
2. B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

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**University Examination Pattern**

**PART A:** *Short answer questions (one/two sentences)*

5 x 2 marks = 10 marks

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

**PART B:** *Analytical/Problem solving questions*

4 x 5 marks = 20 marks

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

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
EE09 605 ELECTRICAL ENGINEERING DRAWING

Objectives

- To make students to be able to plan and draw different views of electrical machines and transformers
- To make the students to draw different types of windings used in electrical machines
- Introduction to AutoCAD in Electrical engineering drawing

Module I (12 Hours)

DC Winding: Simplex lap and wave dc armature windings.

AC Winding: Mush and concentric type single layer three phase ac armature windings.

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

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

Module II (14 Hours)

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

Substation Layouts:

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

Module III (26 hours)

DC Machines:

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

Alternators:

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

Teaching scheme

3 hours drawing per week

Credits: 3

Text Books


Reference Books

2. Clayton and Hancock, Performance and design of dc machines, ELBS.
4. Say M.G, Performance and design of AC machines, Pitman, ELBS
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<td>Q II  - 2 questions A and B of 20 marks from Module II with choice to answer any one.</td>
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<tr>
<td>Q III - 2 questions of 35 marks from Module III with choice to answer any one</td>
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**University of Calicut**

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

**Credits:** 4

**Objective**
- To provide the basic ideas of mathematical modelling and analysis of electric machines

**Module I (15 Hours)**

**Modeling and analysis of DC machines:** Introduction to generalized machine theory-diagrammatic representation of generalized machine-formation of emf equations-expression s for power and torque-representation of D C machines.

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

**Module II (14 Hours)**

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

**Module III (13 Hours)**

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

**Module IV (12 Hours)**

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

**Text Books**


**Reference Books**


**Internal Continuous Assessment (Maximum Marks-30)**

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

**University Examination Pattern**

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

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

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

*Maximum Total Marks: 70*

**EE09 L 02 NUMERICAL ANALYSIS AND OPTIMIZATION TECHNIQUES**

Syllabus-B.Tech Electrical & Electronics Engg. 62
Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

• To impart knowledge in:
  o Finding the numerical solution of algebraic and transcendental equations
  o Finding the solution of a system of linear algebraic equations
  o Finding the numerical solution of ordinary and partial differential equations
  o Different optimization techniques

Module I (14 Hours)


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

Module II (14 Hours)


Module III (13 Hours)


Module IV (13 Hours)

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

Text Books


Reference Books

1. S. S. Sasthry, *Numerical Analysis*, Prentice Hall of India
Internal Continuous Assessment (Maximum Marks-30)

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70

EE09 L03 COMPUTER ORGANISATION AND ARCHITECTURE

Teaching scheme  
3 hours lecture and 1 hour tutorial per week

Credits: 4

Syllabus-B.Tech Electrical & Electronics Engg.
**Objective**

**Module I (15 Hours)**
Computer abstraction and technology - basic principles - historical perspective - measuring performance - relating the metrics, evaluating, comparing and summarizing performance - case study: SPEC95 benchmark - instructions - operations and operands of the computer hardware - representing instructions - making decision - supporting procedures - beyond numbers - other styles of addressing - starting a program - case study - 80x86 instructions

**Module II (13 Hours)**
Computer arithmetic - signed and unsigned numbers - addition and subtraction - logical operations - constructing an ALU - multiplication and division - floating point - case study - floating point in 80x86 - the processor - building a data path - simple and multicycle implementations - microprogramming - exceptions - case study - pentium pro implementation

**Module III (14 Hours)**
Pipelining - overview - pipelined datapath - control - pipeline hazards - exceptions - superscalar and dynamic pipelining - case study - Pentium pro pipeline - memory hierarchy - caches - cache performance - virtual memory - common framework for memory hierarchies - case study - Pentium pro memory hierarchy

**Module IV (12 Hours)**
Input/output - I/O performance measures, types and characteristics of I/O devices - buses - interfaces in I/O devices - design of an I/O system - multiprocessors - programming - bus and network connected multiprocessors - clusters - network topologies

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**University Examination Pattern**

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

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

**PART B:** *Analytical/Problem solving questions*

4 x 5 marks = 20 marks

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

**PART C:** *Descriptive/Analytical/Problem solving questions*

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

Module I (20 Hours)
Entrepreneurial perspectives - understanding of entrepreneurship process - entrepreneurial decision process - entrepreneurship and economic development - characteristics of entrepreneur - entrepreneurial competencies - managerial functions for enterprise

Module II (10 Hours)
Process of business opportunity identification and evaluation - industrial policy - environment - market survey and market assessment - project report preparation - study of feasibility and viability of a project - assessment of risk in the industry

Module III (12 Hours)
Process and strategies for starting a venture - stages of small business growth - entrepreneurship in international environment - entrepreneurship - achievement motivation - time management creativity and innovation structure of the enterprise - planning, implementation and growth

Module IV (12 Hours)
Technology acquisition for small units - formalities to be completed for setting up a small scale unit - forms of organizations for small scale units - financing of project and working capital - venture capital and other equity assistance available - break even analysis and economic ratios technology transfer and business incubation

Reference Books
4. Peter F. Drucker, Innovation and Entrepreneurship, Elsevier India Pvt. Ltd.
6. Dr. Patel V. G., Seven Business Crisis, Tata McGraw Hill

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

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

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

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

Maximum Total Marks: 70

EE09 L05 BIO- MEDICAL ENGINEERING
Teaching scheme

3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- This course gives a brief introduction to human physiology and presents various instrumentations system for measurement and analysis of physiological parameters.

Module I (13 hours)
Development of biomedical instrumentation, biometrics, man instrument system components block diagram, physiological systems of the body (brief discussion on Heart and cardio vascular system, Anatomy of nervous system, Physiology of respiratory systems) problems encountered in biomedical measurements.
Sources of bioelectric potentials – resting and action potentials - propagation of action potentials – bio electric potentials example (ECG, EEG, EMG, ERG, EOG, EGG etc.)

Module II (15 hours)
Cardiac pacemakers – internal and external pacemakers, defibrillators.

Module III (13 hours)
Ventilators, artificial heart valves, heart lung machine, hemodialysis, lithotripsy, infant incubators

Module IV (13 hours)
X-rays- principles of generation, uses of X-rays- diagnostic still picture, fluoroscopy, angiography, endoscopy, diathermy. Basic principle of computed tomography, magnetic resonance imaging system and nuclear medicine system – radiation therapy. Ultrasonic imaging system - introduction and basic principle.
Text Books

2. J. G. Webster, *Medical Instrumentation, Application and Design*, John Wiley and Sons

Reference Books


Internal Continuous Assessment (Maximum Marks-30)

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

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*

EE09 607(P) ELECTRICAL MACHINES LAB II
University of Calicut

**Teaching Scheme**

3 hours per week

**Credits:** 2

**Objective**

- To conduct various tests on different ac machines and transformers and to study the performance.

1. No load & blocked rotor tests on 3 phase squirrel cage & slip ring induction motors

   **Objectives:**
   
   i) Determine the equivalent circuit parameters and hence predetermine the performance at full load from the equivalent circuit and
   
   ii) Draw the circle diagram and hence predetermine the performance at full load from circle diagram.
   
   iii) Plot the performance characteristics from circle diagram

2. Brake test on 3 phase squirrel cage & slip ring induction motors

   **Objectives:**
   
   1) Plot the following performance characteristics.
      
      a) Electrical characteristics – Speed, line current, torque, power factor, efficiency & % slip Vs output power
      
      b) Mechanical characteristics – Torque Vs speed/slip
   
   2) Find the additional kVAR required to improve the power factor to 0.95 at various loads.

3. Performance of induction machine as a generator and motor

   **Objectives:**
   
   i) Operate the given 3 phase induction machine as a) induction motor and b) induction generator
   
   ii) Conduct load test in both generating and motor modes
   
   iii) Plot efficiency vs. output curves
   
   iv) Plot output vs. slip and hence determine the hysteresis power.

4. Slip test on 3-phase salient pole alternator

   **Objectives:**
   
   i) Determine the direct axis and quadrature axis synchronous reactances
   
   ii) Predetermine the voltage regulation at different loads and power factors and plot regulation vs. power factor
   
   iii) Draw the power vs. torque angle characteristics for a specified induced emf.

5. Voltage regulation of alternator

   **Objectives:**
   
   Predetermine the voltage regulation of the given 3 phase alternator by i) emf method ii) mmf method and iii) Zero power factor (Potier) method.

6. Load test on pole changing induction motor
Objectives:
   i) Study the different modes of operation of a 3 phase pole changing induction motor
   ii) Perform load test on pole changing induction motor and plot the various performance characteristics for low speed and high speed operation.

7. No load & blocked rotor tests on single phase induction motor
Objectives:
   i) Conduct the no load and blocked rotor tests on single phase induction motor
   ii) Find the equivalent circuit parameters
   iii) Predetermine its performance at rated speed.

8. V curves on synchronous machine
Objectives:
   i) Synchronize a 3 phase alternator to the supply mains using Dark/Bright lamp method
   ii) Plot the V curves and inverted V curves when synchronous machine is acting as generator and motor at no load and constant power.

9. Speed control of induction motor by variable frequency method
Objectives:
   Control the speed of the 3 phase induction motor by changing the supply frequency on no load and at given load and plot the speed vs. frequency curve.

Internal Continuous Assessment (Maximum Marks-50)
60% - Laboratory practical and record
30% - Test/s
10% - Regularity in the class

Semester End Examination (Maximum Marks-50)
70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record
EE09 608 (P) MINI PROJECT

Teaching scheme
3 hours practical per week

Objectives

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into a working model of an electrical/electronic system.

- For enabling the students to gain experience in organisation and implementation of a small project and thus acquire the necessary confidence to carry out main project in the final year.

In this practical course, each group consisting of three/four members is expected to design and develop a moderately complex electrical/electronic system with practical applications; this should be a working model. The basic concepts of product design may be taken into consideration while designing the project. A committee consisting of minimum three faculty members will perform assessment of the mini project. Students have to submit a report on the mini project and demonstrate the mini project before the evaluation committee.

50% of the total marks to be awarded by the guide/Co-ordinator and the remaining 50% by the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum marks - 50)</th>
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<tbody>
<tr>
<td>40% - Design and development</td>
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<tr>
<td>30% - Final result and Demonstration</td>
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<tr>
<td>20% - Report</td>
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<tr>
<td>10% - Regularity in the class</td>
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<th>Semester End Examination (Maximum Marks-50)</th>
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<tbody>
<tr>
<td>20% - Demonstration of mini project</td>
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<tr>
<td>50% - Practical test connected with mini project</td>
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<tr>
<td>20% - Viva voce</td>
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<tr>
<td>10% - Final Report</td>
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EE09 701 POWER SYSTEM ANALYSIS

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Objective
- Development of a power system model
- Analysing the power system model under normal and abnormal conditions

Module I (18 Hours)
Representation of power systems – one line diagrams, impedance and reactance diagrams, per unit and percent quantities, primitive networks, Y-bus matrix formulation by singular transformation and Direct determination, Z-bus matrices – Building algorithm.
Load flow studies: problem formulation, classification of buses, Gauss –Seidal method, Newton -Raphson method and fast decoupled load flow method

Module II (18 Hours)
Economic load dispatch: system constraints, unit commitment, economic dispatch of thermal plants neglecting line losses, optimum load dispatch including transmission line losses, exact transmission loss formula, automatic load dispatching, hydrothermal coordination.
Speed governing mechanism: speed governing of turbo generator, load sharing and governor characteristics, transfer function model, Load Frequency Control, Automatic Voltage Regulation

Module III (18 Hours)
Short circuit studies: Faults on power systems, three phase to ground faults, SLG, DLG, LL faults, Sequence impedance and sequence networks, symmetrical component methods of analysis of unsymmetrical faults at the terminals of an unloaded generator, Faults on power systems, fault analysis using Z-bus, faults through impedance, short circuit capacity of a bus and circuit breaker rating

Module IV (20 Hours)
Power system stability studies, steady state transient and dynamic stability, electrical

University Examination Pattern

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

Text Books

Reference Books
3. B. F. Wollenberg, Power System Engineering
**Internal Continuous Assessment (Maximum Marks-30)**

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

**University Examination Pattern**

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

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

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

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

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

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

*Maximum Total Marks: 70*
EE09 702 ANALOG AND DIGITAL COMMUNICATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To impart the basic concepts of analog & digital modulation schemes
- To develop understanding about power line communication.

Module I (14 hours)
Amplitude Modulation: spectrum power relations-Modulator and demodulator circuits-AM transmitter block diagram-TRF and superheterodyne receivers-Principles of different types of transmission. Frequency Modulation: Modulation index-Spectrum of FM signal-JFET reactance modulator-FET transmitter block diagram-Foster seeley discriminator.pre-emphasis and de-emphasis.

Module II (14 hours)

Module III (13 hours)
Digital pass band transmission: principles of ASK,PSK and FSK (qualitative level) Multiple Access: TDM-FDM-CDMA-Frequency hopped and direct sequence CDMA. Computer network:-circuit switching- packet switching –basic concept of OSI

Module IV (13 hours)
Power line carrier Communication: Principle, purpose, types of coupling, Interface equipment and communication standards. Power line modems and networks, Digital PLCC, broadband over powerline, Applications

Text Books
2. Dennis Roddy and John Coolen, ‘Electronic Communication Systems’ PHI

Reference Books
2. Simon Haykin, ‘Digital Communication’, Wiley India
3. Ziemmer,’Principles Of Communication, Wiley India, New Delhi,5Ed., 2009
### Internal Continuous Assessment (Maximum Marks-30)

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### University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 703 DIGITAL SIGNAL PROCESSING

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

Objective
- To study the various methods for the analysis of digital systems
- Design a digital filter for the given specifications
- To study the architecture of digital signal processors

Module I (10 Hours)

Module II (8 Hours)

Module III (10 Hours)

Module IV (8 Hours)

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

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

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

Maximum Total Marks: 70
# University of Calicut

## Syllabus-B.Tech Electrical & Electronics Engg.

### Internal Continuous Assessment (Maximum Marks-30)

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### Text Books

### Reference Books

### University Examination Pattern

#### PART A:
**Short answer questions (one/two sentences)**

5 x 2 marks=10 marks

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

#### PART B:
**Analytical/Problem solving questions**

4 x 5 marks=20 marks

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

#### PART C:
**Descriptive/Analytical/Problem solving questions**

4 x 10 marks=40 marks

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

Maximum Total Marks: 70
EE09 704 ELECTRICAL MACHINE DESIGN

Teaching scheme
2 hours lecture and 1 hour tutorial per week

Credits: 3

Objective
• Design of Electrical machines and transformers for the given specifications

Module I (9 Hours)
DC Machines: Output equation – Main dimensions – Choice of specific electric and magnetic loadings – Choice of speed and number of poles – Design of armature conductors, slots and winding – Design of air-gap, field system, commutator, interpoles, compensating winding and brushes – Carter’s coefficient – Real and apparent flux density – Design examples.

Module II (9 Hours)

Module III (9 Hours)
Alternators: Salient pole and turbo alternators – Output equation – Main dimensions – choice of specific electric and magnetic loadings – choice of speed and number of poles – design of armature conductors, slots and winding – Design of air-gap, field system and damper winding – prediction of open circuit characteristics and regulation of the alternator based on design data – design examples

Module IV (9 Hours)
Induction machines: Output equation – Main dimensions – choice of specific electric and magnetic loadings – Design of stator and rotor windings, stator and rotor slots and air-gap of slip ring and squirrel cage motors – calculation of rotor bar and end ring currents in cage rotor – calculation of equivalent circuit parameters and prediction of magnetizing current based on design data – Design examples

Text Books

Reference Books
1. Clayton & Hancock, Performance and Design of DC Machines, ELBS
2. Say M. G., Performance and Design of AC machines, Pitman, ELBS
3. Bhattacharya, Electrical Machine Design
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

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**University Examination Pattern**

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

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

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

*Maximum Total Marks: 70*
University of Calicut

**EE09 707(P) POWER ELECTRONICS LAB**

**Teaching Scheme**
3 hours per week

**Credits**: 2

**Objective**
- *To familiarize different power electronic devices and circuits*

1. Characteristics of SCR
   - Aim: To plot static and dynamic characteristics of SCR
2. Phase Control using R and RC firing
   - Aim: Analysis of load voltage for different firing angles for Rand RC firing
3. UJT Trigger circuit with Single phase controlled Rectifier
   - Aim: Obtain the load voltage waveform
4. AC Voltage Controller using TRIAC
   - Aim: Speed Control of fan using TRIAC
5. Single Phase fully Controlled SCR Bridge circuit
   - Aim: To study the operation of single phase full converter with RL load & with and without FD
6. IGBT based PWM inverter
   - Aim: To control the output of the IGBT based inverter using PWM technique
7. Step down Chopper using MOSFET
   - Aim: To obtain the output voltage waveform for resistive load
8. Simulation of PWM inverter
   - Aim: To simulate three phase PWM inverter for RL load using SPWM
9. Simulation of three phase bridge converter
   - Aim: To simulate three phase bridge converter for RL load
10. Simulation and Analysis of Performance of DC motor with different control schemes(PID, Fuzzy, ANFIS etc)
11. Simulation and Analysis of three phase induction motor drives with different control schemes(Voltage, V/f)
12. Design and Simulation of Buck Converter

**Internal Continuous Assessment (Maximum Marks-50)**
- 60% - Laboratory practical and record
- 30% - Test/s
- 10% - Regularity in the class

**Semester End Examination (Maximum Marks-50)**
- 70% - Procedure, conducting experiment, results, tabulation, and inference
- 20% - Viva voce
- 10% - Fair record

Syllabus-B.Tech Electrical & Electronics Engg. 82
EE09 708(P) ADVANCED ELECTRICAL ENGINEERING LAB

Objective

- Familiarisation control system concepts using hardware and simulation experiments
- Experiments on microprocessors and microcontrollers and its interfacing
- Simulation study and analysis of power system circuits

1. Determination of transfer function of DC motor a) armature control b) field control
2. Design and experimental determination of frequency response of lead/lag networks
3. Experiments using PLC
4. Relay characteristics
5. Study of 8086 microprocessor and implementation of simple programs
6. Study of 8051 microcontroller and implementation of simple programs
7. Interfacing an ADC with microcontroller to read an analogue signal
8. Generate a square wave, saw tooth wave and triangular wave using 8051 microcontroller
9. Generate a sine wave using 8051 microcontroller
10. Familiarization with MATLAB – simple programs
11. Simulation using MATLAB, SIMULINK, RL tool etc.
12. Familiarization of P, PI, PD & PID controllers
13. Power flow analysis of the system with the given single line diagram using the given power flow analysis package.
14. Transient stability analysis of the system with the given single line diagram using the given package. The disturbance is 3-phase to ground solid SC fault at t=0. The fault is cleared at time t=5 cycles by permanently removing the fault line.
15. Experiments by interfacing transducers like strain gauge, LVDT etc with 8085/8086.

Note: Any 10 experiments out of these 15 experiments need be done. The list of experiments given in EE09 708(P) Advanced Electrical Engineering Lab may be updated as and when required to suit the technological developments, with the approval of concerned body.

Internal Continuous Assessment (Maximum Marks-50)

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

Semester End Examination (Maximum Marks-50)

- 70% Procedure, conducting experiment, results, tabulation, and inference
- 20% Viva voce
- 10% Fair record
EE09 709 (P) PROJECT

Teaching scheme
1 hour practical per week

Credit: 1

Objectives

- To judge the capacity of the students in converting the theoretical knowledge into practical systems/investigative analysis.

Project work is for duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project may be implemented using software, hardware, or a combination of both. The project work may be undertaken in electrical power systems / machines/ electronics / computer / instrumentation / biomedical engg. or any allied area and must have relevance in electrical or electronics engineering. Project evaluation committee consisting of the guide and three/four faculty members specialised in the above field. will perform the screening and evaluation of the projects.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee shall study the feasibility of each project work before giving consent.

Students should execute the project work using the facilities of the institute. However, external projects can be taken up in reputed industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

Each student has to submit an interim report of the project at the end of the 7th semester. Members of the group will present the project details and progress of the project before the committee at the end of the 7th semester.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment</th>
<th>:</th>
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</thead>
<tbody>
<tr>
<td>20% - Technical relevance of the project</td>
<td></td>
</tr>
<tr>
<td>40% - Literature survey and data collection</td>
<td></td>
</tr>
<tr>
<td>20% - Progress of the project and presentation</td>
<td></td>
</tr>
<tr>
<td>10% - Report</td>
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<tr>
<td>10% - Regularity in the class</td>
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</tbody>
</table>
EE09 801 ELECTRICAL SYSTEM DESIGN

Teaching scheme
4 hours lecture and 1 hour tutorial per week

Credits: 5

Objectives
- To impart the basic concepts of various electrical installations
- To study the design and estimation of different electrical installations.

Module I (17 hours)

Accessories and protective devices: Load break switches, Switch Fuse Units, Fuse Switches, Circuit Breakers: MCB, MCCB, ELCB, ACB, OCB and VCB - Different types of fuses - Protection against over load
Service connections - Reception and distribution of main supply - Schematic and wiring diagrams - Estimation of wiring materials used for a small residential building - Neutral and earth wire - Earth bus - Design of earthing systems: pipe earthing.

Module II (19 hours)
Load Factor - Demand Factor - Diversity Factor - Design of LT panels - Electrical installations of high rise buildings: Design - Schematic diagram - Layout - Design of Main Supply Board (MSB) and Distribution Boards (DB’s) including air conditioners and lifts with provision for standby generators and its protection - Grading - Estimation of material required - Safety aspects - Electrical installation of commercial buildings - Safety aspects - Selection of LT cables - Cinema Act - Electrical installation in a cinema theater
Design of UPS systems for computer labs and IT industries - Effect of harmonics and harmonic elimination - Parallelizing of UPS Systems - Automatic Power Factor Correction (APFC).

Module III (18 hours)
Design of HT and EHT installations: Selection of EHV and HV power and distribution transformers and switchgears - Case studies - Design - Layout - Schematic diagram - (a) 16 MVA - 110/11KV outdoor substation having one or two incoming and 8 or less outgoing - (b) 11KV/415V outdoor substations upto 630KVA - (c) 11KV/415V indoor substation upto 630KVA - Design of earthing systems: Measurement of earth resistance using earth megger - Standards - Earthmat design - Design of plate earthing - Shielding of electrical system - Lightning protection of buildings.

Module IV (18 hours)
Reference Books
4. ER. V. K. Jain & ER. Amitabh Bajaj, Design of Electrical Installations, Lakshmi Publications
6. ABB Switchgear Manual

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 802 POWER SYSTEM PROTECTION AND UTILIZATION

Teaching scheme
2 hours lecture and 1 hour tutorial per week

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

Module I (8 hours)
Protective Relays: Protective zones, requirement of protective relaying, different types of relays and their applications, generalized theory of relays, protection scheme for generator, transformers, lines and busbars.

Module II (10 hours)
Circuit Breakers: Principles of operation, different types and their operations, ABCB, oil CB, SF6, vacuum CB, circuit breaker ratings, cause of over voltages, protection against lightning, earth wires, lightning diverters, surge absorbers, arcing ground, neutral earthing, basic concepts of insulation levels and their selection, BIL, coordination of insulation.

Module III (8 hours)
Static relays: Amplitude and phase comparators, block diagrams of static relays, microprocessor based protective relaying - over current & impedance relays. Introduction to numerical relays
Surges and traveling waves, voltage waves on transmission line, reflection and attenuation,

Module IV (10 hours)
Electric Traction: Systems of traction, speed time curve, mechanics of traction, braking, power supply, systems of current collection.
Electric Heating: Advantage of electric heating, resistance and induction arc furnaces, construction and field of application, high frequency power supply and the principle and application of dielectric heating

Text Books
8. Soni, Gupta and Bhatnagar, A Course in Electrical Power, Dhanpat Rai & Sons

Reference Books
1. Madhav Rao, Introduction to Static Relays,
2. BadriRam, D. N. Viswakarma, Power System Protection and Switch Gear, Tata McGraw Hill.

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

Syllabus-B.Tech Electrical & Electronics Engg. 87
<table>
<thead>
<tr>
<th>PART A:</th>
<th>Short answer questions (one/two sentences)</th>
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<table>
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<tr>
<th>PART B:</th>
<th>Analytical/Problem solving questions</th>
<th>4 x 5 marks = 20 marks</th>
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<tr>
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<td>Candidates have to answer four questions out of six. There should be at least one question from each Module and not more than two questions from any Module.</td>
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<tr>
<th>PART C:</th>
<th>Descriptive/Analytical/Problem solving questions</th>
<th>4 x 10 marks = 40 marks</th>
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<tbody>
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<td></td>
<td>Two questions from each Module with choice to answer one question.</td>
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Maximum Total Marks: 70
EE09 805(P) SEMINAR

Teaching scheme
3 hours per week

Credits: 2

Objective

- To assess the ability of the student to study and present a seminar on a topic of current relevance in electrical/electronics/computer/ biomedical/ instrumentation engg. or allied areas.

It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report, based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members will evaluate the seminar.

Internal Continuous Assessment (Maximum marks – 100)
20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar
EE09 806 (P) PROJECT

Teaching scheme

11 hours practical per week

This project work is the continuation of the project initiated in seventh semester. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through progress seminars and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation.

Each project group should complete the project work in the 8th semester. Each student is expected to prepare a report in the prescribed format, based on the project work. Members of the group will present the relevance, design, implementation, and results of the project before the project evaluation committee comprising of the guide, and three/four faculty members specialised in electrical power system / machines/ electronics/ computer/ instrumentation/ biomedical Engg. etc.

50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

<table>
<thead>
<tr>
<th>Internal Continuous Assessment (Maximum Marks-100)</th>
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<tbody>
<tr>
<td>40% - Design and development/Simulation and analysis</td>
</tr>
<tr>
<td>30% - Presentation &amp; demonstration of results</td>
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<tr>
<td>20% - Report</td>
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<tr>
<td>10% - Regularity</td>
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Objective

- To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. Course, mini project, seminar, and project. There is only university examination for viva-voce. University will appoint two external examiners and an internal examiner for viva-voce. These examiners shall be senior faculty members having minimum five years teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of mini project, seminar, and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce.

Allotment of marks for viva-voce shall be as given below.

<table>
<thead>
<tr>
<th>Assessment in Viva-voce (Maxim marks – 100)</th>
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<tbody>
<tr>
<td>40% - Subjects</td>
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<tr>
<td>30% - Project and Mini Project</td>
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<tr>
<td>20% - Seminar</td>
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<tr>
<td>10% - Industrial training/industrial visit/educational tour or Paper presented at National-level</td>
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Electives for 7\textsuperscript{th} & 8\textsuperscript{th} Semester
EE09 L06 SPECIAL ELECTRICAL MACHINES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To introduce special types of electric machines and their controls for special applications.

Module I (12hours)
Stepping Motors - Constructional features, principle of operation, modes of excitation, single phase stepping motors, torque production in variable Reluctance (VR) stepping motor, Dynamic characteristics, Drive systems and circuit for open loop control, Closed loop control of stepping motor, microprocessor based controller.

Module II (12hours)
Synchronous Reluctance Motors-Constructional features: axial and radial air gap Motors. Operating principle, reluctance torque – Phasor diagram, motor characteristics.

Module III (15hours)
Permanent Magnet Brushless DC Motors - Commutation in DC motors, Difference between mechanical and electronic commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Torque and emf equation, Torque-speed characteristics, Controllers-Microprocessor based controller. Sensorless control.

Module IV (15hours)
Permanent Magnet Synchronous Motors - Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self control, Vector control, Current control schemes. Sensor less control.

Text Books
4. Athani V.V. “stepper motors – Fundamentals, Applications &Design” New Age International

Reference Books
### Internal Continuous Assessment *(Maximum Marks-30)*

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

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### University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 L07 DIGITAL CONTROL SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To familiarise digital controllers.
- To understand the analysis and design of digital control system.

Module I (12 Hours)
Introduction to discrete time control system- Block diagram of a digital control system-
Typical examples- Sampling process- Data reconstruction and hold circuits-Zero and first
order hold- Review of z- transforms and inverse z- transforms- solution of difference
equations- pulse transfer function- pulse transfer function with dead time- system time
response- Realization of pulse transfer functions( Digital Controllers)- Direct
Programming- Standard Programming- Series programming- parallel programming-
ladder programming.

Module II (16 Hours)
Review of stability analysis in z- plane- Jury’s stability test and extension of Routh’s stability
criterion to discrete systems- Transient and Steady state response analysis- transient response
specifications- steady state error analysis- Construction of root loci- effect of sampling period on
transient response specifications- frequency response specifications- Nyquist stability criterion in
the z- plane- Digital Controllers- PI, PD & PID Controllers- Lag, lead, and lag-lead compensators-
Design of lag compensator and lead compensator based on root locus and Bode plot approaches

Module III (14 Hours)
State Space analysis of digital control systems- state space representation of discrete time systems-
Transfer function from state model- Diagonal/ Jordan Canonical forms from transfer function-
Solution of linear time invariant discrete time state equations- discretization of continuous time
space equation- representing state models in CCF, OCF, DCF/ JCF using transformation matrix

Module IV (12 Hours)
Concept of controllability and observability for a linear time invariant discrete time control
system- condition for controllability and observability- state feedback- condition for arbitrary pole
placement- design via pole placement- state observers- design of full order state observer.

Text Books
1. K. Ogata, *Discrete- time control systems*, Pearson Education

Reference Books
1. B. C. Kuo, *Digital Control Systems*, Prentice Hall
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

**University Examination Pattern**

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

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

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

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

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

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

*Maximum Total Marks: 70*
EE09 L08 VLSI DESIGN

Objective

- Overview of VLSI System Design and fabrication

Module I (12 Hours)

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

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

Module II (17 Hours)

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

Module III (12 Hours)

Layout Design Rules: Need for design rules - Mead conway design rules for the silicon gate nMOS process - CMOS nwell-Pwell1 design rules - Simple layout examples - Sheet resistance - Area capacitance - Wiring capacitance - Drive large capacitive loads. (8)

Module IV (13 Hours)

Logic Design: Switch logic - Pass transistor and transmission gate - Gate logic - Inverter

Text Books
1. Douglas A. Pucknell and Kamran Eshraghian, Basic VLSI design, Prentice Hall of India, New Delhi
3. Amar Mukherjee, Introduction to nMos and CMOS VLSI System Design, Prentice Hall, USA.,

Reference Books
1. Caver Mead and LyTUI Conway, Introduction to VLSI Systems, Addison- Wesley, USA.
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

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**University Examination Pattern**

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

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

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

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

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

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

*Maximum Total Marks: 70*
Objective

- To familiarise with the different renewable energy resources
- To give a fundamental knowledge of electricity billing, energy conservation and management.

Module I (12 Hours)

Concept of renewable energy - Various forms of renewable energy - solar energy - wind energy - bio energy - geothermal energy - wave and tidal energy - Applications and advantages of renewable energy - potential of renewable energy in India.

Fundamentals of energy conversion using solar - photovoltaic - fuel cell - biogas - wind mini-hydel and tidal resources - cogeneration

Module II (15 Hours)

**Electrical system:** Electricity billing - Time of Use Billing or TOD metering - electrical load management and maximum demand control - power factor improvement and its benefits - selection and location of capacitors

**Electric motors:** Types - losses in induction motors - motor efficiency - energy efficient motors - factors affecting energy efficiency and minimizing motor losses in operation.

Module III (15 Hours)

**Energy Economics:** Cost benefit analysis - simple payback period method - Internal rate of return - Net present value method - Life cycle costing - Risk analysis - Depreciation.

**Energy conservation:** Importance - energy saving measures in DG set - fans and blowers - pumps - air conditioning system - energy efficient lighting controls - energy efficient transformers.

Module IV (11 Hours)

**Energy management & audit:** Energy Management Methods - Demand Management methods - Audit - Definition - Importance and types of energy audit - Steps in energy audit - Energy Conservation Options - Energy management (audit) approach - Specific energy Consumption - case study in an educational Institution (Class Assignment).
Text Books

Reference Books

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 L 10 SWITCHED MODE POWER CONVERTERS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Module I (16 Hours)
Linear Power supplies- Introduction to Switched Mode DC-to-DC Converter - Step-down converters - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Discontinuous conduction mode with constant output voltage- Output voltage ripple
Step-up converters - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Discontinuous conduction mode
Buck Boost converters - Continuous Conduction mode – Boundary between continuous and discontinuous conduction – Output voltage ripple – Cuk dc-dc converter
Full Bridge dc-dc Converter – PWM with bipolar voltage and unipolar voltage Switching – dc-dc converter comparison

Module II (14 Hours)
Introduction to Switched Mode DC-to-AC Converter – Basic concepts – PWM switching scheme – square wave switching scheme – single and three phase inverters – switching utilization – ripple in inverter output – effect of blanking time on voltage in PWM inverters
Square wave pulse switching – programmed harmonic elimination switching – current regulated modulation

Module III (12 Hours)
Resonant Converters- Introduction – Switch mode inductive current switching – Zero voltage and Zero current switching
Classification of Resonant Converters – Basic Resonant Circuit concepts – Load Resonant Converters – Series Loaded and Parallel Loaded Resonant dc-dc converters (Discontinuous conduction mode only) - Resonant switch Converters (ZCS and ZVS)

Module IV (12 Hours)

**Text Books**

**Reference Books**
**Internal Continuous Assessment** *(Maximum Marks-30)*

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

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**University Examination Pattern**

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

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

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

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

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

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

*Maximum Total Marks: 70*
Objectives

- To instill moral and social values and loyalty.
- To appreciate the rights of others.
- To create an awareness on Engineering Ethics and Human Values.

Module I (15 hours)
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. Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

Module II (12 hours)

Module III (15 hours)
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) IE(I), Indian Institute of Materials Management, IETE (Institution of electronics and telecommunication engineers ,India), etc.

Module IV (12 hours)
Text Books

Reference Books

Internal Continuous Assessment (*Maximum Marks-30*)

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

University Examination Pattern

**PART A:** Short answer questions (one/two sentences)  \(5 \times 2 \text{ marks}=10 \text{ marks}\)

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

**PART B:** Analytical/Problem solving questions  \(4 \times 5 \text{ marks}=20 \text{ marks}\)

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

**PART C:** Descriptive/Analytical/Problem solving questions  \(4 \times 10 \text{ marks}=40 \text{ marks}\)

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

*Maximum Total Marks: 70*
EE09 L12 EMBEDDED SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give sufficient background for undertaking embedded system design
- To introduce students to the embedded systems, its hardware and software.
- To introduce devices and buses used for embedded networking
- To explain programming concepts and embedded programming in C and C++
- To explain real time operating systems, inter-task communication and an exemplary case of MUCOS- IIRTOS

Module I (10 hours)
Introduction to Embedded Systems: 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

Module II (12 hours)
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

Module III (12 hours)

Module IV (20 hours)
Case Definition – Multiple Tasks and their functions – Creating a list of tasks – Functions and 
IPCs – Exemplary Coding Steps.

**Text Books**

**Reference Books**

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

**University Examination Pattern**

**PART A: Short answer questions (one/two sentences)**

5 x 2 marks=10 marks
All questions are compulsory. There should be at least one question from each Module and not more than two questions from any Module.

**PART B: Analytical/Problem solving questions**

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

**PART C: Descriptive/Analytical/Problem solving questions**

4 x 10 marks=40 marks
Two questions from each Module with choice to answer one question.

*Maximum Total Marks: 70*
EE09 L13 HIGH VOLTAGE ENGINEERING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objective
- To study the breakdown mechanisms in electrical insulators
- To study the generation and measurement of high AC, DC and impulse voltages
- Testing of high voltage equipments

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

Module II (13 Hours)

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

Module IV (13 Hours)

University Examination Pattern

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

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

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

Maximum Total Marks: 70
Text Books

Reference Books
9. **Indian Standards:**
   IS: 2070-1962  IS:2070- 1962
   IS: 2544- 1963  IS: 2079- 1962
   IS:2099-1962  IS:2026-1962
   IS:166-1962  IS:5959- 1970

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

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 L14 ADVANCED TOPICS IN POWER SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

• To understand the concepts of power electronics based conversion and its variations that enable different power systems applications.
• To study the fundamentals of HVDC transmission and the various topologies.
• To study the technology of various FACTS devices and their application to improve power system operation.
• To introduce the basic concepts on power sector restructuring and market reforms.

Module I (15 hours)
Types and characteristics of high-power devices-Thyristor based converters with gate turn-on and synchronous converters with gate turn-off devices- Basic concepts on voltage source converters and current sourced converters-Current source versus voltage source converters- various options to meet high converter ratings. Introduction to HVDC transmission - EHV AC versus HVDC Transmission, Kinds of DC links -power flow through HVDC link, equation-HVDC power flow, effect of delay angle and angle of advance

Module II (14 hours)
Transmission interconnections-Power Flow in AC System – stability considerations -controllable parameters. Definitions on FACTS - Basic Types of FACTS Controllers- FACTS Concept and General System Considerations- Static shunt and series compensators-objectives of shunt compensation-objectives of series compensation-

Module III (15 hours)
SVC and STATCOM- basic Operation - Comparison between SVC and STATCOM - STATCOM for transient and dynamic stability enhancement. TCSC and SSSC- basic Operation- comparison between TCSC and SSSC - SSR and its damping. Unified Power Flow Controller-basic Operation -Comparison with other FACTS devices

Module IV (10 hours)
Vertically integrated utility and its traditional regulated structure- Why Deregulation - Restructure models - Functional units- GENCOS, DISCOS, TRANSCOS, ISO, PX, TSP, - Distributed generation and spot prices- Transmission open Access - Power wheeling
Text Books

Reference Books
4. Adamson C. Hingorani N. G., HVDC Transmission

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
EE09 L15 ADVANCED POWER SYSTEM ANALYSIS AND CONTROL

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
• To prepare students for a career as power system engineers with a basic understanding of modern tools and practices
• To impart an understanding of the activities in load dispatch centers
• To instill an awareness of current research topics

Module I (12 hours)
Optimization: Economic Dispatch- Definition- Problem formulation, assumptions and solution algorithm using Lagrangian for both exact and approximate coordination equations
Unit Commitment- Problem Definition- System constraints- Priority ordering- Dynamic programming
Optimal Power Flow - Problem statement- Lagrangian Solution method- Algorithm- How violations of control and dependant variables are treated
Hydrothermal scheduling- Problem modeling and statement - Discretization- solution algorithm

Module II (15 hours)
Power System Security: Definition- Security functions- State transition diagram- selection of contingency and modeling for analysis- Contingency analysis using (a) sensitivity method- derivation of generalized constants- Analysis of a contingency case of removal of a line or transformer of series impedance $Z_s$
(b) using ac load flow method

Module III (13 hours)
State Estimation: Introduction to SCADA - block diagram concept -definition of state estimation and requirement for an estimator- Problem statement and LSE and weighted LSE - Basic solution- Sequential solution- extension to power system

Module IV (14 hours)
Control area concepts -P-f control of single control area- ACE- Two area control- tie line bias control - extension to pool operation or multi control area systems – ABT (and a case study in India)- control issues in deregulated power markets.
**Text books**


2. O. I. Elgard, *Electrical Energy System Theory: An Introduction* ,

**Reference Books**


**Internal Continuous Assessment (Maximum Marks-30)**

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

**University Examination Pattern**

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

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

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

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

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

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

Maximum Total Marks: 70
EE09 L16 OPTIMAL CONTROL THEORY

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
• To give an overview of the optimal control problem and different solution methods.

Module I (12 hours)

Module II (14 hours)

Module III (14 hours)

Module IV (14 hours)

Text Books

Reference Books

Internal Continuous Assessment (Maximum Marks-30)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
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*Maximum Total Marks: 70*
EE09 L17 DIGITAL IMAGE PROCESSING

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures
- To study the image segmentation and representation techniques.

Module I (12 hours)

Module II (18 hours)

Module III (12 hours)

Module IV (12hours)
Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors-

Text Books

Reference Books
Internal Continuous Assessment (Maximum Marks-30)

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

University Examination Pattern

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

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

Maximum Total Marks: 70
Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- The students acquire a comprehensive idea on the various aspects of planning on power system

Module I (12 hours)
Forecasting-Needs uses and current status of forecasting- Fundamentals of quantitative forecasting- Explanatory and time serious forecasting-least square estimates- Peak load forecasting- Accuracy of forecasting methods. Regression methods- Box Jenkins time serious methods.

Module II (18 hours)
Problems facing electricity industry-Long term forecasting techniques-Methods of long term forecasting- spatial load forecasting- Multivariate procedures-Short term forecasting techniques-

Module III (12 hours)
Forecasting and planning. The role of forecasting in planning-Comparison and selection of forecasting methods _ The accuracy of forecasting methods- Pattern of the Data and its effects on individual forecasting methods- Time horizon effects on forecasting methods.

Module IV (12hours)
Generation planning-Fundamental economic analysis-Generation planning optimized according to generating unit categories-distribution & Transmission system planning.

Text Books

References
1. Makridakis, Spyros, Forecasting Methods and Applications, John Wiley & Sons.

Internal Continuous Assessment (Maximum Marks-30)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
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Maximum Total Marks: 70
EE09 L19 POWER QUALITY ISSUES AND REMEDIAL MEASURES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To understand the various Power Quality issues and its mitigation techniques.

Module I (12 hours)

Module II (16 hours)

Module III (14 hours)
Power factor improvement - Passive Compensation - Passive Filtering - Harmonic Resonance - Impedance Scan Analysis - Active Power Factor Corrected Single Phase Front End - Control Methods for Single Phase APFC - Three Phase APFC and Control Techniques - PFC Based on Bilateral Single Phase and Three Phase Converter - static var compensators - SVC and STATCOM

Module IV (12 hours)
Active Harmonic Filtering - Shunt Injection Filter for single phase, three-phase three-wire and three-phase four-wire systems - d-q domain control of three phase shunt active filters - UPS - constant voltage transformers - series active power filtering techniques for harmonic cancellation and isolation . Dynamic Voltage Restorers for sag, swell and flicker problems.
Grounding and wiring - introduction - NEC grounding requirements - reasons for grounding - typical grounding and wiring problems - solutions to grounding and wiring problems.

References
Internal Continuous Assessment *(Maximum Marks-30)*

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

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*Maximum Total Marks: 70*
EE09 L20 MANAGEMENT INFORMATION SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To understand the relationships among management, information, and systems.
- To understand how information technology can be used by a business organization to gain a competitive advantage.
- To understand the types of information systems that are needed to support the various levels of a business enterprise and the process of analyzing, designing, and developing an information system.

Module I (12 hours)

Module II (18 hours)

Module III (12 hours)

MODULE IV (12 Hours)

Text Book:
1. “Management Information Systems”, S.Sadagopan, PHI, 1/e, 2005

References:
Internal Continuous Assessment *(Maximum Marks-30)*

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

University Examination Pattern

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

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

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

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

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

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

*Maximum Total Marks: 70*
EE09 L 21 ORGANIZATIONAL BEHAVIOR

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To develop positive attitude, leadership qualities, effective organizational skills and to attain proficiency in communication skills

Module I (12 hours)

Module II (14 hours)

Module III (13 hours)

Module IV (13 hours)
Organizational Change – Nature and Factors – Resistance to Change – Organizational Effectiveness – Approach to measure Organizational Effectiveness.
Organizational Development – Concept of Organizational Development – Organizational Development Interventions - Values and Organizational Development.

Text Books
2. L. M. Prasad, Organizational Behavior, S. Chand & Sons.

Reference Books
2. Luthans, Organizational Behavior, McGraw Hill International

Internal Continuous Assessment (Maximum Marks-30)
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class
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Maximum Total Marks: 70
EE09 L 22 SOFT COMPUTING TECHNIQUES

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

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

Module I (12 Hours)

Module II (14 Hours)

Module III (14 Hours)

Module IV (14 Hours)
Text Books

Reference Books

Internal Continuous Assessment *(Maximum Marks-30)*

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**Note:** *One of the assignments may be simulation of soft computing systems using any technical software*

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 L23 PROCESS CONTROL AND INSTRUMENTATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To create an awareness of the different transducers used in industry and signal conditioning
- To familiarize the process control elements and their control characteristics

Module I (8 hours)
Signal Conditioning – Analog – Digital - Signal conversions - Process Control Principles - Identification of elements, block diagram, the loop, control system evaluation stability, regulation, evaluation criteria, and cyclic response.

Module II (10 hours)

Module III (12hours)

Module IV (14hours)
Control Loop Characteristics: Control system configurations, cascade control, multivariable control, feed forward control, Split range control, inferential control, Adaptive control, control system quality – loop disturbance, optimum control, measure of quality, Stability, process loop tuning

Text Books

Reference Books
1. Curtis D. Johnson, Microprocessors in Process Control, PHI
2. George Stephanopoulis, Chemical Process Control
3. Caughner, Process Analysis and Control
4. Deshpande and Ash, Elements of computer process control of Industrial processes, ISA

**Internal Continuous Assessment (Maximum Marks-30)**

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

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**University Examination Pattern**

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

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

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

*Maximum Total Marks: 70*
EE09 L24 MECHATRONICS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:
• To provide knowledge on the fundamentals of mechatronics, Numerical control machine tools, part programming and robotics.

Module I (14 hours)
Fundamentals of numerical control-advantages of NC systems- Classification of NC systems-Point to point and contouring systems- NC and CNC – Incremental and absolute systems-Open loop and closed loop systems-features of NC machine tools- Fundamentals of machining-Design consideration of NC machine tools-Methods of improving machine accuracy and productivity-Special tool holders

Module II (13 hours)

Module III (13 hours)

Module IV (14 hours)

References
Internal Continuous Assessment *(Maximum Marks-30)*

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

University Examination Pattern

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

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

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

*Maximum Total Marks: 70*
EE09 L 25 ROBOTICS AND AUTOMATION

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
• To give an introduction of industrial robotics and automation

Module I (14 Hours)

Module II (13 Hours)

Module III (14 Hours)

Module IV (13 Hours)

Text Books
2. K. S. Fu, R. C. Gonzalez, C. S. G. Lee, Robotics, Control, Sensing and Intelligence, McGraw Hill
**Internal Continuous Assessment (Maximum Marks-30)**

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

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**University Examination Pattern**

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*Maximum Total Marks: 70*
EE09 L 26 SATELLITE COMMUNICATION SYSTEMS

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives
- To give an introduction of industrial robotics and automation

Module I (13 hours)
Satellite orbits - solar day and sidereal day - orbital parameters - satellite trajectory - period, velocity and position of a satellite - geostationary satellites - non-geostationary constellations - launching of geostationary satellites - Hohmann transfer - effect of earth’s shape - other heavenly bodies - atmospheric drag and radiation pressure on the satellite’s orbit

Module II (13 hours)
Communication satellites - spacecraft subsystems - payload - repeater, antenna, attitude and control systems - telemetry, tracking and command - power sub system and thermal control
Earth stations - antenna and feed systems - satellite tracking system - amplifiers - fixed and mobile satellite service earth stations

Module III (13 hours)
Communication link design - frequency bands used - antenna parameters - transmission equations - noise considerations - link design - very small aperture terminals (VSAT) - VSAT design issues

Module IV (13 hours)
Multiple access techniques - frequency division multiple access - time division multiple access - code division multiple access - access protocols for data traffic

Text books
2. Gagliardi R.M., Satellite Communication, CBS
3. Ha T.T., Digital Satellite Communication, MGH

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

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

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

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

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

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

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

*Maximum Total Marks: 70*
GLOBAL ELECTIVES

ME09 L23: Industrial Safety Engineering

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

Objectives
- To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.

Pre-requisites: Nil

Module I (14 Hours)
Introduction to the concept of safety-Need-safety provisions in the factory Act-Laws related to the industrial safety-Measurement of safety performance, Safety Audit, Work permit system, injury and accidents-Definitions-Unsafe act –unsafe condition- causes, investigations and prevention of accidents, hazards, type of industrial hazards-nature, causes and control measures, hazard identifications and control techniques-HAZOP, FMEA,FMECA etc.

Module II (14 Hours)

Module III (13 Hours)
Logics of consequence analysis-Estimation-Toxic release and toxic effects-Threshold limit values, Emergency planning and preparedness, Air pollution-classification- Dispersion modeling -pollution source and effects- -control method and equipments-Gravitational settling chambers-cyclone separators-Fabric filter systems-scrubbers etc.

Module IV (13 Hours)
Concept of reliability-Definition-Failure rate and Hazard function, System reliability models-series, parallel systems, reliability hazard function for distribution functions-exponential-normal –lognormal-weibull and gamma distribution.

Text books

Syllabus-B.Tech Electrical & Electronics Engg. 136
3. C. S. Rao, *Environmental Pollution Control Engineering*, New Age International Limited
Reference books


Internal Continuous Assessment (Maximum Marks-30)

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

University Examination Pattern

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

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

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

Maximum Total Marks: 70
University of Calicut

CS09 L24 : Computer Based Numerical Methods

Teaching scheme 
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

- To impart the basic concepts of mathematical modelling of problems in science and engineering and to know procedures for solving different kinds of problems.
- To understand the various numerical techniques which provide solutions to non linear equations, partial differential equations etc that describe the mathematical models of problems.

Module I (13 hours)

Module II (13 hours)

Module III (13 hours)

Module IV (13 hours)
Statistical Computations - frequency Chart - method of least square curve fitting procedures - fitting a straight line - curve fitting by sum of exponential - data fitting with cubic splines - approximation of functions. Regression Analysis - linear and nonlinear regression - multiple regression - statistical quality control methods.
Text Books

Reference Books

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

University Examination Pattern

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Maximum Total Marks: 70
IC09 L23 Bioinformatics

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives:

• To get the students acquainted with the interdisciplinary field of bioinformatics
• To expose the students to the biological database resources and tools
• To provide an introduction to the important problems and algorithms in bioinformatics.

Prerequisites

Familiarity with internet resources and an aptitude for learning algorithms along with high school level knowledge in biology.

Module I (14 hours)
The biological backdrop:

Cells-Prokaryotes and Eukaryotes-DNA double helix- central dogma – DNA, RNA, aminoacids, Proteins -string representations- different levels of protein structures-DNA cloning- RFLP-SNP-Polymerase chain reaction (PCR)-gel electrophoresis-hybridization-A brief introduction to different mappings techniques of genomes- genome sequencing methods-DNA micro arrays – Human Genome Project-A glossary of biological terms.

Module II (14hours)
Bioinformatics-the big picture and the biological database resources:

Scope of bioinformatics-Genomics and Proteomics- A very brief introduction to major problems in bioinformatics like sequence alignment, phylogeny, gene finding, microarray analysis, secondary structure prediction, protein structure prediction, comparative genomics and drug design.

An introduction to the major re sources at NCBI, EBI and ExPASy- Nucleic acid sequence databases: GenBank, EMBL, DDBJ -Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD - Genome Databases at NCBI, EBI, TIGR, SANGER – How to access these databases and to make use of the tools available.

Various file formats for bio-molecular sequences like genbank and fasta.

The concept of profiles- The derived databases- Prosite, Pfam, PRINTS, CATH, SCOP

Module III (13 hours)
Sequence alignment algorithms and Tools:

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues.

Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM matrices, differences between distance & similarity matrix.

Pairwise sequence alignments: basic concepts of sequence alignment, Needleman & Wunchs, Smith & Waterman algorithms for pairwise alignments. BLAST and FASTA and their versions.

Multiple sequence alignments (MSA): the need for MSA, basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW.

Module IV (13 hours)
Phylogeny, gene finding and molecular visualization:
Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees. Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining.

Gene Finding: The six reading frames-Computational gene finding in prokaryotes and eukaryotes
Basic signals -start and stop codons, promoters etc- important coding measures- Regular expressions- Introduction to Hidden Markov models- Introduction to genomic signal processing
Molecular visualization: Visualization of protein structures using Rasmol or Rastop

Text Books
1. Dan E. Krane and Michael L. Raymer, Fundamentals of Bioinformatics, Pearson Education
6. R. Durbin et al., Biological Sequence Analysis, Cambridge University Press.
7. Gauthm, Bioinformatics databases and algorithms, Narosa Publishers

References
2. Resources at web sites of NCBI, EBI, SANGER, PDB etc

Internal Continuous Assessment (Maximum Marks-30)
60% - Tests (minimum 2)
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PART C: Descriptive/Analytical/Problem solving questions 4 x 10 marks=40 marks
Two questions from each module with choice to answer one question.

Maximum Total Marks: 70
PE09 L24: Industrial Psychology

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
• To give awareness on the Human and Industrial Psychology

Module I (14 hours)

Module II (14 hours)
Organizational behaviour- definition –development- fundamental concept- nature of people- nature of organization – an organizational behaviour system- models- autocratic model- hybrid model- understanding a social-system social culture- managing communication- downward, upward and other forms of communication

Module III 13 hours)
Motivation- motivation driver- human needs- behavior modification- goal setting- expectancy model- comparison models- interpreting motivational models- leadership- path goal model- style – contingency approach

Module IV (13 hours)
Special topics in industrial psychology- managing group in organization- group and inter group dynamics- managing change and organizational development- nature planned change- resistance- characteristic of OD-OD process

Text Books
1. Davis K. & Newstrom J.W., Human Behaviour at work, Mcgraw Hill International

Reference Books
2. Luthans, Organizational Behaviour, McGraw Hill, International

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

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

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

*Maximum Total Marks: 70*
PE09 L25: Entrepreneurship

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Objectives
• To give an idea on entrepreneurial perspectives

Module I (14 hours)
Entrepreneurial perspectives- understanding of entrepreneurship process- entrepreneurial decision process- entrepreneurship and economic development- characteristics of entrepreneur- entrepreneurial competencies- managerial functions for enterprise.

Module II (14 hours)
Process of business opportunity identification and evaluation- industrial policy- environment- market survey and market assessment- project report preparation-study of feasibility and viability of a project-assessment of risk in the industry

Module III (13 hours)
Process and strategies for starting venture- stages of small business growth- entrepreneurship in international environment- entrepreneurship- achievement motivation- time management creativity and innovation structure of the enterprise- planning, implementation and growth

Module IV (13 hours)
Technology acquisition for small units- formalities to be completed for setting up a small scale unit-forms of organizations for small scale units-financing of project and working capital-venture capital and other equity assistance available- break even analysis and economic ratios technology transfer and business incubation

Text Books
5. Dr. Patel V.G., Seven Business Crisis, Tata McGraw hill
8. Rao C.R., Finance for small scale Industries

Internal Continuous Assessment (Maximum Marks-30)

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
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### University Exam Pattern

**PART A:** Short answer questions *(one/two sentences)*

5 x 2 marks = 10 marks

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**PART B:** Analytical/Problem solving questions

4 x 5 marks = 20 marks

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

**PART C:** Descriptive/Analytical/Problem solving questions

4 x 10 marks = 40 marks

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

*Maximum Total Marks: 70*
CH09 L23  NANOMATERIAL AND NANOTECHNOLOGY

Teaching scheme
3 hours lecture & 1 hour tutorial per week

Credits: 4

Objectives
• To impart the basic concepts of nanotechnology
• To develop understanding about application of nanomaterials.

No Pre-requisites

Module 1 (13 Hours)
Introduction to nanotechnology, nanoscale, electromagnetic spectrum, top down and bottom up approach, particle size, chemistry and physics of nanomaterials, electronic phenomenon in nanostructures, optical absorption in solids, quantum effects.

Module 2 (13 Hours)
Nanomaterials, preparation of nanomaterials like gold, silver, different types of nano-oxides, Al$_2$O$_3$, TiO$_2$, ZnO etc. Sol-gel methods, chemical vapour deposition, ball milling etc. Carbon nanotubes, preparation properties and applications like field emission displays. Different types of characterization techniques like SEM, AFM, TEM & STM.

Module 3 (13 Hours)
Nanocomposites, nanofillers, high performance materials, polymer nanocomposites, nanoclays, nanowires, nanotubes, nanoclusters etc. Smart materials, self assembly of materials, safety issues with nanoscale powders.

Module 4 (13 Hours)
Nanomanipulation, Micro and nanofabrication techniques, Photolithography, E-beam, FIB etc. Nanolithography, softlithography, photoresist materials. Introduction to MEMS, NEMS and nanoelectronics. Introduction to bionanotechnology and nanomedicines.

References:
1. Nanocomposite science and technology, Pulikel M. Ajayan, Wiley-VCH 2005
2. Nanolithography and patterning techniques in microelectronics, David G. Bucknall, Wood head publishing 2005
5. Micro and Nanofabrication, Zheng Cui, Springer 2005
## Internal Continuous Assessment *(Maximum Marks-30)*

- **60%** - Tests (minimum 2)
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## University Examination Pattern

**PART A:** Short answer questions *(one/two sentences)*

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**PART C:** Descriptive/Analytical/Problem solving questions

\[
4 \times 10 \text{ marks} = 40 \text{ marks}
\]

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

*Maximum Total Marks: 70*
BM09 L23: Operations Research

Teaching scheme
3 hours lecture and 1 hour tutorial per week

Credits: 4

Objectives

Objective of this introductory course on operations research is to give the students the essential tools of operations research. This will enable them to model and make scientifically based decisions in economic and production environments.

Module 1 (13 hours)
Introduction to operation research: OR model, solving the OR model, simulation models, art of modeling, phases of OR study.
Linear programming: Formulation (Identification of decision variables, constructing objective functions and constraints, assumption), Graphical LP solution,

Module II (14 hours)
Simplex Method: Standard LP form, basic solution, the M-method, the two-phase method, degeneracy, alternative optimal solution, unbounded solution, infeasible solution.
Sensitivity analysis and dual problem: Definition of the dual problem, the relationship between the optimal primal and dual solution, economic interpretation of duality, the dual Simplex method, primal-dual computations, sensitivity analysis

Module III (13 hours)
Transportation Model: Definition of the transportation model, determination of a starting solution, the transportation algorithm, definition of the assignment problem, the Hungarian method.
Network models: Network definition, minimal spanning tree algorithm, shortest route problem, shortest route algorithm, maximal flow model, enumeration of cuts, maximal flow algorithm, CPM, PERT

Module IV (14 hours)
Queuing systems: Elements of a queuing model, role of exponential distribution, birth and death models, steady state measures of performance, single server models
Game theory: Formulation of two person zero sum games, solution of simple games, mixed strategy games (using graphical method and Lp), saddle point condition.

Text Books
### Internal Continuous Assessment *(Maximum Marks-30)*

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

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### University Examination Pattern

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