SCHEME & SYLLABUS

for

B.TECH. COURSE

in

ELECTRICAL ENGINEERING

(w.e.f. Session 2016-2017)

DEPARTMENT OF ELECTRICAL ENGINEERING

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY
FARIDABAD

VISION

YMCA University of Science and Technology aspires to be a nationally and internationally acclaimed leader in technical and higher education in all spheres which transforms the life of students through integration of teaching, research and character building.

MISSION

- To contribute to the development of science and technology by synthesizing teaching, research and creative activities.
- To provide an enviable research environment and state-of-the-art technological exposure to its scholars.
- To develop human potential to its fullest extent and make them emerge as world class leaders in their professions and enthuse them towards their social responsibilities.

Department of Electrical Engineering

VISION

Electrical Engineering Department congregates the challenges of new technological advancements to provide comprehensively trained, career focused ,morally strong accomplished graduates, cutting edge researchers by experimental learning which contribute to ever changing global society and serve as competent engineers.

MISSION

- To commit excellence in imparting knowledge through incubation and execution of high quality innovative educational programs.
- To develop the Research oriented culture to build national capabilities for excellent power management.
- To inculcate and harvest the moral values and ethical behavior in the students through exposure of self -discipline and personal integrity.
- To develop a Centre of research and education generating knowledge and technologies which lay ground work in shaping the future in the field of electrical engineering.

Department of Electrical Engineering

About the Program of Electrical Engineering Department

YMCA University of Science & Technology, Faridabad established in 2009, formerly known as YMCA Institute of Engineering, Faridabad, established in year 1969 as a Joint Venture of Govt. of Haryana and National Council of YMCA of India with active assistance from overseas agencies of West Germany to produce highly practical oriented personnel in specialized field of engineering to meet specific technical manpower requirement of industries. Electrical Engineering Department started in 1969 and has been conducting B.Tech. Course in Electrical Engineering of 4-Years duration since 1997. Students are admitted through centralized counseling nominated by state govt. in 1st Year and 2nd year through lateral entry entrance test. Besides under graduate degree courses, it is also running M.Tech. Electrical Engg. Course (in specialization of Power System) and Ph.D. All courses are duly approved by AICTE/ UGC. The Electrical Engineering Department has been well known for its track record of employment of the pass out students since its inception.

The Department has three storey building with 6 class rooms, 8 laboratory, one workshop, 7 offices, 01 Smart class room and shared Conference Hall. It has excellent faculty with 2 Professors, 02 Associate Professors and 10 Assistant Professors. At present, 6 faculty members are PhD in various specializations. The various syllabi of UG/PG courses in Electrical Engineering Department, has been prepared with active participation from Industry. The Department is organizing number of expert lectures from industry experts for students in every semester. Seven month training is mandatory for every B.Tech. Student. Emphasis has been given on project work and workshop for skill enhancement of students. Choice based credit system allows students to study the subjects of his/her choice from a number of elective courses /audit courses.

With regards,

Dr Rajesh Ahuja

Chairman (EE)

Department of Electrical Engineering

PROGRAM OUTCOMES OF B.TECH IN ELECTRICAL ENGINEERING

Graduates of the Electrical Engineering program at YMCAUST will be able to:

PO1	Apply knowledge of mathematics, science and electrical engineering to the solution of complex engineering problems.
PO2	Design and analyze electrical system or electromagnetic energy conversion system that generate, transmit and distribute electric power more efficiently and economically.
PO3	Understand the principle and construction of various types of electrical machines and measuring instruments and study their performance through testing & their protection.
PO4	Analyze, design and protect modern power electronic converters , electrical drives and power systems.
PO5	Work in a team using common tools and environments to achieve project objectives and communicate ideas.
PO6	Identify, formulate and solve engineering problems.
PO7	Use the techniques, skills and modern engineering tools necessary for engineering practices.
PO8	Understand the professional and ethical responsibility.
PO9	Design and conduct experiments as well as to analyze and interpret data.
PO10	Recognize professional and personal responsibility to the community.

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SYNOPSIS OF

SCHEME OF STUDIES & EXAMINATIONS

4 YEARS B.TECH. (ELECTRICAL ENGINEERING)

SEMESTER I – VIII

(w.e.f. Session 2016-17)

Total Credits: 238 **Total Theory Subjects: 44**

Total Labs (including Drawing, Workshop & Projects): 31

Total Industrial Training: 1

Itemized Break-up:

	No.	Hours/Week	Total Marks	Credits
Theory Subjects: **Discipline Core Course(DCC)=26** **Discipline Elective Course(DCC)=4** **Open Elective Course(OEC)=4** **Basic Engg Course(BEC)=3** **Basic Sc Course(BSC)= 6** **Ability Enhancement Course(AEC)=4**	**44**	**170**	**4400**	**170**
Labs	**22**	**44**	**1100**	**22**
Drawing Classes	**1**	**4**	**100**	**2**
Workshop (SEC)	**7**	**56**	**700**	**28**
Projects	**1**	**8**	**100**	**4**
Industrial Training	**1**	**1 semester**	**500**	**12**
Audit Course (AC)	**2**	**4**	**-**	**-**
Total			**6900**	**238**

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 2nd YEAR (SEMESTER – III) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Category Code
					THEORY	PRACTICAL	Total		
HAS-201	Mathematics – III	4	-	40	60	-	100	4	BSC-201
E-203	Electrical Engineering Materials & Semiconductor Devices	4	-	40	60	-	100	4	DCC-201
E-205	Network Analysis & Synthesis	4	-	40	60	-	100	4	DCC-203
EL-207	Electrical Machines-I	4	-	40	60	-	100	4	DCC-205
E-209	Electrical Measurement & Measuring Instruments	4	-	40	60	-	100	4	DCC-207
E-211	Analog Electronics	4	-	40	60	-	100	4	DCC-209
E-213	Network Analysis & Synthesis Lab	-	2	30		20	50	1	DCC-211
EL-215	Electrical Machines-I Lab	-	2	30	-	20	50	1	DCC-213
E-217	Electrical Measurement & Measuring Instruments Lab	-	2	30	-	20	50	1	DCC-215
E-219	Analog Electronics Lab	-	2	30	-	20	50	1	DCC-217
EL-221	Workshop –III	-	8	60	-	40	100	4	SEC-201
EL-223	Audit Course-1*	2	-						AC-201
	Total	26	16	420	360	120	900	32	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 2nd YEAR (SEMESTER – IV) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Category Code
					THEORY	PRACTICAL	Total		
MGMT-201	Economics For Engineers	4	-	40	60	-	100	4	AEC-202
E-204	Electronics Instrumentation	4	-	40	60	-	100	4	DCC-202
E-206	Computational Techniques	4	-	40	60	-	100	4	DCC-204
E-208	Digital Electronics	4	-	40	60	-	100	4	DCC-206
EL-210	Electrical Machines-II	4	-	40	60	-	100	4	DCC-208
E-212	Electromagnetic Field Theory	4	-	40	60	-	100	4	DCC-210
E-214	Computational Technique Lab	-	2	30	-	20	50	1	DCC-212
E-216	Digital Electronics Lab	-	2	30	-	20	50	1	DCC-214
EL-218	Electrical Machine-II Lab	-	2	30	-	20	50	1	DCC-216
EL-220	Workshop-IV	-	8	60	-	40	100	4	SEC-202
EL-224	Audit Course-1I*	2	-						AC-201
	Total	26	14	390	360	100	850	31	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

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SCHEME OF STUDIES & EXAMINATIONS

B.TECH 3rd YEAR (SEMESTER – V) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Category Code
					THEORY	PRACTICAL	Total		
EL-301	Electrical Machine-III	4	-	40	60	-	100	4	DCC-301
EL-303	Discipline Elective Course-1*	3	-	40	60	-	100	3	DEC-301
E-305	Analog Integrated Circuits	4	-	40	60	-	100	4	DCC-303
EL-307	Power System-I	4	-	40	60	-	100	4	DCC-305
E-309	Power Electronics	4	-	40	60	-	100	4	DCC-307
E-311	Microprocessors & Interfacing	4	-	40	60	-	100	4	DCC-309
EL-313	Open Elective Course-1*	3	-	40	60	-	100	3	OEC-201
EL-315	Electrical Machine-III Lab	-	2	30		20	50	1	DCC-311
EL-317	Power Electronics Lab	-	2	30	-	20	50	1	DCC-312
E-319	Microprocessors And Interfacing Lab	-	2	30	-	20	50	1	DCC-313
E-321	Analog Electronics Circuit Lab	-	2	30	-	20	50	1	DCC-315
EL-323	Workshop-V	-	8	60	-	40	100	4	SEC-301
	Total	26	16	460	420	120	1000	34	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

EL-303: Discipline Elective Course-1*:

1. Principle of communication Engg
2. Non- Conventional Energy Sources

The student will have to select one subject from the above lists.

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SCHEME OF STUDIES & EXAMINATIONS

B.TECH 3rd YEAR (SEMESTER – VI) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Category Code
					THEORY	PRACTICAL	Total		
E-302	Digital System Design	4	-	40	60	-	100	4	DCC-302
EL-304	Control Sytems Engg.	4	-	40	60	-	100	4	DCC-304
EL-306	Conventional & Cad Of Electric Machine	4	-	40	60	-	100	4	DCC-306
EL-308	Advanced Microprocessor & Microcontroller	4	-	40	60	-	100	4	DCC-308
EL-310	Discipline Elective Course-1I*	3	-	40	60	-	100	3	DEC-302
EL-312	Power System-II	4	-	40	60	-	100	4	DCC-310
EL-314	Control Systems Engg Lab	-	2	30	-	20	50	1	DCC-312
EL-316	Advanced Microprocessor & Microcontroller Lab	-	2	30		20	50	1	DCC-314
E-318	Digital System Design Lab	-	2	30	-	20	50	1	DCC-316
EL-320	Power System Lab	-	2	30	-	20	50	1	DCC-318
EL-322	Workshop-VI	-	8	60		40	100	4	SEC-302
	Total	23	16	420	360	120	900	31	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

EL-310: Discipline Elective Course-1I*:

1. Electric Power Generation
2. Power Plant Instrumentation

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 4TH YEAR (SEMESTER – VII) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	Hrs	Exam Schedule (Marks)			Credits	Category Code
			Continuous Assessment	Annual Exam	Total		
E-401	Industrial Training	8/day for 6 months	300	200	500	10	SEC-401

Procedure for Annual Exam and Continuous Assessment of Industrial Training:

(A) Annual Exams Marks

1. Training Evaluation 50 Marks
2. Training Seminar 50 Marks
3. Training Viva 100 Marks

(B) Continuous Assessment Marks

1. Assessment by Institute faculty 100 Marks
2. Assessment by Industrial Guide 150 Marks
3. Conduct Marks 50 Marks

Total: 500 Marks

YMCA UNIVERSITY OF SCIENCE AND TECHNOLOGY, FARIDABAD

SCHEME OF STUDIES & EXAMINATIONS

B.TECH 4th YEAR (SEMESTER – VIII) ELECTRICAL ENGINEERING (2016-17)

Course Code	Course Title	L	P	Marks for Sessional	Marks for End Term Examination		Total Marks	Credits	Category Code
					THEORY	PRACTICAL	Total		
E-402	Digital Signal Processing	4	-	40	60	-	100	4	DCC-402
EL-404	Electric Drives	4	-	40	60	-	100	4	DCC-404
EL-406	Power System Operation And Control	4	-	40	60	-	100	4	DCC-406
EL-408	Discipline Elective Course-III*	3	-	40	60	-	100	3	DEC-402
EL-410	Computer Applications To Power System	3	-	40	60	-	100	4	DCC-408
EL-412	Discipline Elective Course-IV*	3	-	40	60	-	100	3	DEC-404
EL-414	Open Elective Course-II*	3	-	40	60	-	100	3	OEC-402
E-416	Digital Signal Processing Lab	-	2	30	-	20	50	1	DCC-410
EL-418	Electric Drives Lab	-	2	30		20	50	1	DCC-412
EL-420	Major Project	-	8	60	-	40	100	4	SEC-402
EL-424	Workshop-VIII	-	8	60	-	40	100	4	SEC-404
	Total	24	20	460	420	120	1000	35	

Note: Exams Duration will be as under

(a) Theory exams will be of 3 hours duration.

(b) Practical exams will be of 08 hours duration

(c) Workshop exam will be of 8 hours duration

EL-408: Discipline Elective Course-III*:

1. Advanced Control System
2. Power System Stability And Facts

EL-412: Discipline Elective Course-IV*:

1. Utilization Of Electrical Energy
2. High Voltage Engineering

MATHEMATICS-III

L	P	Cr		
4	0	4	3rd SEM	Subject Code: HAS-201 Category Code: BSC-201

Part-A

UNIT-I- COMPLEX VARIABLES:

Functions of complex variable, continuity, Derivative Cauchy-Riemann equations, Analytic Function Harmonic functions, Integration of complex functions. cauchy theorem and cauchy‘s integral formula. Taylor's and Laurent's series, singularities, Residues, residue theorem, calculation of residues, evaluation of real definite integrals (around unit and semi-circle only).

UNIT-II-FOURIER SERIES:

Euler‘s formulae, conditions for a Fourier expansion, fourier expansion of functions having points of discontinuity, change of interval, Fourier expansion of odd and even functions, half range series. Parseval‘s formula, practical harmonic analysis

Part-B

UNIT-III-PARTIAL DIFFERENTIAL EQUATIONS:

Formation, solution. Linear partial differential Equations of the first order. Integral surfaces passing through a given curve non-linear partial differential equations of the first order. Charpit‘s method. Classification of linear second order equations. Euler‘s equations. Linear equations with constant co-efficients method of separation of variables. Applications to the wave equation, one dimensional heat flow, two dimensional heat flow. Laplace equation (two dimensional) and Laplace equation in polar co-ordinates.

UNIT-IV-FOURIER TRANSFORM:

Fourier transform-fourier sine and cosine transforms. Properties of F-transforms, convolution theorem. perseval‘s identity, relation between fourier and laplace transform. Fourier transforms of the derivatives of function. Applications to boundary value problem.

COURSE OBJECTIVES:

Course is designed to develop appreciation of the scope, usefulness and elegance of mathematics. Students will learn fourier series, transforms and use these concepts for solving problems in physics, electronics and computer science.

It will give them knowledge of the basics of operations research, including the students ability to formulate problems and to think creatively and synthesize information. It will develop in them the skills for problem solving when a complex variable is involved.

COURSE OUTCOMES:

After completion of course, students will have:

1. Ability to derive pleasure while using the mathematical skills for problem solving in various subjects.
2. Ability to formulate various OR problems and solve them.
3. Ability to solve problems involving complex variables.
4. Ability to use fourier series and transforms for solving problems in various subjects

TEXT BOOKS:

1. Advanced Engg. Mathematics: F Kreyszig. Wiely Estern Ltd.
2. Higher Engg. Mathematics: B.S. Grewal, Khanna Publishers, New Delhi

REFERENCE BOOKS:

1. Advanced Engg. Mathematics: Michael D. Greenberg.
2. Operation Research: H.A. Taha.
3. Probability and statistics for Engineers: Johnson. PHI.

ELECTRICAL ENGINEERING MATERIALS AND SEMICONDUCTOR DEVICES

Subject Code: E-203

L P Cr **3rd SEM** **Category Code: DCC-201**
4 0 4

UNIT-I- CONDUCTING MATERIALS:
Review of energy bands, description of materials, drift velocity, collision time, Mean free path, mobility, conductivity, relaxation time, factors affecting conductivity of materials, types of thermal conductivity, Wiedmann-Franz law, super conductivity, effect of magnetic field, conducting materials, applications.

UNIT-II- DIELECTRIC MATERIALS:
Behaviour of dielectric materials in static electric field, Dipole moments, Polarization, Dielectric constant, Polarizability, Susceptibility, mechanisms of polarization, behaviour in alternating field, dielectric loss, loss tangent, types of dielectric & insulating materials, electrostriction, Piezo-electricity, Applications.

UNIT-III- MAGNETIC MATERIALS:
Permeability, Magnetic susceptibility, magnetic moment, Magnetization, Dipole moment, types of magnetic materials, Magnetostriction, eddy current & hysteresis losses, applications.

UNIT-IV- SEMICONDUCTORS:
Review of Si and Ge as semiconducting materials, Continuity Equation, P-N junction, Drift & Diffusion, Diffusion & Transition capacitances of P-N junction.

UNIT-V- CONSTRUCTION AND CHARACTERISTICS OF DEVICES:
Brief introduction to Planar Technology for device fabrication, metal -semiconductor junctions (ohmic and non-ohmic), breakdown mechanisms in p-n junction, zener diode, electrical and optical excitation in diodes, LED, solar cells and photo-detectors.

UNIT-VI- BIPOLAR AND MOS DEVICES:
BJT, UJT, JFET, MOSFETS

UNIT-VII- POWER DEVICES:
Thyristor, Diac, Triac, GTO, IGBT, VMOS

COURSE OBJECTIVES:

1. To learn about the conducting and semi-conducting materials behaviour.
2. To learn about dielectric materials.
3. To learn about Magnetic materials behaviour.
4. To learn about semiconductor physics.
5. To learn about the fabrication process of semi-conductor devices.
6. To learn about the characteristics of MOS devices and implementation in IC Technology.
7. To learn about the power devices and applications**.**

COURSE OUTCOMES:

1. Be able to apply general math, science and engineering skills to the solution of engineering problems.
2. Be aware of the social, safety and environmental consequences of their work, and be able to engage in public debate regarding these issues.
3. Be able to apply core concepts of Materials Science to solve engineering problems.
4. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering.

5. Be able to select materials for design and construction.
6. Understand the importance of life-long learning.
7. Be able to design and conduct experiments, and to analyze data.
8. Understand professional and ethical responsibilities of a materials scientist and engineer.
9. Be able to work both independently and as a part of a team.
10. Be able to communicate effectively while speaking, employing graphics and writing.

TEXT BOOKS:

1. Electrical Engineering Materials: A.J. Dekker; PHI.
2. Solid State Electronic Devices: StreetMan & Banerjee; Pearson.
3. Electronic Devices & Circuits: Millman & Halkias; MGH.

REFERENCE BOOKS:

1. Electrical Engineering Materials: S.P Seth & P.V Gupta; Dhanpat Rai.
2. Text Book of Power Electronics: H.C.Rai; Galgoitia Publications.
3 Electronic Devices & Circuit Theory: Boylestad & Nashelsky; Pearson.
4. Semiconductor devices: Jaspreet Singh; John Wiley.

NETWORK ANALYSIS AND SYNTHESIS

3rd SEM **Subject Code: E-205**

L P Cr **Category Code: DCC-203**

4 0 4

UNIT-I- INTRODUCTION

Introduction to lumped element electrical systems,Dualnetworks,Solution to some typical problems,Thevenin's and Norton theorem,equivalentcircuits.Analogus system Electrical analogus to mechanical translational and rotational system. f-v analogy, f-I analogy.

UNIT-II- TRANSIENTS:

Transient response of simple R - L, R - C and R - L - C series and parallel circuits using classical differential equation approach and Laplace Transform method. Response of RL, RC, RLC circuits for impulse and pulse and non sinusoidal periodic functions, excitations using Laplace Transform method.

UNIT-III- NETWORK FUNCTIONS : Terminal pairs or Ports, Network functions for one-port and two-port networks, poles and zeros of Network functions, Restrictions on pole and zero Locations for driving point functions and transfer functions, Time domain behaviour from the pole-zero plot.

UNIT-IV- CHARACTERISTICS AND PARAMETERS OF TWO PORT NETWORKS : Relationship of two-port variables, short-circuit Admittance parameters, open circuit impedance, parameters, Transmission parameters, hybrid parameters, relationships between parameter sets, Inter-connection of two port networks.

UNIT-V- TOPOLOGY

Principles of network topology, graph matrices, network analysis using graph theory.

UNIT-VI- TYPES OF FILTERS AND THEIR CHARACTERISTICS: Filter fundamentals, high-pass, low-pass, band-pass, and band-reject Filters.

UNIT-VII- NETWORK SYNTHESIS:

Positive real functions, synthesis of one port and two port networks, elementary ideas of Active networks.

COURSE OBJECTIVES:

1. To study the transient response of series and parallel A.C. circuits.
2. To study the application of Laplace transforms to circuit analysis.
3. Provide students with basic information on how to perform circuit analysis using network parameters.
4. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
5. To make the students learn about various passive filters and their designing.

COURSE OUTCOMES:

1. Students will be able to solve the Network problems using differential equation approach and transform methods. They will also able to synthesize LC, RC & RL networks.
2. Understand the fundamental concepts of network analysis and synthesis of two-port passive networks.
3. Understand the basic concepts of filters and designing of passive filters

TEXT BOOKS:

1. Network Analysis &Synthesis:Umesh Sinha; Satya Prakash Pub.
2. Network Analysis &Synthesis:F.F.Kuo; John Wiley & Sons Inc.
3. Network Analysis: Van Valkenburg; PHI

REFERENCE BOOKS:

1. Introduction to modern Network Synthesis: Van Valkenburg; John Wiley
2. Basic circuit theory:DasoerKuh; McGraw Hill.
3. A Course in Electrical Circuit Analysis by Soni& Gupta; Dhanpat Rai Publication.
4. Circuit Analysis: G.K. Mithal; Khanna Publication.
5. Networks and Systems: D.Roy Choudhury; New Age International.

ELECTRICAL MACHINES – I

Subject Code: EL-207

L	P	Cr	3rd SEM	Category Code: DCC-205
4	0	4		

UNIT-I- ELECTRO MECHANICAL ENERGY CONVERSIONS:

Electromechanical energy conversion principle, coupling field theory, singly excited magnetic system, doubly excited magnetic system, singly excited electric field system, dynamic equations

UNIT-II- BASIC CONCEPTS OF ROTATING ELECTRIC MACHINES:-

Elementary concept of an electrical machines, common factors of rotating electric machines, types of rotating machines, mmf and flux distribution in DC & AC machines, torque production and torque balance, temperature rise in electrical machines, heating and cooling time curves, duty cycles, rating of machines.

UNIT-III- D.C. GENERATOR

Principles and constructional features and operation of DC generators and motors, types of Windings – lap and wave; Armature reaction and compensations, commutation and inter poles, magnetization curve, field resistance line, characteristics of separately exited DC generators and self-excited DC generator(shunt generator, series generator and compound generator), performance curves, voltage regulation and applications, Parallel operation of D.C. generators,

UNIT-IV- DC MOTOR

Working Principle, importance of back emf, power relation in motors, types of DC motors, speed regulation, torque, armature torque, shaft torque, armature reaction in DC motor, operating characteristics of separately excited DC Motors and self-excited dc motor(shunt, series and compound wound), performance curves and applications, Speed control of DC shunt and series motor, necessity of starter, DC motor starters and their design, automatic starters Power Losses, efficiency and testing of DC machines, brake test, Swinburne‘s, Hopkinson‘s test, Field Test etc, maintenance of DC machines

COURSE OBJECTIVES:-

1. An understanding of principle of electromechanical energy conversion.
2. An understanding of MMF & flux distribution in DC & AC machines.
3. An understanding of construction, working, parallel operation & application of various types Of DC generators.
4. An understanding of modeling & operating characteristics, various types of testing & maintenance of DC motor.

COURSE OUTCOME:

1. Demonstrate knowledge of Electromechanical Energy Conversion.
2. Demonstrate knowledge of D.C. motor and generator operation.
3. Demonstrate knowledge of Electromagnetic induction and to apply it to the theory of Induction machines.
4. Describe the requirements and characteristics of selected motors and generators for a given application.

TEXT BOOKS:

1. Electrical Machines by I.J. Nagrath and D.P. Kothari 3rd Ed., TMH
2. Electric Machinery by P.S. Bhimbra, Khanna Pub.
3. The Performance & design of D.C. Machines by A.E. Clayton

REFERENCE BOOKS:

1. Electric Machinery, 6th Ed. By Fitzgerald & Kingsley, TMH
2. Theory & performance of Electric Machines, by J.B.Gupta, S.K.Kataria & Sons
3. Electric Machinery & Transformers by Irving L.Kosow , PHI

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS

L	P	Cr	3rd SEM	Subject Code: E-209
4	0	4		Category Code: DCC-207

UNIT-I- UNITS STANDARDS AND ERRORS

S.I. units, Absolute standards (International, Primary, Secondary, and Working standards), True Value, Errors(Gross, Systematic and Random); Static Characteristic of instruments(Accuracy, Precision, Sensitivity, Resolution and threshold).

UNIT-II- MEASURING SYSTEM FUNDAMENTALS

Classification of Instruments (based upon mode of measurement- Indicating , Recording and Integrating Instruments), Generalized Instrument (block diagram and description of various blocks) , the three forces in an electromechanical indicating instrument (deflecting controlling and damping forces and the interplay between them), Comparison between gravity and spring controls : Comparison of methods of damping and their suitability for bearing supports , Pivot –less supports (simple suspension and taut band suspension , scale , information , instrument cases (covers) .

UNIT-III- MEASURING INSTRUMENTS

Construction , Operating principle , torque equation , shape of scale , use as Ammeter or as voltmeter (Extension of range) , use on AC / DC or both , advantages and disadvantages, errors(both on AC/DC)of PMMC types, electrodynamic type, moving iron type(attraction , Repulsion and combined attraction, repulsion types). Hot Wire type and induction type, electrostatic type instruments.

UNITIV- METERS WATTMETERS AND ENERGY

Construction, Operating principle, Torque Equation, Shape of Scale, Errors, Advantages and Disadvantages of Electrodynamic and induction type watt meters; and single phase induction type energy meter, compensation and creep in energy meter

UNIT-V- INSTRUMENT TRANSFORMER

Current and Voltage transformer, Constructional features, Ratio and Phase angle errors

UNIT-VI- LOW AND HIGH RESISTANCE MEASUREMENTS

Limitations of wheatstone bridge, Kelvin‘s double Bridge method , difficulties in high resistance measurements , measurement of high resistance by direct deflection , Loss of Charge method , Megohm Bridge and Meggar .

UNIT-VII- A.C. BRIDGES

General Balance equation, Circuit Diagram, Phasor Diagram, Advantages, Disadvantages and Application of Maxwell‘s inductance, Maxwell‘s inductance capacitance bridge, Hay‘s, Anderson‘s, Owen‘s, De-sauty‘s, Schering and Wein‘s Bridges, Shielding and Earthing.

COURSE OBJECTIVES:

- To know the fundamentals of measuring systems.
- To understand principles and working of various types of measuring instruments.
- To measure low, medium and high resistance by using various types of bridges.
- To understand Current Transformer & Voltage Transformer.
- To analyse various energy meters and wattmeter.

COURSE OUTCOMES:

1. To study the possibility of errors in measuring an electrical quantity.
2. To learn the use of DC and AC bridges for measuring R, L and C

3. To learn the use of different types of analog meters for measuring electrical quantities such as current, voltage, power, energy, power factor and frequency.

TEXT BOOK:

A course in Electrical and Electronic measurement and instrumentation: A.K. Sawhney, Dhanpat Rai Publication

REFERENCE BOOKS:

1. Electrical Measurements: E.W. Golding
2. Electrical and Electronic measurement and instrumentation: J.B. Gupta, Kataria and Sons.
3. Electronic instrumentation and measurement technique: W.D. Cooper & A.D. Helfrick
4. Measuring systems: E.O. Doeblin; TMH

ANALOG ELECTRONICS

L	P	Cr	3rd SEM	Subject Code: E-211
4	0	4		Category Code: DCC-209

UNIT-I- SEMICONDUCTOR DIODE & DIODE CIRCUITS

Diode as a circuit element, Load line concepts, half wave & Full wave rectifier, Filter circuits (Capacitor & Inductor Filter), Clipping circuits, clamping circuits, Peak to peak detector, Voltage multiplier circuit.

UNIT-II- TRANSISTOR AT LOW FREQUENCIES

Bipolar junction transistor operation, Characteristics, Analysis of a transistor amplifier circuits using h-parameters, emitter follower, Miller's theorem.

UNIT-III- TRANSISTOR BIASING:

Operating point, Selection of operating point, bias stability, Stability factor, Different methods for transistor biasing: fixed bias, collector to base bias, emitter bias, voltage divider biasing, compensation techniques (thermistor & Sensistor compensation).

UNIT-IV- TRANSISTOR AT HIGH FREQUENCIES:

Hybrid P model, CE short circuit gain, frequency response, alpha cut off frequency, Gain Bandwidth product, Emitter follower at high frequencies .

UNIT-V- FET & FET CIRCUITS:

Junction field effect transistor, Pinch off voltage, Volt ampere characteristics, small signal model, common source amplifier, source follower, biasing of FET, application of FET as voltage variable resistance.

UNIT-VI- REGULATED POWER SUPPLY:

Block Diagram of Power supply, Voltage regulation, Series and Shunt voltage regulator, IC Regulator

COURSE OBJECTIVE:

1. Semiconductor Diode &Diode Circuits: Diode as a circuit element, Load line concepts, half wave & full wave rectifier, Filter circuits (Capacitor &Inductor Filter), Clipping circuits, clamping circuits, Peak to peak detector, Voltage multiplier circuit.
2. Transistor At Low Frequencies: Bipolar junction transistor operation, Characteristics, Analysis of a transistor amplifier circuits -parameters, emitter follower, Miller's theorem.
3. TransistorBiasing:Operatingpoint,Selectionofoperatingpoint,biasstability,Stabilityfactor,Differentmethodsfortransistorbiasing:fixedbias,collectortobasebias,emitterbias,voltagedividerbiasing,compensationtechniques(thermistor&Sensistorcompensation)
4. Transistor At High Frequencies: Hybrid Pi model, CE short circuit gain, frequency response,alphacutofffrequency,GainBandwidthproduct,Emitterfollowerathighfrequencies.
5. FET&FET Circuits: Junctionfield effect transistor, Pinchoff voltage,Voltampere characteristics,smallsignalmodel,commonsourceamplifier,sourcefollower,biasingofFET,applicationofFETasvoltagevariableresistance.
6. RegulatedPowerSupply: Block Diagramof Powersupply, Voltage regulation, SeriesandShuntvoltageregulator, ICRegulator**.**

COURSE OUTCOMES:

After the completion of this course, student would gain enough knowledge of most fundamental aspects of semiconductor devices and their applications. At the end of semester the students will be able to

- Explain and Draw the V-I characteristics of electronic devices, such as PN-junction diode, Zener diode, Bipolar Junction Transistor (BJT) and Field Effect Transistor (FET) and their types.
- Understand and Design simple rectifier circuits and filter circuit. Calculation of their characteristics parameters and comparison of different types of rectifiers and filter with their application.
- Understand voltage multiplier circuits, clippers and clampers circuits.
- Understand the concept of load line, operating point and need of biasing for transistors and different biasing circuits.
- Different techniques for the stabilization and compensation for thermal stability of operating point.
- Transistors equivalent circuit at low and high frequency and application of transistor as an amplifier and calculation of different parameters of amplifier.
- Gain idea about FET parameters and their characteristics. Application of FET as an amplifier and their characteristics.
- Able to understand regulated power supply, its characteristics. Diode based and transistorized and regulated power supply and different IC regulators**.**

TEXT BOOKS:

1 Integrated Electronics: Millman & Halkias ; McGrawHill
2 Electronic circuit analysis and design (Second edition): D.A.Neamen; TMH

REFERENCE BOOKS:

1. Electronics Principles: Malvino ; McGrawHill
2. Electronics Circuits: Donald L. Schilling & Charles Belove; McGrawHill
3. Electronics Devices & Circuits: Boylestad & Nashelsky; Pearson.

ELECTRONICS INSTRUMENTATION

L P Cr **4th SEM** **Subject Code: E-204**
4 0 4 **Category Code: DCC-202**

UNIT -I- OSCILLOSCOPE
Block diagram, study of various stages in brief, high frequency CRO considerations. Sampling and storage oscilloscope.

UNIT -II- ELECTRONIC INSTRUMENTS
Instruments for measurement of voltage, current & other circuit parameters, Q-meters, R.F. power measurements, introduction to digital meters.

UNIT -III- GENERATION & ANALYSIS OF WAVEFORMS
Block diagram of pulse generators, signal generators, function generators wave analysers, distortion analysers, spectrum analyser, Harmonic analyser, introduction to power analyser.

UNIT-IV- FREQUENCY & TIME MEASUREMENT
Study of decade counting Assembly (DCA), frequency measurements, period measurements, universal counter, introduction to digital meters.

UNIT -V- DISPLAY DEVICES
Nixie tubes, LED‘s LCD‘s, discharge devices.

UNIT- VI- TRANSDUCERS
Classification, Transducers of types: RLC photocell, thermocouples etc. basic schemes of measurement of displacement, velocity, acceleration, strain, pressure, liquid level & temperature.

UNIT -VII- INTRODUCTION TO SIGNAL CONDITIONING
DC signal conditioning system, AC signal conditioning system, data acquisition and conversion system

COURSE OBJECTIVES:

1. Understand the general information and application of different types of oscilloscope.
2. Understand the principle and working of different type of oscilloscope.
3. Understand the principle of various types of electronic instruments and their applications.
4. Understand the general processes of generation and analysis of waveforms.
5. Understand basic principles and working of different type of generator and analysers
6. To understand the frequency and time measurement and different electronic instruments connected with them.
7. To understand the principle and application of various display devices.
8. Understand the construction and working of different display devices.
9. To understand about classifications, principle, working and applications of different types of transducers.
10. To understand the general information about signal conditioning with uses and applications

COURSE OUTCOMES:

1. After studying the particular course the student should be able to know about the working Principal of CRO.

2. This course is basically the study of complete Electronic Instrument and Measurement Used in amplifier system and frequency meter.
3. This subject allows students to get the knowledge of previous studied EMMI subject and Use in appropriate manner.
4. Student should be able to know about the measurements of various electrical parameters.

T**EXT BOOK:**

A course in Electrical & Electronics Measurements & Instrumentation: A.K.Sawhney; Dhanpat Rai & Sons.

REFERENCE BOOKS

Electronics Instrumentation & Measurement Techniques: Cooper; PHI.

COMPUTATIONAL TECHNIQUES

L	P	Cr	4th SEM	Subject Code: E-206
4	0	4		Category Code: DCC-204

Part-A

UNIT-I- FINITE DIFFERENCES AND INTERPOLATION

Various difference operators and relation between them .Newton‘s forward and backward interpolation formulae Central difference interpolation formula. Gauss forward and backward interpolation formulae. Langrages interpolation formula and Newton‘s divided difference formulae.

UNIT-II- SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Bisection method, method of false position,secant method, iteration method, Newton's Raphson method, Generalised Newton-Raphson method

UNIT-III- SOLUTION OF SIMULTANEOUS ALGEBRAIC EQUATIONS

Jacobi's method, Gauss-Seidal method, Relaxation method

UNIT-IV- NUMERICAL DIFFERENTIATION AND INTEGRATION

Formula for derivatives Trapezoidal rule, Simpson's 1/3rd and 3/8th rules, Boole's rule and Weddle's rule, Romberg's Integration.

Part-B

UNIT-V- NUMERICAL SOLUTION OF O.D.E

Taylor series,Picard‘s method, Eule , Modified Euler method, Runge-Kutta second and fourth order methods, predictor collector methods(Adams-Bashforth and Milne's method only),

UNIT-VI- NUMERICAL SOLUTION OF P.D.E

Finite difference approximations of partial derivatives, solution of Laplace equation (Standard 5-point formula only), one-dimensional heat equation (Schmidt method, Crank-Nicolson method, Dufort and Frankel method) and wave equation.

COURSE OBJECTIVES:

The main objective of this course is to give the solutions of applied problems and it helps students to have an in-depth knowledge of various advanced methods in numerical analysis.

COURSE OTCOMES:

- Demonstrate understanding of common Numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
- Apply various mathematical operations and tasks, such as interpolation, differentiation, integration, the solutions of linear equations and the solutions of differential equations and partial differential equations.
- Examine approximate solutions to mathematical problems.

TEXT BOOKS:

1. Numerical Methods in Engg. & Science: B.S. Grewal;khanna

2. Numerical Methods for Scientific and Engg. Computations: M.K. Jain, S.R.K. Iyenger and R.K. Jain-Wiley Eastern Ltd

REFERENCE BOOKS:

1. Computer oriented Numerical methods: U.Ra
2. Introduction to Numerical Analysis C.E.Froberg;Addison Wesly

DIGITAL ELECTRONICS

L	P	Cr	4th SEM	Subject Code: E-208
4	0	4		Category Code: DCC-206

UNIT-I- FUNDAMENTALS OF DIGITAL TECHNIQUES

Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra. Review of Number systems. Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.

UNIT-II- COMBINATIONAL DESIGN USING GATES

Design using gates, Karnaugh map and Quine Mcluskey methods of simplification.

UNIT-III- COMBINATIONAL DESIGN USING MSI DEVICES

Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.

UNIT-IV- SEQUENTIAL CIRCUITS:

Flip Flops : S-R, J-K, T, D, master-slave, edge triggered, shift registers, F/F Conversions, sequence generators, Counters, Asynchronous and Synchronous Ring counters and Johnson Counter, Design of Synchronous and Asynchronous sequential circuits.

UNIT-V- DIGITAL LOGIC FAMILIES:

Switching mode operation of p-n junction, bipolar and MOS. devices. Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.

UNIT-VI- A/D AND D/A CONVERTER:

Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters: Quantization, parallel -comparator, successive approximation, counting type, dual-slope ADC, specifications of ADCs.

UNIT-VII- MEMORIES AND PLD'S

Classification of memories –RAM organization l-Bipolar RAM cell – MOSFET RAM cell –Dynamic RAM cell – ROM- PROM –EPROM –EEPROM –EAPROM –Programmable Logic Devices – Programmable Logic Array (PLA)- Programmable Array Logic (PAL)-Field Programmable Gate Arrays(FPGA).

COURSE OBJECTIVE:

1. To learn Digital signal, logic gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR, Boolean algebra, Review of Number systems, Binary codes: BCD, Excess-3, Gray, EBCDIC, ASCII, Error detection and correction codes.
2. To study Combinational design using gates, K-map and Q-M methods of simplification, Multiplexers and Demultiplexers and their use as logic elements, Decoders, Adders / Subtractors, BCD arithmetic circuits, Encoders, Decoders / Drivers for display devices.
3. To study Sequential circuits, Flip Flops : S-R , J-K, T, D, master-slave, edge triggered, shift registers, F/F Conversions, sequence generators, Counters, Design of Synchronous and Asynchronous sequential circuits.
4. To learn Digital Logic Families: Switching mode operation of p-n junction, bipolar and MOS devices,Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS, and CMOS logic families. Tristate logic, interfacing of CMOS and TTL families.

5. To study A/D AND D/A converters: Sample and hold circuit, weighted resistor and R -2 R ladder D/A Converters, specifications for D/A converters. A/D converters : Quantization, parallel - comparator, successive approximation, counting type, dualslope ADC, specifications of ADCs.
6. To learn memories and PLD'S, Classification of memories –RAM organization l-Bipolar RAM cell – MOSFET RAM cell –Dynamic RAM cell – ROM- PROM –EPROM –EEPROM –EAPROM –Programmable Logic Devices –PLA, PAL, and FPGA.

COURSE OUTCOMES:

At the end of the course the students shall be able to:

1. Design combinational and sequential digital circuits to meet a given specification and be able to represent logic functions in multiple forms—understanding the advantages and disadvantages of each.
2. Understand how CMOS transistors can be used to realize digital logic circuits and understand basic characteristics of logic gates (such as power, noise margins, timing, tri-state circuitry, etc.).
3. Understand numerical and character representations in digital logic including ASCII, sign magnitude, 2's complement, and floating point and the corresponding design of arithmetic circuitry.
4. Understand the importance and need for verification and testing of digital logic circuits
5. Understand the principle of operation and design of a wide range of electronic circuits such as computer RAM and ROM
6. Understand how convert signals from analog to digital and digital to analog

TEXT BOOK:

1. Modern Digital Electronics (Edition III) : R. P. Jain; TMH

REFERENCE BOOKS:

1. Digital Integrated Electronics: Taub & Schilling; MGH
2. Digital Principles and Applications: Malvino & Leach; McGraw Hill.
3. Digital Design: Morris Mano; PHI.

ELECTRICAL MACHINES – II

L	P	Cr		
4	0	4	4th SEM	Subject Code: EL-210
				Category Code: DCC-208

UNIT –I-SINGLE PHASE TRANSFORMER

Principle, Constructional features of transformers, working, ideal transformer, EMF equation, no load and load phasor diagram, transformer with winding resistance and leakage reactance, equivalent circuit of single phase transformers, approximate equivalent circuit, regulation, losses, efficiency and all day efficiency, testing of transformers: OC & SC tests, sumpner's test, Parallel operation of transformer with equal and unequal voltage ratios and its load sharing

UNIT – II- POLY PHASE TRANSFORMERS

Three phase transformer, Auto transformers, 3 phase transformer windings and its connections star-star, star-delta, delta-star, delta-delta and Zig-zag, open delta, Tertiary transformer winding, Scott connected transformers, tap changing

UNIT –III- POLYPHASE INDUCTION MOTORS

Introduction, construction and principle of operation, frequency of rotor current, rotor emf, torque equation and torque slip and torque speed characteristics, effect of change of voltage and frequency on torque and slip or speed, full load torque and maximum torque, starting torque and maximum torque, equivalent circuit, power losses, efficiency, testing of induction motors and circle diagram.

Starting of induction motor, types of starters speed control of induction motors-pole changing, cascade connection, injection of emf into rotor circuit, harmonics, cogging and crawling, effect of harmonics, elimination of harmonics, double cage rotors, Induction generators and their applications

UNIT-IV- SINGLE PHASE INDUCTION MOTORS:

Double field revolving theory, starting methods – split phase, capacitor start and run, shaded pole motors and their characteristics and their applications, equivalent Circuit.

COURSE OBJECTIVES:

1. An understanding of modeling, principle of operation, construction, application of transformers.
2. An understanding of advantages of using polyphase transformers, three phase transformers connections, auto transformers, practical applications.
3. An understanding of modeling & principle of operation & performance characteristics of 3-8 induction motor, application of induction generator.
4. An understanding of the working principle of various type, practical application of Single phase induction motor.

COURSE OUTCOMES:

Have knowledge of various parts of a electrical machine.

1. Able to conduct open circuit/ short circuit test on transformer

2. Ability to conduct experiments on Ac Machines to find their characteristics.
3. Able to calculate torque and speed of given Machine.
4. Ability to conduct No Load and Full load tests on transformers / induction Motor.
5. Able to know about the various specific application of various types of transformers and induction machine (both three- phase and single- phase)

TEXT BOOKS:

1. Electric Machines by Nagarath & Kothari
2. Generalized theory of Electric Machines by P.S.Bimbra
3. Electrical Machinery by Fitzgerald, Kingsley and S.D.Umans ,MGH

REFERENCE BOOKS:

1. Alternating current Machines by A.F. Puchatein, T.C. Lloyd and A.G.Conarad
2. A.C Machines by A.E.Langsford

ELECTROMAGNETIC FIELD THEORY

L	P	Cr	4th SEM	Subject Code: E-212
4	0	4		Category Code: DCC-210

UNIT-I- STATIC ELECTRIC FIELDS

Coulomb‘s Law, Introduction to Del operation, Study of Del operation on scalar and vector and its interpretation, Laplacian operator, Stoke‘s Theorem and Divergence Theorem, Gauss‘s Law, potential function, field due to a continuous distribution of charge, equi-potential surfaces, Poison‘physical s equation, Laplace‘s equation, method of electrical images, capacitance, electro-static energy, boundary conditions, the electro-static uniqueness theorem for field of a charge distribution, Dirac-Delta representation for a point charge and an infinitesimal dipole.

UNIT-II- STEADY MAGNETIC FIELDS

Faraday Induction law, Ampere‘s Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere‘s Force Law, boundary conditions for magnetostatic, magnetic vector potential, scalar vector potential (Alternative derivation).

UNIT-III- TIME VARYING FIELDS

Introduction to conduction current, convection current and displacement current; Equation of continuity for static and time varying fields, inconsistency of Ampere‘s law, Maxwell‘s field equations and their interpretation, solution for free space conditions, electromagnetic waves in a homogeneous medium, Discussion on : Group velocity, Phase velocity, Attenuation constant, Phase constant, Refractive index; propagation of uniform plane-wave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell‘s equations using phasor notation, wave propagation in a conducting medium, Loss Tangent, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization, linear, circular and elliptical,

UNIT-IV- REFLECTION AND REFRACTION OF E M WAVES

Reflection and refraction of plane waves at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewester's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-line analogy, poynting theorem, interpretation of E x H, power loss in a plane conductor.

UNIT-V-TRASMISSION LINE THEORY

Transmission line as a distributed circuit, Primary and Secondary constant, Transmission line equation, input impedance of terminated line, infinite transmission line, Distortion less and Loss less transmission line, Open circuit and short circuit transmission line, Reflection coefficient, Standing waves, VSWR, Smith's chart and its applications.

COURSE OBJECTIVE:

1) Coulomb’s Law, Introduction to Del operation, Study of Del operation on scalar and vector and its physical interpretation, Laplacian operator, Stoke’s Theorem and Divergence Theorem, Gauss’s Law, potential function, field due to a continuous distribution of charge, equi-potential surfaces, Poison’s equation, Laplace’s equation, method of electrical images, capacitance, electro-static energy, boundary conditions, the electro-static uniqueness theorem

for field of a charge distribution, Dirac-Delta representation for a point charge and an infinitesimal dipole.

2) Faraday Induction law, Ampere's Work law in the differential vector form, Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere's Force Law, boundary conditions for magnetostatic, magnetic vector potential, scalar vector potential (Alternative derivation).

3) Introduction to conduction current, convection current and displacement current; Equation of continuity for static and time varying fields, inconsistency of Ampere's law, Maxwell's field equations and their interpretation, solution for free space conditions, electromagnetic waves in a homogeneous medium, Discussion on : Group velocity, Phase velocity, Attenuation constant, Phase constant, Refractive index; propagation of uniform plane-wave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, Loss Tangent, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization, linear, circular and elliptical,

4) Reflection and refraction of plane waves at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewester's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-line analogy, poynting theorem, interpretation of E x H, power loss in a plane conductor.

5) Transmission line as a distributed circuit, Primary and Secondary constant, Transmission line equation, input impedance of terminated line, infinite transmission line, Distortion less and Loss less transmission line, Open circuit and short circuit transmission line, Reflection coefficient, Standing waves, VSWR, Smith's chart and its applications.

COURSE OUTCOMES:

At the end of the course the students shall be able to:

1. Static electric fields
2. Steady magnetic fields
3. Time varying fields
4. Reflection and refraction of E M waves
5. Transmission line theory

TEXT BOOKS:

1. Electro-magnetic Waves and Radiating System: Jordan & Balmain, PHI.

REFERENCE BOOKS:

1. Engineering Electromagnetics: Hayt; TMH
2. Electro-Magnetics: Krauss J.DF; Mc Graw Hill.
3. Priciples of Electromagnetics; Matthew N.O. Sadiku; Oxford publications

ELECTRICAL MACHINES-III

L	P	Cr	5th SEM	Subject Code: EL-301
4	0	4		Category Code: DCC-301

UNIT -1- SYNCHRONOUS GENERATOR

Constructional features, production of sinusoidal alternating EMF, winding factor, EMF equation, Harmonics in voltage waveform, leakage reactance, armature reaction, synchronous impedance, determination of synchronous impedance, short circuit ratio, voltage regulation, Voltage regulation by Synchronous impedance method, mmf method , Zero power factor or Poitier method, two reactance concept for salient pole synchronous machines, power developed by synchronous generator, transient condition of alternator, losses and efficiency

UNIT-2-SYNCHRONOUS MOTOR

Principle of operation, effect of load on a synchronous motor, armature reaction, effect of varying excitation on armature current and power factor, equivalent circuit and phasor diagram, power developed in synchronous motor, different torques, two reactance concept for salient pole synchronous motor, stability and maximum load angle, v-curves, synchronous condenser, hunting, starting methods of synchronous motor

UNIT-3-PARALLEL OPERATION OF ALTERNATORS

Introduction, requirement for parallel operation, synchronizing of alternators, methods of synchronization, load sharing, synchronous machine on infinite bus bar

UNIT-4-GENERALIZED THEORY OF ELECTRICAL MACHINES

Basics for development of generalized approach for analysis of electrical machines, Kron's Primitive machine, Concept of rotational transformer, voltage and pseudo stationary coil, Expression for self and mutual inductances of various windings w.r.t. rotor position, Park's and Inverse Parks transformation.

UNIT-5-SPECIAL ELECTRIC MOTORS

Linear induction motor, Schrage motor, AC series motor, Universal Motor, stepper motor, reluctance motor, hysteresis motor etc.

COURSE OBJECTIVES:

To expose the students to the concept of synchronous generator, parallel operation of alternators, synchronous motors, various types of special machine with their applications and generalized theory of electrical machines.

COURSE OUTCOMES:

Upon successful completion of this course, the student understand

CO1: The constructional details of synchronous machines, their load characteristics, able to solve the problems on regulation, parallel operation of alternation.
CO2: The working principle methods of application of synchronous motor.
CO3: Generalized theory of electrical machines, park's transformation, Inverse Park's transformation etc.
CO4: Principle operation of AC series motor, universal motor, reluctance motor, stepper motor and other special machines

TEXT BOOKS:

1. Electric Machines by Nagarath & Kothari
2. Generalized theory of Electric Machines by P.S.Bimbra
3. Electrical Machinery by Fitzgerald, Kingsley and S.D.Umans ,MGH

REFERENCE BOOKS:

1. Alternating current Machines by A.F. Puchatein, T.C. Lloyd and A.G.Conarad
2. A.C Machines by A.E.Langsford

PRINCIPLES OF COMMUNICATION ENGINEERING

L	P	Cr	5th SEM
4	0	4	**Subject Code: EL-303**
			Category Code: DEC-301

UNIT- I- INTRODUCTION TO COMMUNICATION SYSTEMS

Block diagram of communication system with brief description to each block, importance of modulation

UNIT- II- AMPLITUDE MODULATION

Basic definition, mathematical and graphical analysis of AM signals, power relation, generation of AM waves, demodulation of AM waves

UNIT -III-ANGLE MODULATION

Basic definitions: phase modulation & frequency modulation, mathematical analysis of frequency & phase modulation, narrow band frequency modulation, generation and demodulation of FM waves.

UNIT -IV- PULSE MODULATION

Sampling theory, pulse amplitude modulation (PAM), pulse width modulation, pulse position modulation, element of pulse code modulation and data modulation

UNIT- V- DIGITAL COMMUNICATION TECHNIQUES

Block diagram of digital communication system, different digital communication techniques, and advantages of digital communication

UNIT -VI- NOISE

Various types of noise, S/N ratio, noise figure

UNIT-VII-OPTICAL COMMUNICATION

Block diagram of optical communication system, basics of transmission of light rays, advantages of optical fiber communication, brief introduction to optical fiber

UNIT-VIII- RADAR AND SATELLITE COMMUNICATION

Radar block diagram, basic radar range equation, basic pulse radar system, introduction to satellite communication system

COURSE OBJECTIVE:-

1. To understand the communication system, importance of modulation, multiplexing techniques(FDM,TDM)
2. To learn Mathematical analysis of AM, FM, PM with their generation and reception.
3. To understand the importance of Sampling Theorem, to learn the Pulse modulation System, PAM, PPM, PWM, and PCM with their generation and reception.

4. To know the digital communication system with their advantages and disadvantages, to understand the ASK, PSK, FSK with modulation& demodulation techniques.
5. To learn the Internal and External Noise.
6. To understand the optical communication system, basics of transmission of light rays, advantages of optical fiber communication.
7. To learn basic Radar System, basic radar range equation, basic pulse radar system, to understand the satellite communication system

COURSE OUTCOMES:-

At the end of the course the students shall be able to:

1. Describe the communication system, importance of modulation, multiplexing techniques(FDM,TDM)
2. Mathematical analysis of AM, FM, PM with their generation and reception.
3. Importance of Sampling Theorem, Describe the Pulse modulation System, PAM, PPM, PWM, and PCM.
4. Describe the digital communication system with their advantages and disadvantages, ASK, PSK, FSK modulation technique. Internal and External Noise.
5. Block diagram of optical communication system, basics of transmission of light rays, advantages of optical fiber communication.
6. Basic Radar System, basic radar range equation, basic pulse radar system, introduction to satellite communication system

TEXT BOOKS:

1. Electronic Communication systems: Kennedy; TMH.

REFERENCE BOOKS:

1. Communication system: Simon Hykin (Johan Wiely)
2. Introduction to Radar System: M.I. Skolanik (MGH)
3. Optical Fiber Communication: Johan M Senior (PHI)

ANALOG INTEGRATED CIRCUITS

L	P	Cr	5th SEM	Subject Code: E-305
4	0	4		Category Code: DCC-303

UNIT-I- SINGLE AND MULTISTAGE AMPLIFIERS

Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, step response of an amplifier, pass-band of cascaded stages, RC-coupled amplifier, low frequency response of RC coupled stage, effect of an emitter bypass capacitor on low Frequency response, multistage CE amplifier.

UNIT-II- FEEDBACK AMPLIFIERS

Feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, input resistance, output resistance, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.

UNIT-III- OSCILLATORS

Sinusoidal oscillators, Barkhausen criteria, R-C phase shift oscillator, general form of oscillator circuit, wien-bridge oscillator, crystal oscillator.

UNIT-IV- POWER AMPLIFIERS

Class A, B, and C operations; Class A large signal amplifiers, higher order harmonic distortion, efficiency, transformer coupled power amplifier, class B amplifier : efficiency & distortion; class A and class B push-pull amplifiers; class C power amplifier.

UNIT-V- OPERATIONAL AMPLIFIERS

Ideal and practical operational amplifiers, inverting and non-inverting amplifier, differential amplifier, emitter coupled differential amplifier, transfer characteristics of a differential amplifier, offset error : voltage and current, common mode rejection ratio (CMRR) .

UNIT-VI- LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS

Scale changer, phase shifter, adder, voltage to current converter, current to voltage converter, DC voltage follower, Bridge amplifier, AC coupled amplifier, AC voltage follower, Integrator, differentiator.

UNIT-VII- NON-LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS

Comparators, sample & hold circuits, logarithmic amplifier, anti-log amplifier, logarithmic multiplier, waveform generators, regenerative comparator (Schmitt Trigger), multi-vibrators, 555 timer IC (mono stable & Astable operation) & its application

COURSE OBJECTIVE:

- Classification of amplifiers and distortion in amplifiers, RC coupled amplifier, effect of emitter by pass capacitor and coupling capacitor on low frequency response of RC coupled amplifier.
- Basic concepts of feedback amplifier, general characteristics of negative feedback amplifier, Voltage series feedback, current series feedback, and voltage shunt feedback, current shunt feedback.

- Barkhausen criteria of oscillation, RC phase shift oscillator, wein bridge oscillator, crystal oscillator.
- Class A, Class B and Class C operation, Class A power amplifier, and transformer coupled Class A power amplifier, harmonic distortion, Class A push pull amplifier, Class B power amplifier, Class B push pull amplifier, Class C power amplifier.
- Operational amplifier and their characteristics, Inverting and non-inverting mode, offset error and CMMR.
- Linear and non-linear application of operational amplifier, logarithmic amplifier, antilog amplifier, logarithmic multiplier, waveform generators, multivibrators using IC 555 and its application.

COURSE OUTCOMES:

After completing this course students will be able to understand:

- Concept of single and multistage amplifier, RC coupled amplifier and effect of emitter by pass capacitor and coupling capacitor on low frequency response of RC coupled amplifier..
- Basic concept of negative feedback and their effects, also understand different types of negative feedback.
- Basic concept of oscillators and circuits of RC phase shift and wein bridge oscillator.
- The difference between power and voltage amplifier, concept of Class A, Class B and Class C power amplifier, concept of push pull amplifiers.
- Basics of Operational amplifier and their linear and non-linear application, concept of multivibrator using 555 IC and its applications.

TEXT BOOKS:

1. Integrated Electronics: Milman Halkias, TMH.
2. Microelectronic Circuits: Sedra & Smith.

REFERENCE BOOKS:

1. Operational Amplifiers: Gaikwad
2. Electronic Circuit Analysis and Design (Second edition): D.A.Neamen; TMH
3. Linear Integrated Circuit: D R Chaudhry

POWER SYSTEMS -1

L	P	Cr	5^{th} SEM	Subject Code: EL-307
4	0	4		Category Code: DCC-305

UNIT-I- INTRODUCTION

Structure of a power system, indoor and outdoor substations, equipment for substations, layout, and auxiliary supply

UNIT-II- TRANSMISSION LINES

Calculation of line parameters, Ferranti effect, proximity effect

UNIT-III- PERFORMANCE OF LINES

Models of short, medium and long transmission lines, performance of transmission lines, circle diagram, capacity of synchronous condenser, tuned lines, voltage control

UNIT-IV- MECHANICAL DESIGN

Sag and stress calculations, effect of ice and wind, dampers.

UNIT-V- INSULATORS

Types, insulating materials, voltage distribution over insulator string, equalizer ring

UNIT-VI- CORONA

Phenomenon, critical voltage, power loss, , reduction in losses , radio interference , HVDC transmission – types of links , advantages and limitations

UNIT-VII- CABLES

Types of LV and HV cables, grading of cables, capacitance, ratings

UNIT-VIII- DISTRIBUTION SYSTEMS

Radial, ring mains and network distribution system, comparison of various types of AC and DC systems

COURSE OBJECTIVES:

- To understand Power System Structure.
- To learn the fundamentals of Power System for designing a s/m that meets the specific needs.
- To analyze phase or techniques in analysis of Power System.
- To analyse the performance of Transmission lines.
- To understand the mechanical design of transmission lines.

COURSE OUTCOMES:

1. Determine the electric circuit parameters of Transmission Line
2. Analyze performance of transmission lines.
3. Understand the layout of substation and underground cables and corona.
4. Understand methods of voltage control and compensation in power system.
5. Understand mechanical design of transmission lines

TEXTBOOKS:

1. Power System Engg. : I.J.Nagrath and D.P.Kothari (TMH).
2. A Course in Electrical Power: Gupta, Soni and Bhatnagar (Dhanpat rai and sons).

REF. BOOKS:

1. Elements of Power system analysis: W.D.Stevenson (MGH).
2. Electric Power: S.L.Uppal (Khanna Pub).
3. Electrical Power: J.B.Gupta (S.K.Kataria and sons).
4. Power System engg. : B.R.Gupta .
5. Electric power system: B.M.Weedy , John Wiley and sons.
6. Transmission & distribution of electrical Engg. : H.Cotton .
7. Transmission & distribution of electrical Engg : Westing house and Oxford University Press , New Delhi .

POWER ELECTRONICS

L	P	Cr	5th SEM
4	0	4	**Subject Code: E-309**
			Category Code: DCC-307

UNIT-I- INTRODUCTION

Introduction to Thyristors, Their static and dynamic characteristics, Turn-on and Turn - off methods and circuits, Ratings and protection of SCR'S, Other members of thyristor family, Series and parallel operation of thyristors, Firing circuits for SCRs. Commutation circuits.

UNIT-II- PHASE CONTROLLED CONVERTERS

Principle of phase control, Single phase half wave circuit with different types of loads, Single phase and three phase semi converter and full converter bridge circuits with line commutation, Continuous and discontinuous conduction effect of source inductance on single phase and three phase full converters, Single phase and three phase dual converters and their operation with circulating and non-circulating currents.

UNIT-III- DC CHOPPERS

Principle of chopper operation, Control strategies, Types of choppers, Step upand step down choppers, Types of choppers, Steady state time domain analysis with R, L, and E type loads, Voltage, Current and Load commutated choppers.

UNIT-IV- INVERTERS

Single phase VSI, Half bridge and full bridge inverters and their steady state analysis, Introduction of Series and parallel inverters, and three phase bridge inverters with 1800 and 1200 modes. Single-phase PWM inverters. Current source inverters, CSI with R load (qualitative approach)

UNIT-V- AC VOLTAGE CONTROLLERS

Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load

UNIT-VI- CYCLOCONVERTERS

Principles of operation, Single phase to single phase step up and step down cycloconverters, three phase to single phase and three-phase to three-phase cycloconverters, Output voltage equation for a cycloconverter.

COURSE OBJECTIVES:

1. To make student capable of designing and operating of basic power electronic converter circuits with the knowledge of various switching devices.
2. To develop the understanding of working of various types of power converter circuit such as DC-DC converter, AC-DC converter, AC-AC converter, DC-AC converters in detail
3. To give the knowledge of .various industrial, commercial and residential applications of power converter circuits.

COURSE OUTCOMES:

1. Knowledge about various power semiconductor devices and their characteristics.

2. To be able to analyze characteristics of different power electronics switches and selection of components for different applications.
3. Understanding of analysis and design of various single phase and three phase power converter circuits and knowledge of their applications.
4. Ability to identify the basic requirements for power electronics based design application.
5. Understand the use of power converters in commercial and industrial applications.

TEXT BOOKS

1. Dubey, G.K., Doradla, S.R., Joshi, A. and Sinha, R.M.K., Thyristorised Power Controllers, New Age international (P) Limited, Publishers (2004).
2. Rashid, M., Power Electronics, Prentice−Hall of India (2006) 3rd ed.
3. Bhimbra P.S., Power Electronics,Khanna Publisher

REFERENCE BOOK

1. Mohan, N., Underland, T. and Robbins, W. P., Power Electronics: Converter Applications and Design, John Wiley (2007) 3rd Ed.

MICROPROCESSORS & INTERFACING

L	P	Cr	5th SEM
4	0	4	**Subject Code: E-311**
			Category Code: DCC-309

Part-A

UNIT-I- ARCHITECTURE OF 8085

Functional block diagram—Registers, ALU, Bus systems. Pin configuration, Timing and control signals, Machine cycle and timing diagrams.
Interrupts—Types of interrupt, interrupt structure

UNIT-II- PROGRAMMING OF 8085

Instruction format, Addressing modes, Instruction set. Development of assembly language programs

Part-B

UNIT-III- INTERFACING DEVICES

(a).The 8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.
(b). The 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

UNIT-IV- INTERRUPT AND DMA CONTROLLER

(a). The 8259 Interrupt controller chip: Architecture, pin configuration, control words, modes
(b). The 8257 DMA controller chip: Architecture, pin configuration, control words, modes

Part- C

UNIT-V- ARCHITECTURE OF 8086

Functional block diagram of 8086, details of sub-blocks such as EU, BIU, memory segmentation, physical address computations, pin configuration, program relocation,
Minimum and Maximum modes of 8086— Block diagrams and machine cycles.
Interrupts—Types of interrupt, interrupt structure

UNIT-VI- PROGRAMMING OF 8086

Instruction format, Addressing modes, Instruction set. Development of assembly language programs Assembler directives.

COURSE OBJECTIVES:

1. 8085 Microprocessor: Architecture and Operations, Pin configuration, Machine cycle, Timing diagram, Interrupts, Instruction set, Addressing modes and Assembly language Programs.
2. 8086 Microprocessor: Architecture and Operations, Pin configuration, Machine cycle, Timing diagram, Interrupts, Instruction set, Addressing modes and Assembly language Programs.
3. Interfacing Devices: Architecture, Pin configuration, Control words and Modes of Interfacing Devices Programmable Peripheral Interfacing 8255, Programmable Interval Counter 8254, Programmable Interrupt Controller 8259, Programmable DMA Controller 8257.

4. Interfacing of Programmable Peripheral Interfacing 8255, Programmable Interval Counter 8254 with Microprocessors**.**

COURSE OUTCOMES:

At the end of the course the students shall be able to:

1. Understand the operation of microprocessor 8085 and 8086.
2. Understand the working of different working blocks of microprocessor 8085 and 8086.
3. Understand the instruction set and addressing modes of 8085 and 8086.
4. Understand the way of writing assembly language programs using instructions of both processors.
5. Understand the need and concept of peripheral devices.
6. Understand the working of different types of programmable peripheral devices and their interfacing with microprocessor 8085 and 8086.

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085 : Ramesh S Gaonkar; Wiley Eastern Ltd.

2. Microprocessor and applications – A.K.Ray.

REFERENCE BOOKS:

1. Microprocessors and interfacing: Hall; TMH

2. The 8088 & 8086 Microprocessors-Programming, interfacing,Hardware & Applications :Triebel & Singh; PHI

3. Microcomputer systems: the 8086/8088 Family: architecture, Programming & Design : Yu-Chang Liu & Glenn A Gibson; PHI.

4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

DIGITAL SYSTEM DESIGN

L	P	Cr	6th SEM	Subject Code: E-302
4	0	4		Category Code: DCC-302

UNIT-I- INTRODUCTION TO HDL

Design flow, Design Methodologies, Capabilities, Hardware abstraction, Model analysis. Basic VHDL elements—Identifiers, data objects, data classes, data types, Operators

UNIT -II- TYPES OF MODELLINGS

Behavioural modelling—Entity declaration, Architecture body, Various Sequential statements and constructs, multiple processes, Postponed processes.

Dataflow modelling—concurrent signal assignment statements, delta delay model, multiple drivers, block statement, concurrent assertion statement.

Structural modelling—Component Declaration, component instantiation, resolving signal values.

UNIT -III- COMBINATIONAL CIRCUIT DESIGN

VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.

UNIT-IV- SUPPORTING CONSTRUCTS

Generics, Configuration, subprogram overloading, operator overloading, Package declaration, package body, design libraries, visibility, Introduction to Test bench, Subprograms: Application of Functions and Procedures.

UNIT -V- SEQUENTIAL CIRCUITS DESIGN

VHDL Models and Simulation of Sequential Circuits such as flip-flops,
Shift Registers, Counters etc.

UNIT -VI- PROGRAMMABLE LOGIC DEVICES

ROM, PLA, PAL, GAL, CPLD and FPGA. Designing using ROM, PLA and PAL

COURSE OBJECTIVES:

1. Basics of Design and language elements: Steps for basic design flow, design methods, need of hardware description languages for design flow.Identifiers, operators, data types, data objects, data objects.
2. Design units of VHDL: Different design units of VHDL, different types of modelling and statements that can be used under different modelling styles.
3. Modelling Styles: Behavioural modelling (Sequential statements), dataflow modelling (concurrent statements), and structural modelling (component instantiation statements). Concept of delays, signal drivers.
4. Combinational and sequential Circuit Design: VHDL code for different combinational and sequential circuits in all the modelling like mux, demux, comparators, decoders/encoders, Flip-Flops, counters, registers etc. etc.

5. Supporting Constructs for VHDL: Generics, Configuration declaration, overloading, package declaration, package body, design libraries, visibility, Testbench, Functions and Procedures.
6. PLDs: Introduction of different programmable logic devices, designing of digital circuit using PLDs.

COURSE OUTCOMES:

At the end of the course the students shall be able to:

1. Understand basic design flow algorithms for digital systems, abstraction levels and need of HDL.
2. Understand basic language elements and design units of VHDL.
3. Design various combinational circuits using all the modelling styles.
4. Design various sequential circuits using all the modelling styles.
5. Understand different supporting constructs available in VHDL language.
6. Understand PLDs and design different digital circuits using PLDs.

TEXT BOOKS:

1. A VHDL Primmer: Bhasker; Prentice Hall 1995.
2. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).

REFERENCE BOOKS:

1. IEEE Standard VHDL Language Reference Manual (1993)
2. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
3. Digital System Design using VHDL: Charles. H.Roth ; PWS (1998).
4. VHDL-Analysis & Modelling of Digital Systems: Navabi Z; McGraw Hill.
5. VHDL-IV Edition: Perry; TMH (2002)
6. Introduction to Digital Systems: Ercegovac. Lang & Moreno; John Wiley (1999).
7. Fundamentals of Digital Logic with VHDL Design: Brown and Vranesic; TMH (2000)

CONTROL SYSTEM ENGINEERING

L	P	Cr	6th SEM
4	0	4	Subject Code: EL-304
			Category Code: DCC-304

UNIT-I- INTRODUCTORY CONCEPTS:

System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, servomechanism, regulating system, Synchros, AC and DC techo-generators, servomotors, stepper motors, & their applications, magnetic amplifier. Linear time-invariant (LTI) system, time-varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations), stability, external disturbance (noise), overall gain etc. Introductory remarks about non-linear control systems.

UNIT-II- MATHEMATICAL MODELLING

Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram algebra, signal flow graphs: Mason's gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design

UNIT-III- TIME DOMAIN ANALYSIS

Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation, w and wn, time domain specifications of a general and an under-damped 2nd order system, steady state error and error constants.Effect of adding pole-zero to a system, controllers.

UNIT-IV- STABILITY ANALYSIS

Stability in time domain: Necessary and sufficient conditions for stability, Hurwitz stability criterion, Routh stability criterion and relative stability, Root Locus technique for stability.

UNIT-V-FREQUENCY DOMAIN ANALYSIS:

Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications.

UNIT-VI-COMPENSATION:

Necessity of compensation, compensation networks, application of lag and lead compensation.

COURSE OBJECTIVES:

1. To teach the fundamental concepts of Control systems and mathematical modelling of modelling of electric, mechanical and electromechanical systems, using differential equations, transfer functions, block diagrams, and state variablesthe system.
2. To study the concept of time response and frequency response of the system.
3. To analyse steady state analysis of control systems.
4. To teach the basics of stability of the system and stability analysis techniques in time domain and frequency domain.
5. Study the principles of system modelling, system analysis and feedback control, and use them to design and evaluate feedback control systems with desired performance like steady state error, settling time etc.

COURSE OUTCOME:

The students will be able to:

1. Determine transfer function models of electrical, mechanical and electromechanical systems.
2. Represent a set of algebraic equations by block diagram and signal flow graphs.
3. Determine specified transfer functions from block diagrams and graphical methods.
4. Evaluate robustness/sensitivity of systems with and without feedback.
5. Relate time response of both continuous and discrete systems to poles and zeros.
6. Relate transient performance parameters, overshoot, ride time, peak time and settling time, to poles and zeros of transfer function for continuous systems.
7. Evaluate steady state error from transfer functions.
8. Determine the stability of system by different time domain and frequency domain methods.

TEXT BOOK:

1. Control System Engineering: I.J.Nagrath & M.Gopal; New Age
2. Modern Control Engg :K.Ogata; PHI.

REFERENCE BOOKS:

1. Automatic Control Systems: B.C.Kuo, PHI.
2. Control Systems - Principles &Design: Madan Gopal; Tata Mc Graw Hill.
3. Modern Control Engineering.R.C.Dorl& Bishop; Addison-Wesley

CONVENTIONAL AND CAD OF ELECTRIC MACHINES

L P Cr **6th SEM** **Subject Code: EL-306**
4 0 4 **Category Code: DCC-306**

UNIT-1- GENERAL

General features and limitations of electrical machine design, modern trends in design of electric machines, cooling of machines, cooling system, Enclosures for rotating machines, cooling of turbo alternators: air cooling, hydrogen cooling and direct cooling of alternator

UNIT-2- MAGNETIC CIRCUITS

Mmf calculations for air gap and iron parts of electrical machines, gap contraction and gap expansion factors, Mmf for teeth, Real and Apparent flux densities, Leakage flux and reactance calculation, calculation of magnetizing current, Design of Electro-magnet

UNIT-3- DESIGN OF TRANSFORMER

Classification of transformer, Construction: Transformer Core, Winding, Tank, insulation, Bushings, Tapping and Tap Changing, Conservator and Breather, Buchholz Relay, Design detail: Output of Transformer, optimum design, Design of core, choice of flux density, design of winding, selection of type of winding, design of insulation, Window space factor, window dimension, design of yoke, overall dimensions, simplified steps for transformer design, Regulation, mechanical forces, no load current, Change of parameters with change of frequency, temperature rise of transformer, design of tank with tubes, cooling of transformer, Design Problems

UNIT-4- DESIGN OF DC MACHINES

Classification, constructional details and applications, Output equation, choice of average gap density, choice of ampere conductors per meter, Selection of number of poles, core length, armature diameter, pole proportions, Length of air gap, armature reaction, effect of armature reaction, reduction of effects of armature reaction, Choice of armature winding, number of armature coils, number of armature slots, slot dimensions, Armature voltage drop, depth of armature core, design of field system, Design of commutator, losses and efficiency, Design problems

UNIT-5- DESIGN OF 3-Φ INDUCTION MOTOR

Constructional detail, output equation, choice of average flux density in air gap, choice of ampere conductors per meter, Main dimensions, stator winding, shape of stator slots, number of stator slots, area of stator slots, stator teeth, stator core, Rotor design: length of air gap, design of squirrel cage induction motor, number of rotor slots, design of rotor bars and slots, design of end rings, Design of wound rotor, no load current, dispersion coefficient, methods of improving starting torque, design problems

UNIT-6-DESIGN OF SYNCHRONOUS MACHINE

Constructional detail, output equation, choice of specific magnetic loading, choice of specific electric loading, Design of salient pole machines, main dimensions, short circuit ratio, effect of SCR on machine performance, length of air gap, Armature winding, number of armature slots, turns per phase,

Elimination of harmonics, estimation of air gap length, losses, Design of turbo alternators, stator design, rotor design, Design problem

UNIT-7-COMPUTER AIDED DESIGN

Advantages of digital computer, computer aided design-Different approaches, Program developed for design of electric machines

COURSE OBJECTIVES:

To expose the students to the design concept of transformers, DC machines, Induction motors, and synchronous machines. This course attempts to create the awareness of design parameters in students, so that they can apply the general principles of design and knowledge of design parameters for better operation and maintenance of electrical equipment and machines.

COURSE OUTCOMES

1. Analyze the general aspects of design of electrical equipment and machines
2. Ability to analyze magnetic materials used to design electrical machine and magnetic Circuit of electrical machine
3. Design different types of electromagnets
4. Ability to analyze the performance, design winding and core of transformer, Understand the procedural steps to design 1-phase and 3-phase transformers
5. Ability to analyze the performance, design winding and core of rotating electrical Machine and understand the procedural steps to design different rotating electrical machines (DC machine, Induction motor, Synchronous machine)

TEXT BOOKS:

1. A Course in Electrical Machine Design, A.K. Sawhney, Dhanpat Rai & Sons

REFERENCE BOOKS:

1. Theory , Performance and design of alternating current machine by M.G. Say , ELBS
2. Theory, Performance and design of direct current machines by A.E. Clayton

ADVANCED MICROPROCESSOR AND MICROCONTROLLER

L	P	Cr	6th SEM	Subject Code: EL-308
4	0	4		Category Code: DCC-308

UNIT-I- THE 8086 ARCHITECTURE

Pin Diagram of 8086 and description of sub-blocks such as EU and BIU and of various registers, description of address computations and memory segmentation, program relocation, addressing model, instruction formats

UNIT-II- INSTRUCTION SET OF 8086

Instruction execution timing , Assembler instruction format , data transfer instructions , arithmetic instruction , branch instruction , looping instruction , NOP and HLT instructions , flag manipulation instructions , logical
instructions , Shift and Rotate instructions , Directives and Operators , Simple example such as copying a block of data , finding maximum from an array of numbers , using Look Up Table technique etc.

UNIT-III- MICROCONTROLLER

Comparison between Microcontroller and Microprocessor, Block Diagram of 8051, Pin diagram and Details, I/O Structure, memory organization, special function registers, external memory, 8032 / 8052 Enhancements, reset operation

UNIT-IV- INSTRUCTION SET

Addressing modes, arithmetic, logical data transfer, Boolean variable, program branching instructions

UNIT-V-TIMER OPERATION

Timer Mode, Register, Timer control Register, Timer Modes and over flow flag, clocking sources, start, stopping and controlling timers, programs for generating various frequency square waves.
SERIAL PORT OPERATION: Serial Port Control register, Modes and operation, serial port band rate, multiprocessor communication, initialization and programming of serial port

UNIT-VI- INTERRUPT

Organization, processing interrupts, program design using interrupts, serial port, and interrupt, external interrupt.

COURSE OBJECTIVES:

1. To introduce students to design of basic microprocessor architectural concepts memory addressing architectural & ALU.
2. To introduce the students to various types of instruction interrupts and I/O devices.
3. To introduce the students to 8051 architectural, programming model & instructions.

4. To introduce the students regarding architectural of advanced microprocessor, addressing models, instruction set & interrupts.
5. To introduce the students regarding interfacing I/O devices, A/D converter & D/A convertors to microprocessor.
6. To introduce the students for developing microprocessor based products.

COURSE OUTCOMES:

On successful complete of this course, the students should be able to:

1. Understand the microprocessor architecture, programming and instructions.
2. Understand the instructions & also write the program using the instructions.
3. Understand the various types of I/O device & Interrupts.
4. Understand the concept of 8051, instructions & addressing models.
5. Understand & write the programs using 8051.
6. To interface I/O devices, A/D & D/A converters with microprocessor & microcontroller.
7. Understand the advanced microprocessors along with their architecture, programming model & addressing models.
8. Understand the testing & design tolls for microprocessor development.
9. Understand & design the microprocessor based product.

TEXT BOOK:

1. THE 8051 MICROCONTROLLER; Scott Mackenzie, Prentice Hall, Eagle Wood Cliff.

2. Yu – Chang Liu & Glenn A. Gibson Microcomputer Systems: the 8086 / 8088 Family: Architecture, programming and design.

REFERENCE BOOKS:

1. Brey , ―Intel Microprocessors,8086,8088,80186,80286/Pentium‖

2. Triekel and Singh, ‖The 8088 & 8086 Microprocessor- Programming, interfacing.

3. Bhupinder singh chabra ‖, the intel 8086/8088 Microprocessors architecture programming, Design and interfacing, ‖ Dhanpat Rai & sons.

4. Kennneth J. Ayala, ‖8051 Microcontroller architecture, programming and applications‖, 2nd edition 1996, Penram international publishers, India

5. Www. Atmel.com.

ELECTRICAL POWER GENERATION

L	P	Cr	6th SEM	Subject Code: EL-310
4	0	4		Category Code: DEC-302

UNIT-I- INTRODUCTION

Energy sources, their availability, recent trends in power generation, interconnected generation of power plants.

UNIT-II- POWER GENERATION PLANNING

Load forecasting, Load curves , Load duration curve , base load and peak load power plants , connected load , maximum demand , demand factor , group diversity factor , load factor , significance of load factor , plant factor, capacity factor , selection of unit size , number of units , reserves , cost of power generation , depreciation , tariff .

UNIT-III- CONVENTIONAL ENERGY SOURCES

THERMAL POWER PLANT: Selection of Site, capacity calculations, classification, schematic diagram and working, boilers, coal handling, feed water treatment

HYDROELECTRIC PLANT: Hydrology, hydrographs, mass curves, selection of Site, classification, schematic diagram and working, turbines; classification & characteristics

NUCLEAR POWER PLANT: Selection of Site, schematic diagram and working, reactors

DIESEL POWER STATIONS: schematic diagram and working,

GAS TURBINE PLANT: schematic diagram and working.

UNIT-IV- NON CONVENTIONAL ENERGY SOURCES

Wind, solar, tidal, ocean and geo thermal sources of energy, Fuel cell, magneto-hydro dynamic (MHD) system, small hydro plants

UNIT-V- ELECTRIC ENERGY CONSERVATION AND MANAGEMENT

Energy Management, energy audit, energy efficient motors, co-generation.

COURSE OBJECTIVES:

- To understand various energy sources i.e. Conventional & Non- Conventional.
- To know power system planning and the parameters relates.
- To understand conventional energy source, select ion of site and working.
- To understand Non- Conventional energy source.
- To know the energy management techniques and energy audit.

COURSE OUTCOMES:

1. Understand the operation of conventional generating stations and renewable sources of

Electrical energy.
2. Evaluate the power tariff methods.
3. Understand various parameters which determine the economics of power generation.
4. Understand electric energy audit and management

TEXT BOOKS:

1. Electric power generation, B.R.Gupta .
2. Power Plant Engineering: G.D.Rai
3. Power plant engg.: Wakil

REFERENCE BOOKS:

1. A course in electric power system, Soni , Gupta , Bhatnagar , Dhanpat Rai and Sons .
2. Power System Engineering, Nagrath and Kothari, TMH, New Delhi.
3. Electric Power: S.L.Uppal (Khanna Publishing).

POWER SYSTEMS-II

L	P	Cr	6th SEM	Subject Code: EL-312
4	0	4		Category Code: DCC-310

UNIT-I- FAULT CALCULATIONS

Per unit system, Percentage system, calculation of symmetrical & unsymmetrical fault currents in power system network using the symmetrical components, use of current limiting reactors

UNIT-II- PROTECTIVE DEVICES

Fuse: Introduction, types & applications.

Protective relays: Basic operating principal, types of relays, Distance and Inverse definite minimum type relays, phase & amplitude comparators, development of static relays, basic elements of a static relay

Circuit Breakers: Principal, Types, Ratings & Applications

UNIT-III- PROTECTIVE SCHEMES

Protection of feeders, protection of generators & transformers, carrier current protection , protection against surges ,surge diverters, surge absorbers ,use of ground wires on transmission lines, methods of grounding method, Insulation coordination

UNIT-IV

Current trends in protective relays, Microprocessor & PC based relaying. Introduction to PLC

COURSE OBJECTIVES:

1. To educate the basic concepts and new developments in power system protection
2. To emphasize the significance of protection for electrical equipments.
3. To analyze the behavior of the power system under faulted condition.
4. To have a brief knowledge of protection schemes of transformers, generators, feeders, Transmission lines etc
5. To have a brief knowledge of different equipments for grounding

COURSE OUTCOMES:

1. The basic concepts and principle of working of power system protection are studied.
2. Different methods for Protection of electrical equipments are analyzed
3. Power system under faulted condition is solved and analyzed
4. Ability to understand different schemes of protection for transformers, generators, feeders, Transmission lines etc.
5. Study different methods for grounding.

TEXT BOOKS:

1. Switchgear and protection – S.S.Rao : Khanna Pub.
2. Power System Engg. I.J. Nagrath and D.P.Kothari(TMH)

REFERENCE BOOKS:

1. Protective Relays- Their Theory and Practice Vol. I&II: W.Van Warrington
2. Advanced Power system analysis and dynamics: L.P.Singh, Wiley eastern N.Delhi.
3.Digital Protection: protective relay from Electro-Mechanical to Microprocessor- L.P.Singh,Wiley Eastern.
4. Power System Protection and switchgear- B.Ravinder Nath and M.Chander,Wiley Eastern ,N.Delhi .
5. A course in electrical power- Soni, Gupta and Bhatnagar – Dhanpat Rai & sons.
6. Power System Engg. V.K. Mehta.

DIGITAL SIGNAL PROCESSING

L	P	Cr	8th SEM	Subject Code: E-402
4	0	4		Category Code: DCC-402

UNIT-I- DISCRETE-TIME SIGNALS:
Signal classifications, frequency domain representation, time domain representation, representation of sequences by Fourier transform, properties of Fourier transform, discrete time random signals, energy and power theorems

UNIT-II- DISCRETE-TIME SYSTEMS: Classification, properties, time invariant system, finite impulse Response (FIR) system, infinite impulse response (IIR) system.

UNIT-III- SAMPLING OF TIME SIGNALS:
Sampling theorem, application, frequency domain representation of sampling, and reconstruction of band limited signal from its samples, discrete time processing of continuous time signals, changing the sampling rate using discrete time processing

UNIT-IV- Z-TRANSFORM
Introduction, properties of the region of convergence, properties of the Z-transform, inversion of the Z-transform, applications of Z-transform

UNIT-V- BASICS OF DIGITAL FILTERS
Fundamentals of digital filtering, various types of digital filters, design techniques of digital filters: window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP, DSP algorithm implementation consideration. Applications of DSP

UNIT-VI- MULTIRATE DIGITAL SIGNAL PROCESSING
Introduction to multirate digital signal processing, sampling rate conversion, filter structures, multistage decimator and interpolators, digital filter banks.

COURSE OBJECTIVES:

1. To classify various types of Signals in both frequency and time domain.
2. To make students understand the concept of Fourier transform,Z-tranforms,and their properties. So, that they may apply them on hardware as well as on software.
3. To make the students know about various systems, most importantly FIR and IIR systems.
4. After gaining knowledge of signals and systems the students must be able to process a signal using their samples on the system. They also should be able to analyse frequency domain representation of sampling, reconstruction of band limited signal from its samples and also able to change the sampling rate using discrete time processing.

5. To make students aware about Fundamentals of digital filtering, various types of digital filters, design techniques of digital filters : window technique for FIR, bi-linear transformation and backward difference methods for IIR filter design, analysis of finite word length effects in DSP,FIR &IIR Filter structure-direct1,direct2,cascade and parallel, Application of DSP.
6. To know about multi-rate digital signal processing, filter structures, multistage decimator and interpolators, digital filter banks.

COURSE OUTCOME:

A student who successfully fulfils the course will be able to:

1. Program digital signal processing algorithms in LABVIEW and MATLAB, including the Design, implementation, and real-time operation of digital filters.
2. Program a DSP chip with a variety of real-time signal processing algorithms, such as Filtering for noise reduction or digital audio effects. Apply digital signal processing Fundamentals.
3. Understand the processes of analog-to-digital and digital-to-analog conversion.
4. Master the representation of discrete-time signals in the frequency domain using z-Transform and discrete time Fourier transform (DTFT).
5. Learn the basic structures of FIR and IIR filters and how to design filters with desired Frequency responses using different design techniques.
6. Demonstrate the effect of the time window length on the achievable spectral resolution.
7. Learn the design procedures for filter bank.
8. Understand the concept of Multi-rate signal processing and sample rate conversion.
9. Acknowledge time-frequency analysis and applications of digital signal processing.

TEXT BOOKS:

1. Digital Signal Processing: Proakis and Manolakis; PHI
2. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH

REFERENCE BOOKS:

1. Digital Signal Processing: Alon V. Oppenhelm;PHI
2. Digital Signal processing (II-Edition): Mitra, TMH

ELECRICAL DRIVES

L	P	Cr	8th SEM	Subject Code: EL-404
4	0	4		Category Code: DCC-404

UNIT-I- ELECTRICAL DRIVES

Introduction, classification, advantages, characteristics of electric motors, choice of electrical drive machines, status of AC and DC drives

UNIT-II- CONTROL OF ELECTRICAL DRIVES

Modes of Operation, closed loop control of drives, sensing of current and speed, Microprocessor based control of electric drives

UNIT-III- DYNAMICS OF ELECTRICAL DRIVES

Fundamental Torque equation, multi-quadrant operation, equivalent values of drive parameters, load torque components, types of load

UNIT-IV- SELECTION OF MOTOR POWER RATING

Heating and cooling , determination of motor rating , continuous , short time and intermittent duty rating , load equalization and determination of moment of inertia of the fly wheel

UNIT-V- DC MOTOR DRIVES

Starting, acceleration control, braking, transient analysis, converter fed DC drive and chopper fed DC drive

UNIT-VI- INDUCTION MOTOR DRIVES

Starting , acceleration control , braking , transient analysis ,static control techniques – stator frequency control , stator voltage control , rotor resistance control ,v/f control, slip power recovery, vector control

UNIT-VII- PMBLDC AND PMSAC DRIVES

Permanent magnet brushless DC drive, permanent magnet sine fed drives, switched reluctance machine drives.

COURSE OBJECTIVES:

1. To make students_familiar with the basic structure of electric drive system and their practical applications.
2. To create understanding of working of AC and DC motors drives with various power converters for speed control operation.
3. Knowledge of various types of load torques and their components, nature of different loads for effective use of electric drive system.

COURSE OUTCOMES:

1. To introduce the students with the structure of Electric Drive systems and their role in Various applications such as energy conservation, renewable energy, transportation etc.
2. Ability to acquire and apply knowledge of power electronics in DC drives, Induction

Motor drives and Synchronous motor drives

3. Understanding of the basic requirements placed by mechanical systems on electric drives.
4. Ability to choose a suitable rotating machine and suitable power electronic converter Structure for an electrical drive.

TEXT BOOKS:

1. Fundamentals of electrical drives: G.K.Dubey , Prentice Hall.
2. Electric Drives: Concepts and applications, V.Subrahmaniyam , TMH , New Delhi .

REFERENCE BOOKS:

1. Power Semiconductor controlled drives: G.K.Dubey , Prentice Hall
2. Kusko, A., Solid State DC Motor drives, MIT Press, Cambridge, Mass USA 1969.
3. Pillai S.K., A First Course in electric drives, Wiley Eastern, New Delhi.
4. Chillikan, M., Electric Drives, MIR Publishers, MOSCOW 1970.
5. Bose B.K. , Power Electronics and AC drives , Prentice Hall , New Delhi 1991 .

POWER SYSTEM OPERATION & CONTROL

L	P	Cr	8th SEM	Subject Code: EL-406
4	0	4		Category Code: DCC-406

UNIT-I- AUTOMATIC GENERATION CONTROL Definitions of control area-Single area control-Modelling of speed governing system-Turbine Model-Generator load model, Excitation systems Modelling, Role of AVR's, Block diagram representation of an isolated system –Steady state analysis-Dynamic response-Proportional and Integral control and its block diagram representation Load frequency control and economic despatch control, Two area load frequency control-tie line bias control, Load frequency control with generation rate constraints-Speed governor dead band and its effect on AGC

UNIT-II-OPTIMAL SYSTEM OPERATION Introduction-Optimal operation of Generators in Thermal Power Station-heat rate curve-cost curve-Incremental fuel and Production cost, input-output characteristics, Optimum generation allocation with line losses neglected ,Unit commitment, Optimum generation allocation including effect of transmission losses –Loss coefficients, General transmission line loss formulae, Optimal scheduling of hydrothermal system

UNIT-III-REACTIVE POWER & VOLTAGE CONTROL Overview of reactive power control-Reactive power control in transmission systems-advantages and disadvantages of compensating equipments

COURSE OBJECTIVES:

1. To gain knowledge on economic operation of power system and its solution techniques.
2. To understand hydrothermal scheduling techniques and maintenance scheduling.
3. To get the insight of load frequency control and its modelling
4. To study the concept of voltage control using compensation devices.
5. To understand the role of energy control centre, SCADA, EMS functions and power system security states.

COURSE OUTCOMES:

1. Dispatch the load economically among thermal plants
2. Model LFC, AGC and AVR for single and two area power systems
3. Understand SCADA system for power system operation and control
4. Explain power system security and voltage stability
5. Estimate state of the system using weighted least squares method
6. To Model the hydrothermal system
7. To learn about the concept of reactive power control

TEXT BOOKS:

1. Power system operation & Control by S.Sivangraju, Pearson Publication
2. Modern Power System Analysis-I.J.Nagrath &D.P.Kothari, Tata Mcgraw Hill
3. Electric Power System – C.L.Wadhwa NewAge International
4. Power System Analysis-Hadi Saadat-TMH Publication

REFERENCE BOOKS

1. Voltage Stability by Taylor
2. Power system control and stability:P.Kundur:MGH
3. Electric Energy System Theory: OI Elgerd;

1. ADVANCED CONTROL SYSTEMS

L	P	Cr	8th SEM	Subject Code: EL-408
4	0	4		Category Code: DEC-402

UNIT-I- STATE VARIABLE TECHNIQUES

State variable representation of systems by various methods, Solution of state equations-state transition matrix Transfer function from state variable model, Controllability and observability of state variable model

UNIT-II- SECOND ORDER SYSTEMS AND STATE PLANE

Phase portrait of linear second systems. Method of isoclines, phase portrait of second order system with non linearities, limits cycle, singular points.

UNIT-III- DESCRIBING FUNCTION ANALYSIS

Definition, limitation, use of describing function for stability analysis, describing function of ideal relay, relay with hysteresis and dead zone, saturation/coulomb friction and backlash

UNIT-IV- LINEAR APPROXIMATIONS OF NON LINEAR SYSTEMS

Taylor series, Liapunov‘s second method

UNIT-V- SAMPLED DATA SYSTEMS

Sampling process, impulse modulation, mathematical analysis of sampling process, application of Laplace transform, Shannon‘s theorem, reconstruction of sampled signal, zero order and first order hold, Z transform, definition, evaluation of Z transform, inverse Z transform, pulse transfer function, limitations of Z transform, state variable formulation of discrete time systems. Solution of discrete time state equations, stability, definitions, Schur-Cohn stability criterion, Jury‘s test of stabiliy, extension of Routh-Hurwitz criteron to discrete time systems

COURSE OBJECTIVES:

1. To teach the fundamental concepts of Control systems and mathematical modelling of modelling of electric, mechanical and electromechanical systems, using differential equations, transfer functions, block diagrams, and state variables the system.
2. To study the concept of Controllability and observability of state variable model
3. To analyse non- linear functions.
4. To study the concept of Z transform.
5. To analyse the stability using Taylor series, Liapunov‘s second method

COURSE OUTCOME:

The students will be able to:

1. To analyse whether the system is Controllable and observable.
2. Understanding of behaviour of non-linear function.
3. Determine specified transfer functions from block diagrams and graphical methods.
4. To analyse the second order systems with non- linearity.
5. Students will be aware of stability concept using Routh-Hurwitz criteron to discrete time systems
6. Relate transient performance parameters, overshoot, ride time, peak time and settling time, to poles and zeros of transfer function for continuous systems.
7. Evaluate steady state error from transfer functions.
8. Determine the stability of system by different time domain and frequency domain methods.

TEXTBOOKS

1. M. Gopal: Digital Control and State Variable Methods, TMH.

REFERENCE BOOKS

1. M. Gopal: Modern Control Theory, Wiley International
2. K. Ogata: Discrete time control system, PHI
3. B.C. Kuo: Digital control systems
4. J.E. Slotine and W.P. Li: Applied Non-Linear Control, Prentice Hall, USA
5. Isodori : Non-Linear control Systems, Pub: Springer-Verlag

2. POWER SYSTEM STABILITY AND FACTS

L	P	Cr	8th SEM	Subject Code:EL-408
4	0	4		Category Code: DEC-402

UNIT-I- POWER SYSTEM STABILITY PROBLEM

Rotor angle stability, voltage stability, short term and long term stabilities, swing equation and its solution techniques

UNIT-II- SYNCHRONOUS MACHINES AND ITS MODELLING

Power transformation, flux linkage equations, voltage equation, formulation using state-space equations, normalizing voltage and torque eqns., equivalent circuit of synchronous m/c, the flux linkage state-space model. Linearization of the flux linkage model, Simplified linear model block diagram, state-space representation of simplified model

UNIT-III- DYNAMIC STABILITY

State-space representation, stability of a dynamic system, analysis of stability, Eigen properties of the state matrix, Small signal stability of a single m/c infinite bus system, Effect of excitation systems, power system stabilizer, system state matrix with armature winding

UNIT-IV- TRANSIENT STABILITY

An elementary view of transient stability, numerical integration methods, simulation of power system dynamic response

UNIT-V- VOLTAGE STABILITY

Basic concept related o voltage stability, voltage collapse, voltage stability analysis, prevention of voltage collapse.

UNIT-VI- FLEXIBLE AC TRANSMISSION SYSTEM

FACTS definitions, review of FACTS devices, series compensation in transmission systems, cascade connection of components-shunt and series compensation.

UNIT-VII- SUB-SYNCHRONOUS OSCILLATORS

Turbine generator torsional characteristics, characteristics of series capacitor compensated transmission system, Self excitation, torsional interaction, counter measure to SSR problems, ferro resonance.

COURSE OBJECTIVES:

1. Understand the general information about power system stability problems.
2. Understand the classification and prevention of different type of stability.
3. Understand the principle of synchronous machines and its modeling.
4. Understand the state space model and state space representation of simplified model of synchronous machine.
5. Understand the causes and prevention of dynamic stability.

6. Understand the causes and prevention of transient stability.
7. Understand the causes and prevention of voltage stability.
8. Understand the general information about voltage collapse and how to overcome voltage collapse.
9. To get the information about principle, working and application of flexible A.C. Transmission system.
10. To understand the about the sub synchronous resonance problem and counter measure to ssr problems.

COURSE OUTCOMES:

1. Student should be able to understand about the classification of stability.
2. Student should be able to know power system stability problem.
3. Student should be able to know about synchronous machine modelling.
4. Student should be able to how to handle various stability and unstability problem.
5. Student should be able to know about FACTS DEVICES and their operation in Grid, about sub synchronous oscillators

TEXTBOOKS:

1. Power System Stability and Control by Prabha Kumar: MGH
2. Power System Control and Stability by Anderson and Fouad: Galgotia Publications

REFERENCE BOOKS

1. Extra high voltage AC Transmission Engg. By Rokosh Das Begamudre
2. Electrical energy theory: An Introduction by O.I. Elgerd: TMH

COMPUTER APPLICATION TO POWER SYSTEM

L	P	Cr	8th SEM	Subject Code: EL-410
4	0	4		Category Code: DCC-408

UNIT-I- LOAD FLOW STUDIES

Introduction, bus admittance matrix, formation of Y-bus, tree graph, co-tree, primitive networks, bus incidence matrix, formulation of Y-bus using singular transformation, load flow equations, approximate load flow study, Gauss-Siedel method for load flow study, algorithm and flowchart for computer application to load flow studies, using G-S method, Newton Raphson method for load flow studies, algorithm and flowchart for computer application to load flow studies using N.R. method, Decoupled load flow studies, fast decoupled load flow. Comparison between G-S and N.R. methods, Load flow study of distribution system. Sparsity in power System

UNIT-II- DIGITAL TECHNIQUES IN FAULT CALCULATIONS

Review of symmetrical components, sequence networks for synchronous machines, transforms and transmission lines, bus impedance matrix, algorithm for formulation of bus. All types of modifications short circuit studies: Single line to ground fault, line to line fault, double line to ground fault and symmetrical fault. Consideration of pre-fault currents

UNIT-III- COMPUTER CONTROL AND AUTOMATION

Introduction to energy control centres, various states of a power system, SCADA systems and RTU

COURSE OBJECTIVES:

- To know the concept of load flow studies
- To understand the application of Gauss Seidel, Newton Raphson and Fast Decoupled load flow methods.
- To understand fault analysis and short circuit analysis.
- To understand various states of power system , SCADA Systems & RTU.

COURSE OUTCOMES:

1. Understand the concept of load flow analysis and prerequisites for load flow analysis.
2. Understand application of Gauss- Seidel , Newton-Raphson and Fast Decoupled Load Flow Methods.
3. Understand fault analysis using digital techniques.
4. Understand basic principles of SCADA and RTU.

TEXTBOOKS:

1. Computer Methods in Power System: G.W. Stagg and A.H. E.I-Abiad, M.G.H
2. Power System Analysis: Hadi Saadat, TMH
3. Power System Engg.: I.J. Nagrath and D.P. Kothari, TMH

REFERENCE BOOKS:

1. Advanced Power System analysis and dynamics: L.P. Singh, Wiley Eastern Ltd.
2. Electrical energy system Theory: An introduction by O.I. Elgerd, TMH
3. Elements of power system analysis: W.D. Stevenson. MGH
4. Power system engineering: B.R. Gupta

1. UTILIZATION OF ELECTRIC POWER AND TRACTION

L P Cr **8th SEM** **Subject Code: EL-412**
4 0 4 **Category Code: DEC-404**

UNIT-I- ILLUMINATION

Basic laws of illumination, illumination due to a strip and circular disc, light sources and their characteristics, sources of light, design of lighting schemes, incandescent lamp, sodium lamp, mercury lamp and fluorescent lamp, comparison of various lamps.

UNIT-II- ELECTRIC HEATING

Principle and application of resistance, induction, dielectric heating and temperature control

UNIT-III- ELECTRIC WELDING

Resistance welding, arc welding, welding generator and welding transformer, properties of arcing electrode

UNIT-IV- ELECTROLYTING PROCESS

Principles and applications of electrolysis, Faraday‘s law of electrolysis, electroplating, charging and discharging, capacity and efficiency of battery, defects in battery.

UNIT-V- ELECTRIC TRACTION

Advantages of electric traction, requirements of an ideal traction system, train movement, mechanism of train movement, traction motors, traction motor control, multi unit control, braking of electric motors, thyristor control of electric traction

COURSE OBJECTIVES:

1. Understand the law of illumination and calculate the illumination intensity of light.
2. Understand the principle and construction of various types of various type of lamps
3. Understand the principle of various type of heating and their applications.
4. Understand the process of Calculate heat developed in induction furnace.
5. Understand basic principles and process of an electric welding.
6. To understand the properties of various metals and electrodes
7. To understand the principle and application of electrolysis process.
8. Understand the working and operating applications of different type of battery.
9. To get general information about electric traction.
10. To understand the working and control of various electric drives connected with electric traction

COURSE OUTCOMES:

1. Understand basic principles of electric heating and welding
2. Determine the lighting requirements for flood lighting, household and industrial needs.
3. Calculate heat developed in induction furnace.
4. Evaluate speed time curves for traction

TEXT BOOKS:

1. Art and Science of Utilization of Electrical energy: H.Pratab; Dhanpat Rai

REFERENCE BOOKS:

1. Utilization of electric energy: Open Shaw Taylor; ELBS
2. Generation, distribution and utilization of electric power: C.L. Wadhwa; Khanna Publications

2. HIGH VOLTAGE ENGINEERING

L P Cr **8th SEM** **Subject Code: EL-412**
4 0 4 **Category Code: DEC-404**

UNIT-I- INTRODUCTION
Recent trends in high voltage transmission.

UNIT-II- CONDUCTION AND BREAKDOWN
Conduction and breakdown in gases, liquids and solod dielectrics, insulator breakdown, insulation characteristics of long air gaps

UNIT-III- VOLTAGE GRADIENTS ON CONDUCTORS
Electrostatic fields of sphere gaps, fields of line charges and their properties, charge-potential relations for multi conductor lines, surface voltage gradients on conductors, distribution of voltage gradient on some conductors of bundle.

UNIT-IV- CORONA
Corona and cor

ona loss, corona loss formula, attenuation of traveling waves due to corona, audible noise generation and characteristics, corona pulses-their generation and properties, properties of pulse, radio interference.

UNIT-V- LIGHTNING
Lightning, lightning stroke mechanism, principle of lightning protection, tower foot resistance, insulator flash over and withstand voltage, lightning arrestors and their characteristics.

UNIT-VI- H.V. TESTING AND LAB EQUIPMENTS
Standard wave shapes for testing, wave shaping circuits: principles and theory; impulse generator, generation of A.C high voltage for testing, generation of direct voltage, measurement of high voltage, general layout of H.V. lab.

COURSE OBJECTIVES:

1. Understand the concept of insulation breakdown.
2. Understand the concept of voltage gradient.
3. Understand the concept of corona and its properties
4. Understand the concept of Impulse Generator and H.V. lab

COURSE OUTCOMES:

1. Understand basic principles High Voltage Transmission.
2. Able to analyse the property of lightening strokes and its protection. .
3. Able to understand the measurement and testing high voltage..

TEXT BOOKS/ REFERENCE BOOKS:

1. E.H.V. AC Transmission: R.D. Begamudre, Wiley Eastern Ltd.
2. H.V. Engineering: V. Kamaraju and M.S. Naidu. TMH

Audit Course
(Two different Course-I &II)

1. German -1
2. German-2 (with German-1 as prerequisite)
3. French -1
4. French-2 (with French-1 as prerequisite)
5. Sanskrit -1
6. Sanskrit-2 (with Sanskrit-1 as prerequisite)
7. Personality Development
8. Interview and Group Discussion Skills
9. Yoga and Meditation
10. Art of Living/Life Skills
11. Contribution of NSS towards Nation/Role of NSS
12. Physical Education

NOTE FOR THEORY PAPERS:

Question paper has two parts. Part-1 has 10 questions each of 2 marks. It covers the entire syllabus. Attempt any four questions out of six from Part-2.

Grading Scheme

Marks %	Grade	Grade points	Category
90-100	O	10	Outstanding
80≤marks<90	A+	9	Excellent
70≤marks< 80	A	8	Very good
60≤marks< 70	B+	7	Good
50≤marks< 60	B	6	Above average
45≤marks< 50	C	5	Average
40≤marks< 45	P	4	Pass
<40	F	0	Fail
……	Ab	0	Absent

Percentage calculation= CGPA * 9.5